TOWN AND COUNTRY DRY CLEANERS

MONROE COUNTY

BRIGHTON, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: 828149

Prepared for:

New York State Department of Environmental Conservation
Albany, New York

Prepared by:

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MACTEC Project No. 3616206122

Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date
0	April 2023	Original	
1	July 2023	Additional comments from NYSDOH	

JULY 2023

CERTIFICATION STATEMENT

I Charles Staples certify that I am currently a Qualified Environmental Professional as in defined in 6 NYCRR Part 375 and that this Site Management Plan 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).

Charles R Staples
_________________________ QEP

07/20/2023
_________________________ DATE

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List of Acronyms

COC	Certificate of Completion
CP	Commissioner Policy
DER	Division of Environmental Remediation
DUSR	Data Usability Summary Report
EC	Engineering Control
ECL	Environmental Conservation Law
EWP	Excavation Work Plan
FEMA	Federal Emergency Management Agency
HASP	Health and Safety Plan
IC	Institutional Controls
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules and Regulations
OM&M	Operation, Maintenance and Monitoring
PRR	Periodic Review Report
QEP	Qualified Environmental Professional
RAO	Remedial Action Objective
ROD	Record of Decision
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SSD	Sub-slab Depressurization

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:

Site Identification: NYSDEC Site No. 828149, Town and Country Dry Cleaners, 2308 and 2310 Monroe Avenue, Town of Brighton, Monroe County

Institutional Controls:	1. The property may be used for "Commercial Use" as defined in New York State Department of Environmental Conservation (NYSDEC) Regulations Title 6 of the New York Codes, Rules, and Regulations Part 375 – 1.8(g)(2)(iii) and (iv).
	2. Institutional controls (ICs) for the Site are detailed in this Site Management Plan for the controlled property which will: • Require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3); • Allow the use and development of the controlled property for commercial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws; • Restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the County DOH and the NYSDOH; and • Require compliance with Department approved Site Management Plan.
Engineering Controls:	1. A cover system consisting of asphalt pavement, concrete sidewalks, and concrete building slabs.
	2. Sub-slab depressurization systems (SSDS) to mitigate soil vapor in the neighboring community. The SSDSs are being monitored and maintained by the NYSDEC under a separate contract.

Inspections:	Frequency
1. Cover inspection	Annually
Monitoring:	
1. Groundwater Monitoring Wells GEMW-1, GEMW-2, MW-1, MW-2B, MW-3, MW-8, MW-10, MW-13, MW-13B, MW-16B, MW-17B, MW-19B, MW-21B, DP-10, DP-11, DP-12, DP-16, DP-17, DP-18, DP-19, DP-20, and DP-21	Annually
Maintenance:	
1. Fence repair	As needed
2. Building structures	As needed
3. Monitoring Wells	As needed
Reporting:	
Periodic Review Report	Annually

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 Town and Country Dry Cleaners Site located in Brighton, New York (hereinafter referred to as the "Site"). The Site is located at 2308 and 2310 Monroe Avenue, Town of Brighton, Monroe County, New York; See Figure 1.1. The Site is listed as a Class 2 Inactive hazardous waste site, Site No. 828149, in the Registry of Hazardous Waste Sites in New York State (NYS). An active dry cleaning and laundry business currently occupies the Site which is zoned for commercial use.

After completion of the remedial work, some contamination was left at this site, which is hereafter referred to as "remaining contamination". Engineering Controls (ECs) have been incorporated into the site remedy to control exposure to remaining contamination to ensure protection of public health and the environment.

This SMP was prepared to manage remaining contamination at the site in accordance with Environmental Conservation Law (ECL) Article 71, Title 36. This plan has been approved by the NYSDEC 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. Failure to properly implement the SMP is a violation, 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, 6 NYCRR Part 375 and the Consent Decree Civil Action Number 87-CV-1418 for the site.
- In accordance with the Record of Decision (ROD), an Environmental Easement will be developed and included in a Revised SMP.

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.

This SMP was prepared by MACTEC, on behalf of the NYSDEC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required for the site.

1.2 Revisions

Revisions 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 soil, or other significant change to the site conditions. In accordance with the SMP for the site, the NYSDEC project manager 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:

1. 60-day advance notice of any proposed changes in site use that are required under 6 NYCRR Part 375 and/or Environmental Conservation Law.

2. 7-day advance notice of any field activity associated with the remedial program.

3. 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.

4. 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.

5. Notice within 48 hours of any non-routine maintenance activities.

6. 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.

7. 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:

8. 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 all approved work plans and reports, including this SMP.

9. 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 notifications. 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 1: Notifications*

Name	**Contact Information**	**Required Notification****
Jasmine Stefansky, NYSDEC Project Manager	(518) 402-9813; jasmine.stafansky@dec.ny.gov	All Notifications
Jeffrey Dyber, Remedial Bureau E Section Chief	(518) 402-9621; jeffrey.dyber@dec.ny.	All Notifications
Julia M. Kenney Public Health Specialist, NYSDOH Project Manager	(518) 402-7873 beei@health.ny.gov	Notifications 4, 6, and 7

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

** Note: Numbers in this column reference the numbered bullets in the notification list in this section.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

The Site is located at 2308 and 2310 Monroe Avenue, Town of Brighton, Monroe County, New York and is identified as Section 137.14 Block 2 and Lot 71.1 on the Monroe County Tax Map (Figure 1.1).

The Site is approximately 0.39 acres and is located near the intersection of Brooklawn Drive and Monroe Avenue. The Site is bound to the northwest by commercial properties, to the northeast by residential properties, to the southeast by commercial and residential properties, and to the southwest by Monroe Avenue. Commercial properties are located on the opposite side of Monroe Avenue.

The owner(s) of the site parcel(s) at the time of issuance of this SMP is:
2308 Monroe Ave, LLC
C/O Phil and Loretta Gulian
7 Glenmore Circle
Pittsford, NY 14534

2.2 Physical Setting

2.2.1 Land Use

The Site consists of the following: approximately 0.39 acres, with 0.28 acres developed with a single story, 2,200 square-foot concrete block structure with a partial basement and associated asphalt paved parking lot; the remaining 0.11 acres is undeveloped and covered by vegetation (i.e., wooded). The wooded undeveloped area is flat, although there is a drop of approximately three feet to the residential properties to the south of this undeveloped area.

The Site building was constructed on the site in 1931 and the Site has operated as a dry cleaning and laundry facility since 1969 (Barton & Loguidice [B&L], 2012). The active dry cleaning and laundry business continues to occupy the Site which is zoned for commercial use.

2.2.2 Geology

The overburden at the Site consists of heterogeneous fill materials consisting primarily of re-worked sand and gravel that extends from the ground surface (i.e., below the asphalt pavement) to depths of approximately 0.5 ft. to 4 ft. bgs. In the area of the storm water catch basin on the Site where soil removal actions were conducted, fill materials extended to a depth of approximately 10 ft. bgs. Fill on an adjacent property was observed to contain fragments of cinders and ash. The fill material is underlain by a silty sand deposit approximately one to six feet thick. The silty sand deposit was observed to be heterogeneous with horizontal lenses of sand and silt. The silty sand deposit is underlain by a silty clay layer that was observed to range between one and five feet in thickness and appears to be continuous across the central portion of the Site (silty clay is present at depths ranging from approximately nine to 14 feet bgs in the central portion of the Site parking lot to the east-northeast of the Site building). The silty clay layer does not appear to be continuous for an extended area outside the central portion of the Site, since it was not observed on the western or eastern edges of the site property, or on the south side of the residential property south of the site. A silty sand and gravel or fractured/broken bedrock layer that was observed to range in thickness from between 2.6 ft. and 5.7 ft. underlies this silty clay and sits on top of bedrock (MACTEC, 2016).

Depth to bedrock at the Site in the vicinity of the rear parking lot ranges from approximately 16 to 19 feet bgs, which corresponds to elevations of 458 to 463 feet above msl (ground surface is not flat). Bedrock surface appears to be higher on the west side of the Site than the east side, indicating a potential downward slope from west to east. The bedrock in the vicinity of the Site is identified as Lockport Dolomite (B&L, 2012). Based on the Finger Lakes Bedrock Geology Map from the NYS GIS Clearinghouse, the primary bedrock is mapped as the Guelph Dolostone, an Upper Silurian age dolostone of the Lockport group. This was observed to be a light gray to dark gray fine grained dolostone, with some silt seems. Rock quality designation of the shallow bedrock was poor to fair with primarily horizontal fractures along bedding planes, although some vertical fractures were also observed (MACTEC, 2016).

2.2.3 Hydrogeology

Overburden Groundwater. Groundwater below the Site was measured at depths of approximately three to six feet bgs. Historically, the catch basin located just east-northeast of the Site building had no bottom and acted partially like a dry well, although there was some flow from the catch basin to the northwest by an eight-inch pipe to the storm drain system. The collection of surface water in this catch basin was historically observed to have caused mounding of groundwater in the overburden, resulting in radial groundwater flow from the catch basin. Although this catch basin was replaced with a solid bottom catch basin, groundwater measurements continued to indicate apparent groundwater mounding after replacement. Outside this groundwater mounding area, the primary groundwater flow direction is interpreted to be to the east. Depth to groundwater in the vicinity of the catch basin was approximately three feet bgs. Water levels drop fairly quickly at the east side of the site, but no clay layer was identified in borings in this area.

The shallow overburden was noted to be silty sand and hydraulic conductivity of the shallow overburden was estimated to be 1.45 feet per day and the shallow overburden groundwater travel time was estimated to be 75 feet per year. Based on several of the microwells purging dry, this estimate is likely biased high. An approximate one- to five-foot-thick silty clay layer present at between approximately nine to 14 feet below the surface at the Site, appears to be acting as a confining layer with minimum connection to a more porous zone identified just above bedrock (i.e. 14-19 feet bgs).

Vertical hydraulic gradients from overburden to shallow bedrock in the vicinity of the catch basin were measured at 2.46 feet in the downward direction.

Groundwater elevation data is provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix B.

2.3 Investigation and Remedial History

The following narrative 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. Previous Investigations:

- A Phase II site investigation was conducted in December 2006 at 2290, 2294, and 2298 Monroe Avenue, which is upgradient and adjacent to the Site. The Phase II report identified Town and Country Cleaners as a potential source of chlorinated compound groundwater contamination at the adjacent property (GeoQuest Environmental, Inc. 2006).
- In January 2008, a site characterization was conducted by the NYSDEC to determine if Town and Country Cleaners is a potential source of contamination. The site characterization confirmed the presence of hazardous waste at the Site based on the concentrations of chlorinated volatile organic compounds (CVOCs) and their associated breakdown products found in subsurface soils, groundwater, and soil vapor (CMD, 2009).
- A remedial investigation (RI) was conducted by the property owner in 2010 that identified soil and groundwater contamination to the rear (east) of the Site building (Day Environmental, 2010).
- A remedial investigation work plan was prepared for the Site by the property owner that summarized previous investigations and included additional information on the Site property (Barton & Loguidice, P.C. , 2012). This work plan was never implemented.
- An RI and Feasibility Study (FS) were completed by the NYSDEC under the state Superfund program between 2013 and 2016, which defined the remaining contaminant concentrations and non-delineated areas (MACTEC, 2016b).

- As part of the RI/FS, an Interim Remedial Measure (IRM) was completed by the NYSDEC in September 2015 which replaced the catch basin CB-1 located northeast of the site building, and removed contaminated soils surrounding the catch basin. A limited amount of potassium permanganate was also placed within the excavation to treat residual soil contamination (MACTEC, 2016a).
- A pre-design investigation was conducted in 2017 to refine the delineation of on-site soil that that exceeded the commercial use Soil Cleanup Objectives (SCOs), and off-site soil that exceeded the residential use SCOs (MACTEC, 2017).
- A round of groundwater samples was collected in 2019 from Site monitoring wells to assess groundwater concentrations post soil removal IRM (MACTEC, 2019).
- A soil removal remedial action was completed in 2021 that removed soil on-site that exceeded commercial use criteria and removed soil from the residential property to the south that had concentrations of contaminants greater than the residential use SCOs (MACTEC, 2022).

Key investigation findings and remedial actions are discussed below.

The primary dry-cleaning solvent tetrachloroethene (PCE) was used from 1969 to May 2011, when its use was discontinued (Barton & Loguidice, P.C., 2012). During that time period, discharges of PCE apparently occurred that resulted in soil and groundwater contamination. The RI conducted by MACTEC identified an unlined catch basin (CB-1) as the primary source of PCE detected in soil and groundwater at the Site. The catch basin was connected to a solid bottomed catch basin that was part the public storm sewer system (CB-2) by a four inch drain pipe (Figure 1.2); however, because (1) the catch basin CB-1 did not have a constructed bottom, and (2) the drain pipe exited the catch basin at an elevation higher than the bottom of the basin, the catch basin CB-1 essentially functioned as a dry well. In addition to the basin being identified as the entry point of PCE contamination, the action of storm water entering the catch basin resulted in groundwater mounding, aiding in the mobilization of contamination away from the catch basin. Soil contamination was primarily present from the water table to a clay layer that was present at approximately 10 feet below ground surface (bgs). Contamination was not identified in the soil above the water table (i.e. not identified in approximately the top four feet of soil below the Site parking lot).

In 2015, as part of the MACTEC RI, soil interim remediation was conducted to remove the highest concentrations of VOCs in soil and to prevent the continued mounding effect resulting from the open bottom catch basin. The objectives were met by excavation, removal, and offsite disposal of source area soil containing VOCs above the SCOs for restricted residential use (NYS, 2006) located (1) below the catch basin at the rear of the Site building (CB-1), and (2) north and northwest of the catch basin. The catch basin was also replaced with a solid bottom catch basin.

In 2021, the NYSDEC performed a soil removal action as per the ROD to remove remaining soil at the site with concentrations of contaminants (primarily PCE) greater than commercial use SCOs, and to remove soil at the adjacent residential property to the south with concentrations of contaminants greater than the residential SCOs. This soil removal action generally met the objectives, although some contamination exceeding SCOs for commercial use remain at depth on the north edge of the property where further excavation was not possible/practical due to excavation sloping requirements.

The soil remedial actions removed the largest source of groundwater contamination, as well as the areas with the highest identified groundwater concentration (PCE was detected at 63,000 micrograms per liter in 2019 within the limits of excavation). Although contaminant concentrations in groundwater were lower outside the soil removal area, they still exceed groundwater standards.

2.4 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the site as outlined in the ROD (NYSDEC, 2017) are as follows:

2.4.1 <u>Groundwater</u>

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.
- 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 into buildings at a site.

2.5 Remaining Contamination

2.5.1 Soil

Contamination remains in soil at the Site at concentrations greater than unrestricted use SCOs (Figure 2.1). Soil removal actions were conducted to depths of 8 to 10 feet below grade which removed most of the soil at the Site that was contaminated at levels above commercial use SCOs, as well as off-site soil with contaminant levels above the restricted residential SCOs. As an engineering control, the soil cover consists of clean backfill material that meets unrestricted use SCOs. Additional information on this engineering control is in Section 3.3. In addition to the remaining contamination above restricted residential SCOs, there is a limited area on the north side of the Site that had historic soil results above commercial use SCOs for PCE that could not be excavated due to sloping requirements near the property line (locations TCC-D16A and TCC-D15).

Figure 2.1 summarizes the results of all soil samples collected that exceed the Unrestricted Use, Residential, Restricted Residential, or Commercial Use SCOs at the site after completion of the interim remedial measure and remedial action.

2.5.2 Groundwater

Remaining contamination is also present onsite and off-site in groundwater. Groundwater samples were collected from 25 Site monitoring wells in May 2019, prior to the remedial action. Groundwater results are presented in Table 3.

Concentrations detected in groundwater in May 2019 of PCE, the primary groundwater contaminant, are presented on Figure 1.3. The locations with the highest concentrations (MW-2 and DP-14) were removed with the soil removal remedial action in 2021. The highest concentrations of PCE outside the area of the soil remedial action were at monitoring wells MW-1 (2,000 micrograms per liter [µg/L]) and MW-13 (2,400 µg/L). Concentrations diminished fairly rapidly away from the former source area.

2.5.3 Soil Vapor

Remaining contamination is present in soil vapor at the Site. Sub-slab soil vapor and indoor air sampling conducted prior to and during the RI indicated the potential for soil vapor intrusion (SVI) at and in the vicinity of the Site. As a result, three sub-slab depressurization system were installed:

1) At the Site building by the site property owner.
2) At two off-site properties.

Systems were installed due to the presence of PCE in soil vapor (max concentration of 780 micrograms per cubic meter below the building south of site). Based results of SVI sampling at other properties surrounding and hydraulically downgradient from the site, the New York State Department of Health (NYSDOH) did not require additional action at other properties. For buildings developed on the Site or in an off-site area of contamination, a soil vapor intrusion evaluation will be completed.

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 project manager.

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 this Site Management Plan;
- 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 C) 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 project manager.

3.2 Institutional Control

A series of ICs is required by the ROD 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 uses only. Adherence to these

ICs on the site are required by the SMP. ICs identified in the SMP may not be discontinued without an amendment to or extinguishment of the SMP. These ICs are:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8 (h)(3);
- allow the use and development of the controlled property for commercial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the County DOH; and
- require compliance with the Department approved SMP.

The SMP requires following the EWP provided in Appendix C to prevent exposure to remaining contamination, as well as to manage soil that exceeds Standards, Criteria and guidelines (SCGs) per DER-10. The EWP outlines the procedures required to be implemented in the event sub-surface work is conducted at the site. 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) prepared for the site.

3.3 Engineering Controls

3.3.1 Sub-Slab Depressurization Systems

Exposure to contaminated indoor air resulting from vapor intrusion has been mitigated with the installation of an SSDS at the Site building, as well as an SSDS at the commercial properties north and south of the Site. The system at the Site and the property to the north of the Site were installed by the individual property owners. The system on the property south of the Site was installed by the NYSDEC. The systems consist of one or more sub-slab suction points and exterior mounted fans. The fans run continuously and do not require routine maintenance but should be checked occasionally to ensure it is operational. (SSDSs are described in more detail in Section 5.0 of this SMP).

3.3.2 Soil Cover

Exposure to remaining contamination in soil is mitigated by the placement of clean backfill as a soil cover. The soil cover is additionally protected by asphalt pavement as part of site restoration activities. Any disturbance of the soil must follow the Soil Excavation Plan in Appendix C.

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

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 Commissioner Policy 43. The remedial party will also conduct any needed site restoration activities, such as asphalt patching.

3.3.3.1 Sub-Slab Depressurization (SSD) System

The active SSD system at the Site will not be discontinued unless prior written approval is granted by the NYSDEC and the NYSDOH project managers. One property installed an SSDS and maintains and operates the system. One SSDS was installed by NYSDEC, but is monitored by the property owner and maintained by NYSDEC.

3.3.3.2 Monitoring Wells associated with Monitored Natural Attenuation

Groundwater monitoring activities to assess natural attenuation will continue, as determined by the NYSDEC project manager in consultation with NYSDOH project manager, 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 monitoring will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC project manager. 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 project manager. 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 Quality Assurance Project Plan and Program Field Activities Plan (MACTEC, 2020a).

The off-site residential SSD/ventilation systems are being monitored by and maintained by the NYSDEC. To monitor these systems, the NYSDEC sends an annual letter to the owner or tenant of the property to remind them to check to see the fan is operational, to confirm that it is drawing a vacuum, and to report any issue to the NYSDEC so they can take care of any maintenance or repairs needed.

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

- Sampling and analysis of groundwater;
- Assessing compliance with applicable NYSDEC SCGs, particularly groundwater standards; 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;
- Analytical sampling program requirements;
- Inspection and maintenance requirements for monitoring wells;

- Monitoring well decommissioning procedures; and

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. These periodic inspections must be conducted when the ground surface is visible (i.e. no snow cover). Site-wide inspections will be performed by 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. Modification to the frequency or duration of the inspections will require approval from the NYSDEC project manager. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. The inspections will 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;
- Whether stormwater management systems, such as basins and outfalls, are working as designed;
- 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 (where required);
- If these controls continue to be protective of human health and the environment;

- Compliance with requirements of this SMP;
- Achievement of remedial performance criteria; and
- If site records are complete and up to date.

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 project manager 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 defined in 6 NYCCR Part 375. Written confirmation must be provided to the NYSDEC project manager 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.

4.3 Post-Remediation Media Monitoring and Sampling

The effectiveness of the remedial actions previously implemented at the Site will be conducted through the collection and evaluation of groundwater quality hydraulically upgradient and downgradient of the previous soil removal actions. Samples shall be collected from the groundwater monitoring wells on a routine basis. Sampling locations, required analytical parameters, and schedule are provided in Table 4 – Post Remediation Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

Table 4 – Post Remediation Sampling Requirements and Schedule

Monitoring Well ID	Analytical		Sample Schedule
	VOCs (EPA 8260)	MNA Parameters	
GEMW-1	X		Annual
GEMW-2	X		Annual
MW-1	X	X	Annual
MW-2B	X		Annual
MW-3	X	X	Annual
MW-8	X		Annual
MW-10	X		Annual
MW-13	X	X	Annual
MW-13B	X		Annual
MW-16B	X		Annual
MW-17B	X		Annual
MW-19B	X		Annual
MW-21B	X		Annual
DP-10	X		Annual
DP-11	X		Annual
DP-12	X		Annual
DP-16	X	X	Annual
DP-17	X		Annual
DP-18	X		Annual
DP-19	X		Annual
DP-20	X		Annual
DP-21	X		Annual

MNA Parameters include:

- Ethane, Ethene, Methane, and Carbon Dioxide by Method RSK-175
- Manganese and Iron by USEPA Method 6010
- Chloride and Sulfide by SM4500
- Alkalinity by SM2320
- Sulfate and Nitrate by Method 300.0
- Total Organic Carbon by Method 415

Detailed sample collection and analytical procedures and protocols are provided in the MACTEC Quality Assurance Program Plan and Field Activities Plan (MACTEC, 2020).

Samples will be collected using low flow sampling procedures (if possible). Groundwater purged from wells where previous analytical data indicated concentrations of contaminants greater than Class GA groundwater standards will be collected for either on-site treatment through granular activated carbon, or for off-site disposal to a licensed facility.

4.3.1 Groundwater Sampling

Groundwater monitoring will be performed annually to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC project manager.

The network of monitoring wells has been installed to monitor upgradient, on-site and downgradient groundwater conditions at the site. Water in the vicinity and downgradient of the Site are not used for drinking water purposes. Monitoring wells at the downgradient edge of the Plume (DP-21 and MW-21D) have typically had concentrations at, or slightly above the class GA standards and since the plume has been shown to be fairly stable, these are considered sentinel wells.

Table 2 summarizes the wells identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells. The depth to groundwater will be measured for each monitoring well in the network before sampling.

Baseline water levels are also presented in Table 2. Monitoring well construction logs are included in Appendix B of this document. The groundwater monitoring network is shown on Figure 1.2.

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 project manager 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 project manager. 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 project manager.

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

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

4.3.2 Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and associated sampling log as provided in the standard operating procedures (SOPs) included in Appendix E. Other observations (e.g., groundwater monitoring well integrity) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network.

Additional detail regarding monitoring and sampling protocols are provided in the Quality Assurance Program Plan and Program Field Activities Plan (MACTEC, 2020a).

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

This Operation and Maintenance Plan provides a brief description of the measures necessary to operate, monitor and maintain the mechanical components of the remedy selected for the site. This Operation and Maintenance Plan:

- Includes the procedures necessary to allow individuals unfamiliar with the site to operate and maintain the SSDSs associated with contamination present at the Site;

- Will be updated periodically to reflect changes in site conditions or the manner in which the SSDSs are operated and maintained.

The responsibilities of monitoring and maintaining the SSDSs is as follows:

- The SSDS at the on-site building was installed and is monitored and maintained by the property owner.
- Two SSDSs exist off-site, one installed by a property owner and one installed by NYSDEC.

The sections below are included as part of this SMP for informational purposes as per the ROD.

5.2 Remedial System (or other Engineering Control) Performance Criteria

The SSDSs are designed to create a minimum vacuum below the entire building footprint for each building. The vacuum is created by a fan(s) installed on the exterior of the buildings that are designed to run uninterrupted. The fan(s) are connected by PVC pipe to a suction point located in the basement floor or slab on grade floor. A liquid manometer is present on the pipes above the suction points that indicate the vacuum in inches of water column. Performance of the systems is monitored by viewing the manometer and ensuring the vacuum observed is within the parameters marked on the manometer by the installer.

5.3 Operation and Maintenance of the SSD Systems

The following sections provide a description of the operations and maintenance of the SSDS.

5.3.1 System Start-Up and Testing

They SSD systems are design to run continuously. If any individual system is shut down, it should be turned back on and the vacuum measurement on the liquid manometer observed. If the vacuum is below original design parameters, the building floor should be evaluated for new/unsealed cracks in the concrete or damaged pipes that could be short circuiting the system. If the floor is sealed and the system components are in good repair, additional pressure field testing can be conducted across the basement floor to ensure the vacuum created meets design specifications.

The system testing described above will be conducted if, in the course of the SSD system lifetime, any individual system goes down or significant changes are made to the system and the system must be restarted.

5.3.2 Routine System Operation and Maintenance

The SSDSs are designed to run continuously with little to no maintenance needs. Each individual system should be evaluated at a minimum annually to ensure:

- The fan(s) is running and the vacuum measurement on the liquid manometer is within design criteria.
- There are no new/unsealed cracks on the basement floor (or slab on grade floor).
- The system components (PVC pipes, floor seal, fan, couplings) are in good repair.
- The fan exhaust extends above the roofline and there are no new windows or other openings within 10 feet of the exhaust.

5.3.3 Non-Routine Operation and Maintenance

Non routine maintenance will be conducted in the event the system or system components are broken or damaged. If any of the individual SSDS fans are found to be non-functioning, they can be replaced by the installer without removing the rest of the system.

5.3.4 System Monitoring Devices

As stated above, the SSDSs are installed with a liquid manometer to gauge the vacuum created by the fan. If, upon inspection, there is no vacuum shown on the manometer, then applicable maintenance and repairs will be conducted, as specified in the Operation and Maintenance Plan for that system. Inspections and operational problems for the systems monitored by the individual property owners will not be noted in the Periodic Review Reports.

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.

Because the Site and surrounding area is fairly flat and urbanized, and with the exception of an SSDS there are no active remedial systems in place, the Site is considered fairly resilient to climate change. However, a vulnerability assessment will be conducted annually as part of the annual inspection. This assessment will include an evaluation of the following potential vulnerabilities:

- Site Drainage and Storm Water Management: The western half of the site is covered in asphalt parking and the Site building. The eastern half is forested. Roof drains, where present, discharge to the asphalt parking to the east of the Site building. If the municipal storm sewer lines reach capacity during extreme events, or become clogged, it could be possible for water to flood the rear parking lot; however contamination is below four feet and if erosion occurs it would not expose contaminated soil. Nonetheless, the vulnerability assessments should include review of adjacent storm drains for clogging. The site is not located in a flood prone area; the Federal Emergency Management Agency (FEMA) Flood Insurance map for the site is available in Appendix F.

- Erosion: The site is primarily covered with asphalt and therefore less susceptible to erosion. Flooding water would flow to grass south of the Site and although erosion could occur during periods of severe rain events, it would not expose contaminated soil. However, the vulnerability assessment should include evaluation of asphalt at the site to ensure large cracks have not formed that could result in erosion of the surface cover onto the adjacent residential property during severe rain events.

- Electricity: There is an SSDS located at the Site building, and at the buildings to the north and south of the Site that run continuously to prevent vapor intrusion of site related contaminants. In the event of power loss and/or dips/surges in voltage during severe weather events, including lightning strikes, the fans associated with this system could lose power or become damaged. The vulnerability assessment should include evaluation of electrical lines entering these buildings to ensure they are secure to the utility pole and buildings.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the Periodic Review Report (PRR), including:

- Land and/or ecosystems
  - No land or ecosystems will be disturbed during routine Site management activities.
- Water Usage
  - No water will be used as all engineering controls are vapor mitigation systems.
- Waste Generation
  - Remaining contamination is covered by asphalt/site building which do not require operation or scheduled maintenance and, therefore, no waste will be generated. Groundwater generated during groundwater sampling will be treated on-site to minimize the need to transport and dispose of water off-site.

- Energy usage
    - Unlike a soil vapor extraction system, the SSDSs are designed to run with minimal energy usage while preventing contaminants from migrating into structures.
- Emissions
    - Trips to the Site for inspections will be combined with other activities, when possible, to limit the emissions produced.

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken any time that the NYSDEC project manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

6.2.2 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Site, use of consumables in relation to visiting the Site in order to collect samples, and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

6.2.3 Metrics and Reporting

As discussed in Section 7.0 information on energy usage, solid waste generation, transportation and shipping, water usage and land use and ecosystems will be recorded to facilitate and document consistent implementation of green remediation during site management and to identify corresponding benefits. A set of metrics has been developed.

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 included in Appendix G. These forms are subject to NYSDEC revision. All site management inspection, maintenance, and monitoring events will be conducted by 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.

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 7.1 and summarized in the Periodic Review Report.

Table 7.1: Schedule of Monitoring/Inspection Reports

Task/Report	Reporting Frequency*
Groundwater Monitoring and Inspection Report	Annually
Periodic Review Report	Annually

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

All 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., groundwater);

- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation);

- 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™ 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 every three years to the NYSDEC project manager or at another frequency as may be required by the NYSDEC project manager. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses each site. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certificate`on 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, fire 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.

- Identification of any wastes generated during the reporting period, along with waste characterization data, manifests, and disposal documentation.

- 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 tables and figures will include a presentation of past data as part of an evaluation of contaminant concentration trends, including but not limited to:
  - Trend monitoring graphs that present groundwater contaminant levels from before the start of the remedy implementation to the most current sampling data;
  - Trend monitoring graphs depicting system influent analytical data on a per event and cumulative basis;
  - A current plume map for sites with remaining groundwater contamination; and
  - A groundwater elevation contour map for each gauging event.
- 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™ 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:

  - The compliance of the remedy with the requirements of the site-specific ROD;

  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;

  - 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;

  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan;

  - An evaluation of trends in contaminant levels in the affected media to determine if the remedy continues to be effective in achieving remedial goals as specified by the ROD; and

  - The overall performance and effectiveness of the remedy.

  - A performance summary for the SSD systems will not be included since the systems are being monitored by and maintained by the NYSDEC.

To monitor these systems, the NYSDEC sends an annual letter to the owner or tenant of the property to remind them to check to see the fan is operational, to confirm that it is drawing a vacuum, and to report any issue to the NYSDEC so they can take care of any maintenance or repairs needed.

- A quantitative and qualitative overview of a site's environmental impacts will be provided through the completion of the Summary of Green Remediation Metrics.

- A summary of the Green Remediation Evaluation.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional as defined in 6 NYCRR Part 375 or Professional Engineer licensed to practice and registered 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;*
- *Use of the site is compliant with the SMP;*

- *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*
- *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 am certifying as Remedial Party's Designated Site Representative for the site."

Certification of the SSD systems, the only Engineering Controls for the site, will be completed by the property owners for the Site and property to the north of the Site, and by the NYSDECs SSDS inspection contractor for the property to the south of the Site.

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 or failure to conduct site management activities, a Corrective Measures Work Plan will be submitted to the NYSDEC project manager 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 project manager.

8.0 REFERENCES

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

Barton & Loguidice, P.C. , 2012; *Remedial Investigation Work Plan*, Town and Country Cleaners, 2308 and 2310 Monroe Avenue Brighton, New York, Site #C828149, Brownfield Cleanup Program, Prepared by Barton & Loguidice, P.C.; September 2011, Final NYSDEC Approved Version: January 2012.

Day Environmental, Inc., 2010. *Data Package, Delineation Study: Storm Water Catch Basin Area.* Brownfield Cleanup Program, Town and Country Cleaners, 2308 and 2310 Monroe Avenue, Brighton, NY, BCP Site C828149. December 2010.

MACTEC, 2016a. *Soil Removal IRM – Construction Completion Report - Town and Country Dry Cleaners;* Site Number #828149. Prepared for New York State Department of Environmental Conservation Albany, New York. June 2016.

MACTEC, 2016b. *Remedial Investigation/Feasibility Study*, Town and Country Dry Cleaners, Site 828149. December 2016.

MACTEC, 2017. *Pre-Design Investigation Report*, Town and County Dry Cleaners Site. March 27, 2017.

MACTEC, 2019. *2019 Groundwater Sampling Report*, Town and Country Dry Cleaners Site; Site Number 828149. August 2, 2019.

MACTEC, 2022. *Draft Final Engineering Report*, Town and Country Dry Cleaners Site. June 2022.

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).

NYSDEC, 2017. Record of Decision. Town and Country Dry Cleaners State Superfund Project, Brighton, Monroe County, Site No. 828149. March 2017.

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

TABLES

Table 2 - Monitoring Well Details and Groundwater Elevation Data

Location ID	Northing	Easting	Ground Elevation (ft amsl)	PVC Riser Pipe Elevation (ft amsl)	Screen Length (ft)	Clay Layer? (ft bgs)	DTW 7/22/13 (ft btor)	GW Elevation 7/22/13 (ft amsl)	DTW 4/25/16 (ft btor)	GW Elevation 4/25/16 (ft amsl)	DTW 10/09/2017 (ft btor)	GW Elevation 10/09/2017 (ft amsl)	DTW 5/6/2019* (ft btor)	GW Elevation 5/6/2019* (ft amsl)
DP-10	1138737.73	1422305.44	477.84	477.53	6.0	10.5-15	7.34	470.19	4.17	473.36	9.2	468.33	2.56	474.97
DP-11	1138734.19	1422359.91	478.37	478.05	8.0	None	12.40	465.65	12.16	465.89	12.2	465.85	6.19	471.86
DP-12	1138700.85	1422352.85	477.42	477.09	10.0	None	11.65	465.44	10.94	466.15	12.48	464.61	9.14	467.95
DP-14**	1138717.51	1422261.09	477.14	476.82	5.0	12.5-13.5	4.53	472.29	3.59	473.23	5.71	471.11	2.42	474.40
DP-15**	1138744.94	1422284.51	477.25	476.98	5.0	9.8-14.6	5.44	471.54	2.61	474.37	6.75	470.23	1.9	475.08
DP-16	1138766.08	1422168.18	479.06	478.77	5.0	9.3-11.4	5.15	473.62	5.49	473.28	5.97	472.80	5.05	473.72
DP-17	1138699.91	1422092.66	479.89	479.50	10.0	None	7.06	472.44	7.12	472.38	6.9	472.60	6.63	472.87
DP-18	1138578.39	1422161.46	478.82	478.29	6.0	10.9-12.8	6.47	471.82	7.06	471.23	5.55	472.74	5.99	472.3
DP-19	1138532.70	1422378.17	475.49	475.15	10.0	None	5.65	469.50	5.46	469.69	5.06	470.09	5.19	469.96
DP-20	1138477.85	1422664.27	474.21	473.80	10.0	None	11.61	462.19	11.68	462.12	13.82	459.98	9.6	464.20
DP-21	1138650.76	1422923.25	468.74	468.38	8.0	None	7.43	460.95	6.21	462.17	9.02	459.36	6.59	461.79
GEMW-1	1138768.73	1422148.96	479.70	479.57	5.0	NA	6.58	472.99	6.79	472.78	6.87	472.70	6.41	473.16
GEMW-2	1138751.76	1422130.52	480.36	480.25	5.0	NA	7.80	472.45	7.70	472.55	7.58	472.67	7.43	472.82
MW-1	1138762.61	1422240.53	477.40	477.05	5?	NA	3.64	473.41	3.66	473.39	3.45	473.60	2	475.05
MW-2**	1138726.34	1422216.42	477.13	476.87	5?	NA	2.53	474.34	3.74	473.13	2.6	474.27	2.91	473.96
MW-2B	1138727.39	1422222.76	477.06	476.71	5.0	UNK-13	4.83	471.88	4.88	471.83	4.3	472.41	4.23	472.48
MW-3	1138741.96	1422179.86	478.37	478.00	5?	NA	3.27	474.73	5.22	472.78	4.76	473.24	4.62	473.38
MW-8	1138868.41	1422501.18	473.10	473.04	5.0	NA	>9.2 (dry)	<463.84	>9.2 (dry)	<463.84	>9.2 (dry)	<463.84	>9.2 (dry)	<463.84
MW-10	1138876.06	1422009.43	482.11	481.70	5.0	NA	8.59	473.11	7.16	474.54	8.64	473.06	6.58	475.12
MW-13	1138720.92	1422285.49	477.39	480.36	5.0	NA	9.10	471.26	6.99	473.37	11.44	468.92	5.6	474.76
MW-13B	1138716.73	1422294.21	477.80	480.37	5.0	NA	9.29	471.08	9.9	470.47	9.85	470.52	9.15	471.22
MW-16B	1138763.12	1422164.89	478.95	478.58	5.0	NA	6.74	471.84	6.78	471.80	6.33	472.25	6.36	472.22
MW-17B	1138696.71	1422088.47	479.75	479.35	5.0	NA	7.26	472.09	8.13	471.22	8.52	470.83	7.51	471.84
MW-19B	1138531.53	1422373.04	475.69	475.35	5.0	NA	5.91	469.44	5.68	469.67	5.28	470.07	5.39	469.96
MW-21B	1138654.47	1422923.58	468.55	468.15	5.0	NA	7.82	460.33	7.66	460.49	9.28	458.87	7.02	461.13

Notes:

Horizontal Coordinates reference to the New York State Plane Coordinate System, West Zone (3103) based on NAD 83 (2011).

Vertical Datum is NAVD88. Survey conducted by Prudent Engineering, dated 8/12/2013.

- = not measured   > = greater than   < = less than

ft = feet

amsl = above mean sea level

BOW = bottom of well

btor = below top of riser

DTW = depth to water below measuring point

GW = groundwater

NA = not available

UNK = unknown

* Depth to water for DP-10, DP-15, and DP-17 were measured at a later date during the same week, prior to sampling.

** These wells were removed during the remedial action.

Prepared By: HEP 6/28/2019
Checked by: CRS 3/28/23

Table 3: Groundwater VOC Results

		Location	DP-010		DP-011		DP-012		DP-014		DP-015		DP-016		DP-017		DP-018		DP-019		DP-020	
		Sample Date	5/8/2019		5/8/2019		5/8/2019		5/7/2019		5/8/2019		5/8/2019		5/8/2019		5/7/2019		5/8/2019		5/8/2019	
		Sample ID	828149-DP010008		828149-DP011012		828149-DP012015		828149-DP014009		828149-DP015009		828149-DP016009		828149-DP017015		828149-DP018009		828149-DP019012		828149-DP020012	
		QC Code	FS		FS		FS		FS		FS		FS		FS		FS		FS		FS	
Parameter	**GA**	**GV**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
1,1-Dichloroethane	5	NC	1	U	1	U	1	UJ	50	U	5	U	**0.44**	J	1	U	1	U	1	UJ	1	U
1,1-Dichloroethene	5	NC	1	U	1	U	1	UJ	50	U	5	U	**3.8**		1	U	1	U	1	UJ	1	U
Acetone	NC	50	5	U	5	U	5	UJ	250	U	25	U	10	U	5	U	5	U	5	UJ	5	U
Carbon disulfide	NC	60	1	U	1	U	1	UJ	50	U	5	U	2	U	1	U	1	U	1	UJ	1	U
Chloroform	7	NC	1	U	1	U	1	UJ	50	U	5	U	2	U	1	U	1	U	1	UJ	1	U
Chloromethane	5	NC	1	U	1	U	1	UJ	50	U	5	U	2	U	1	U	1	U	1	UJ	**0.28**	J
cis-1,2-Dichloroethene	5	NC	**55**		1	U	**0.54**	J	**340**		**47**		**610**		1	U	1	U	**7.8**	J	1	U
Tetrachloroethene	5	NC	**120**		**0.96**	J	**0.59**	J	**8100**		**1300**		**300**		1	U	1	U	**19**	J	1	U
trans-1,2-Dichloroethene	5	NC	**0.45**	J	1	U	1	UJ	50	U	5	U	**4**		1	U	1	U	**0.21**	J	1	U
Trichloroethene	5	NC	**38**		1	U	1	UJ	**310**		**59**		**91**		1	U	1	U	**5.5**	J	1	U
Vinyl chloride	2	NC	1	U	1	U	1	UJ	50	U	5	U	**32**		1	U	1	U	1	UJ	1	U

Notes:
Samples Analyzed for VOCs by Method 8260
Results in micrograms per liter (µg/L)
Only detected compounds shown
(detections in bold)
Qualifier
U = not detected
J = estimated value
QC Code
FS = field sample
FD = field duplicate
GA = New York State Class GA Groundwater
GV = New York State Guidance Values
Highlighted cell exceeds GA or GV criteria
NC = no criteria

Prepared by: HEP 7/10/19
Checked by: CRS 7/26/19

Table 3: Groundwater VOC Results

		Location	DP-021		GEMW-1		GEMW-2		MW-1		MW-1		MW-2		MW-2B		MW-3		MW-3	
		Sample Date	5/8/2019		5/7/2019		5/8/2019		5/7/2019		5/7/2019		5/8/2019		5/7/2019		5/6/2019		5/6/2019	
		Sample ID	828149-DP021009		828149-GEMW001014		828149-GEMW002014		828149-MW001010		828149-MW001010D		828149-MW002010		828149-MW02B020		828149-MW003009		828149-MW003009D	
		QC Code	FS		FS		FS		FS		FD		FS		FS		FS		FD	
Parameter	**GA**	**GV**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
1,1-Dichloroethane	5	NC	1	U	1	U	1	U	20	U	20	U	500	U	1	U	5	U	5	U
1,1-Dichloroethene	5	NC	1	U	**1.1**		1	U	20	U	20	U	500	U	1	U	**6.2**		**6.3**	
Acetone	NC	50	5	U	5	U	5	U	100	U	100	U	2500	U	5	U	25	U	25	U
Carbon disulfide	NC	60	1	U	1	U	1	U	20	U	20	U	500	U	1	U	5	U	5	U
Chloroform	7	NC	**0.3**	J	1	U	1	U	20	U	20	U	500	U	1	U	5	U	5	U
Chloromethane	5	NC	1	U	1	U	1	U	20	U	20	U	500	U	1	U	5	U	5	U
cis-1,2-Dichloroethene	5	NC	1	U	**150**		**0.94**	J	**34**		**38**		500	U	**7.4**		**530**		**530**	
Tetrachloroethene	5	NC	**1.8**		**93**		**81**		**1900**	J+	**2000**	J+	**63000**		**20**		**390**		**380**	
trans-1,2-Dichloroethene	5	NC	1	U	**1.2**		1	U	20	U	20	U	500	U	1	U	**3.6**	J	**3.6**	J
Trichloroethene	5	NC	1	U	**38**		**0.93**	J	**34**		**35**		**160**	J	**6**		**220**		**220**	
Vinyl chloride	2	NC	1	U	**7.3**		1	U	20	U	20	U	500	U	1	U	**190**		**190**	

Notes:
Samples Analyzed for VOCs by Method 8260
Results in micrograms per liter (µg/L)
Only detected compounds shown
(detections in bold)
Qualifier
U = not detected
J = estimated value
QC Code
FS = field sample
FD = field duplicate
GA = New York State Class GA Groundwater
GV = New York State Guidance Values
Highlighted cell exceeds GA or GV criteria
NC = no criteria

Prepared by: HEP 7/10/19
Checked by: CRS 7/26/19

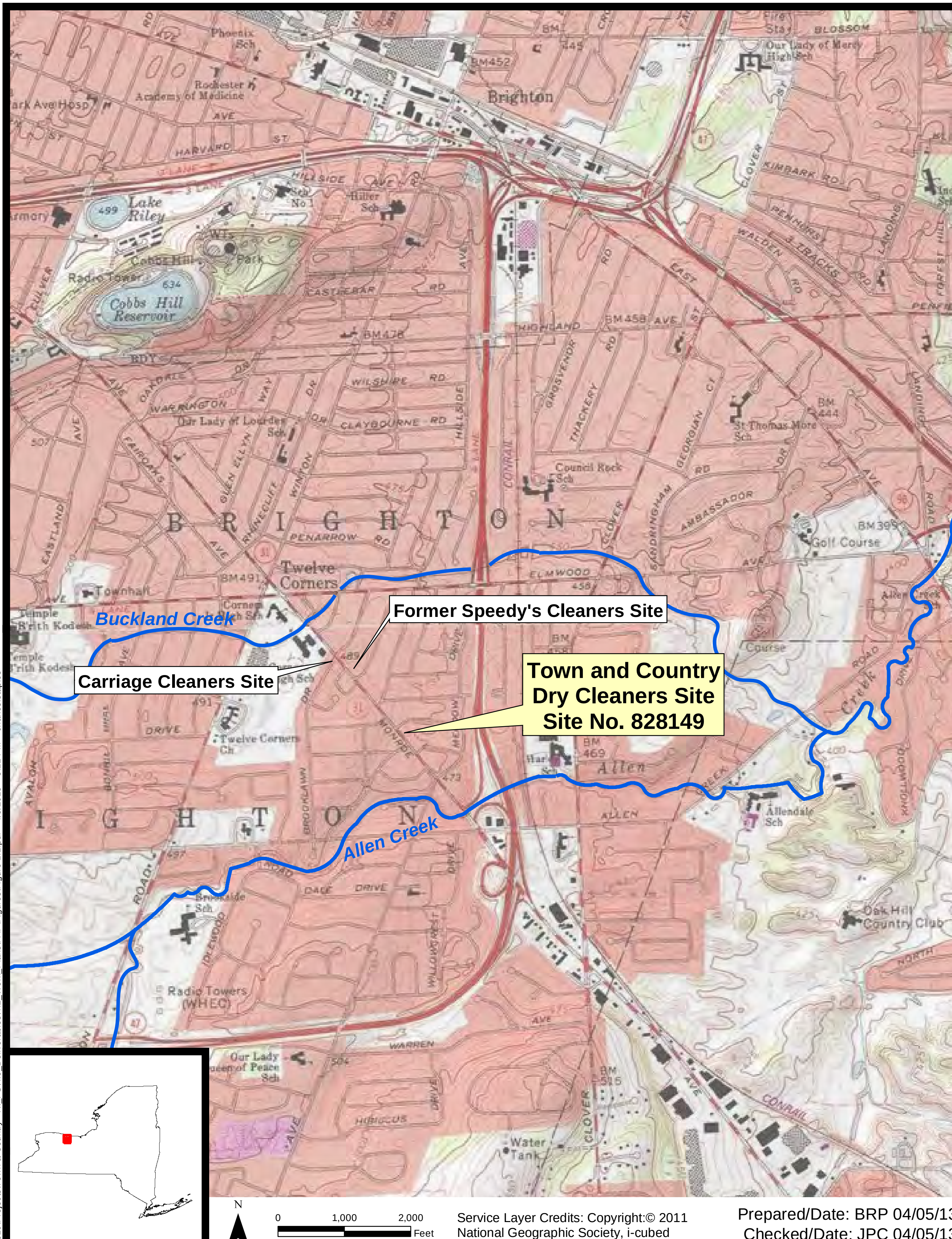
Table 3: Groundwater VOC Results

		Location	MW-10		MW-13		MW-13B		MW-16B		MW-17B		MW-19B		MW-21B	
		Sample Date	5/9/2019		5/7/2019		5/7/2019		5/6/2019		5/8/2019		5/8/2019		5/8/2019	
		Sample ID	828149-MW010010		828149-MW013012		828149-MW013B023		828149-MW16B023		828149-MW017B018		828149-MW019B025		828149-MW021B019	
		QC Code	FS		FS		FS		FS		FS		FS		FS	
Parameter	**GA**	**GV**	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier
1,1-Dichloroethane	5	NC	1	U	10	U	1	U	1	U	1	U	1	UJ	1	U
1,1-Dichloroethene	5	NC	1	U	10	U	1	U	1	U	1	U	1	UJ	1	U
Acetone	NC	50	5	U	50	U	5	U	5	U	5	U	5	UJ	5	U
Carbon disulfide	NC	60	1	U	10	U	**4.1**		1	U	**4.5**		1	UJ	1	U
Chloroform	7	NC	1	U	10	U	1	U	1	U	1	U	1	UJ	1	U
Chloromethane	5	NC	1	U	10	U	1	U	1	U	1	U	1	UJ	1	U
cis-1,2-Dichloroethene	5	NC	1	U	**160**		**2**		**0.95**	J	1	U	**9.4**	J	**0.38**	J
Tetrachloroethene	5	NC	1	U	**2300**		**1.6**		**0.95**	J	1	U	**13**	J	**6**	
trans-1,2-Dichloroethene	5	NC	1	U	10	U	1	U	1	U	1	U	1	UJ	1	U
Trichloroethene	5	NC	1	U	**190**		**1.2**		**0.45**	J	1	U	**6.9**	J	**0.59**	J
Vinyl chloride	2	NC	1	U	10	U	1	U	1	U	1	U	1	UJ	1	U

Notes:
Samples Analyzed for VOCs by Method 8260
Results in micrograms per liter (µg/L)
Only detected compounds shown
(detections in bold)
Qualifier
U = not detected
J = estimated value
QC Code
FS = field sample
FD = field duplicate
GA = New York State Class GA Groundwater
GV = New York State Guidance Values
Highlighted cell exceeds GA or GV criteria
NC = no criteria

Prepared by: HEP 7/10/19
Checked by: CRS 7/26/19

FIGURES



Prepared/Date: BRP 04/05/13
Checked/Date: JPC 04/05/13

TOWN AND COUNTRY DRY CLEANERS
SITE NO. 828149
BRIGHTON, NEW YORK

MACTEC

SITE LOCATION

Project 3612-13-2267 Figure 1.1

Document: \\pld2-fs1\Project\Projects ysdec1\Contract D007619\Projects\Town & Country - RI_FS\4.0_Deliverables\4.5_Databases\GIS\Map_Documents\Site_Location_8.5x11P.mxd 4/5/2013 5:22 PM charles.staples
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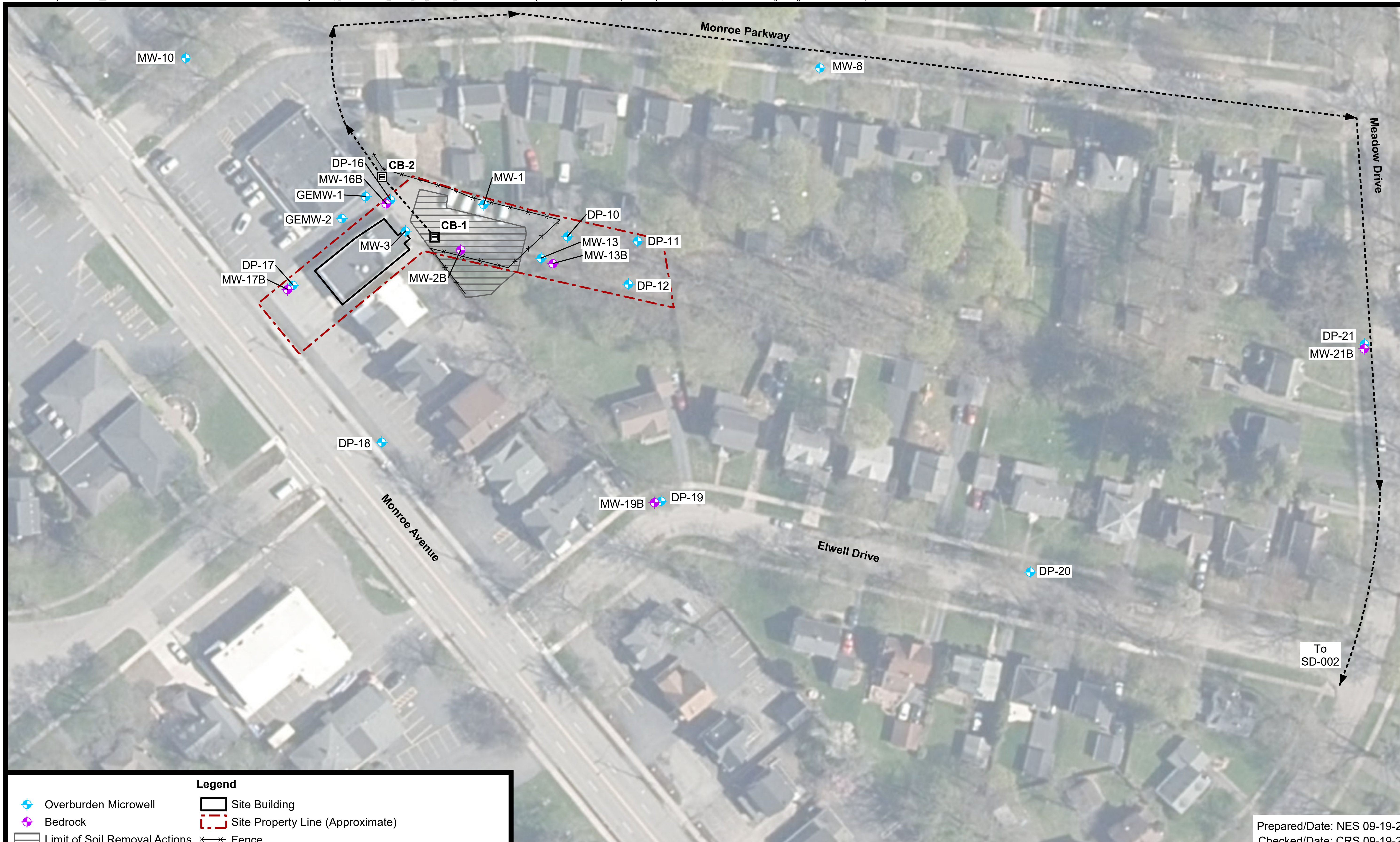
Document: P:\Projects\NYSDEC__General NYSDEC Information D009809\Database\GIS\Town and Country GIS\Map_Documents\Post_Remed_Site_Features_11x17LS.mxd PDF: P:\Projects\NYSDEC\Town & Country RA\8.0 Project Deliverables\8.1 Reports\8.1.6 SMP\Figures\Figure 1.2 - Site Features.pdf 09-19-2022 3:22 PM nathan.soule



Legend

- Overburden Microwell
- Bedrock
- Limit of Soil Removal Actions
- Site Building
- Site Property Line (Approximate)
- Fence
- Catch Basin/Manhole
- Storm Sewer Pathway (Approximate)

N

0 35 70 Feet

Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Prepared/Date: NES 09-19-22
Checked/Date: CRS 09-19-22

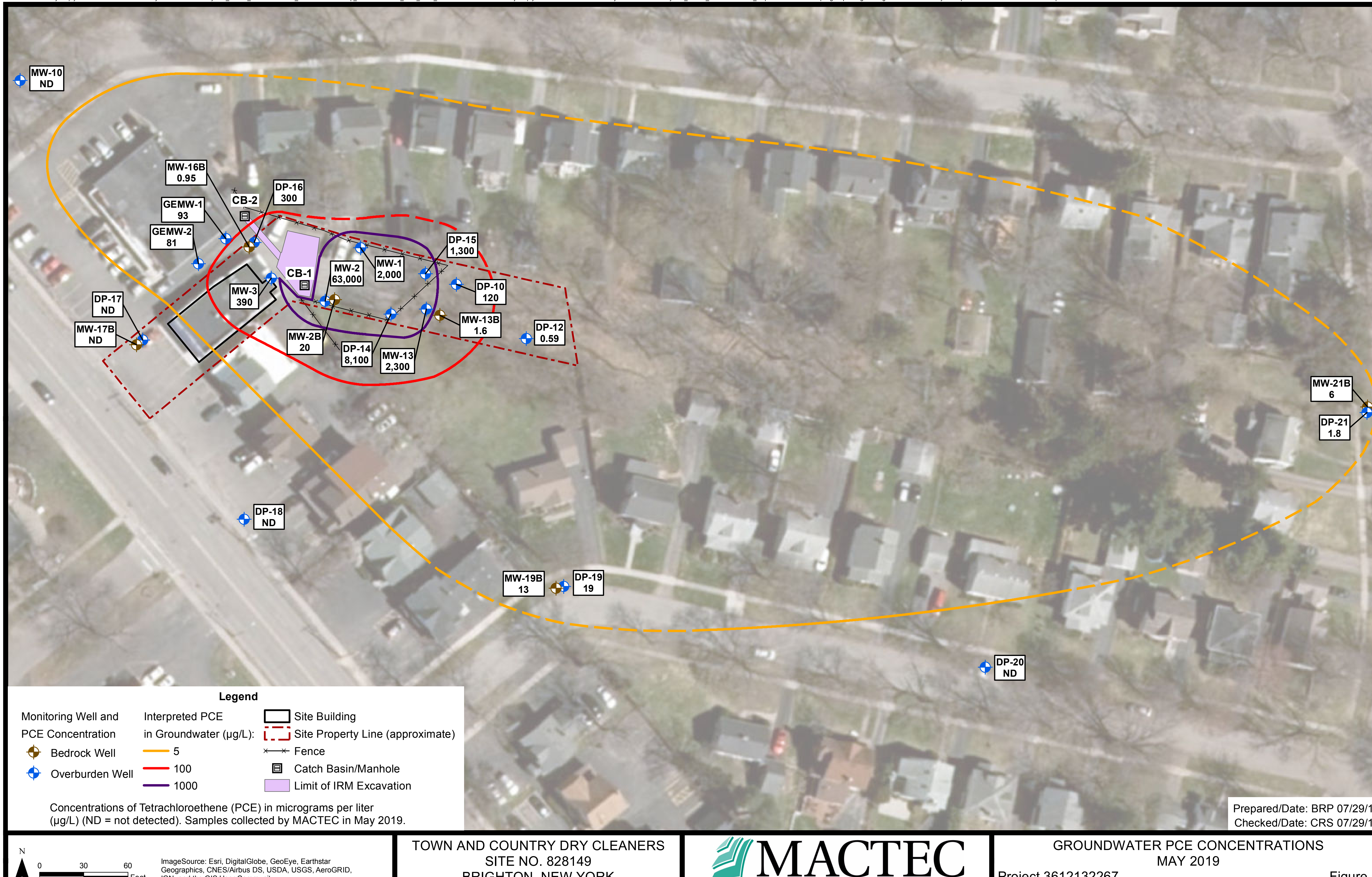
TOWN AND COUNTRY DRY CLEANERS
SITE NO. 828149
BRIGHTON, NEW YORK

MACTEC

SITE FEATURES

Project 3616206122

Figure 1.2



ImageSource: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

TOWN AND COUNTRY DRY CLEANERS
SITE NO. 828149
BRIGHTON, NEW YORK

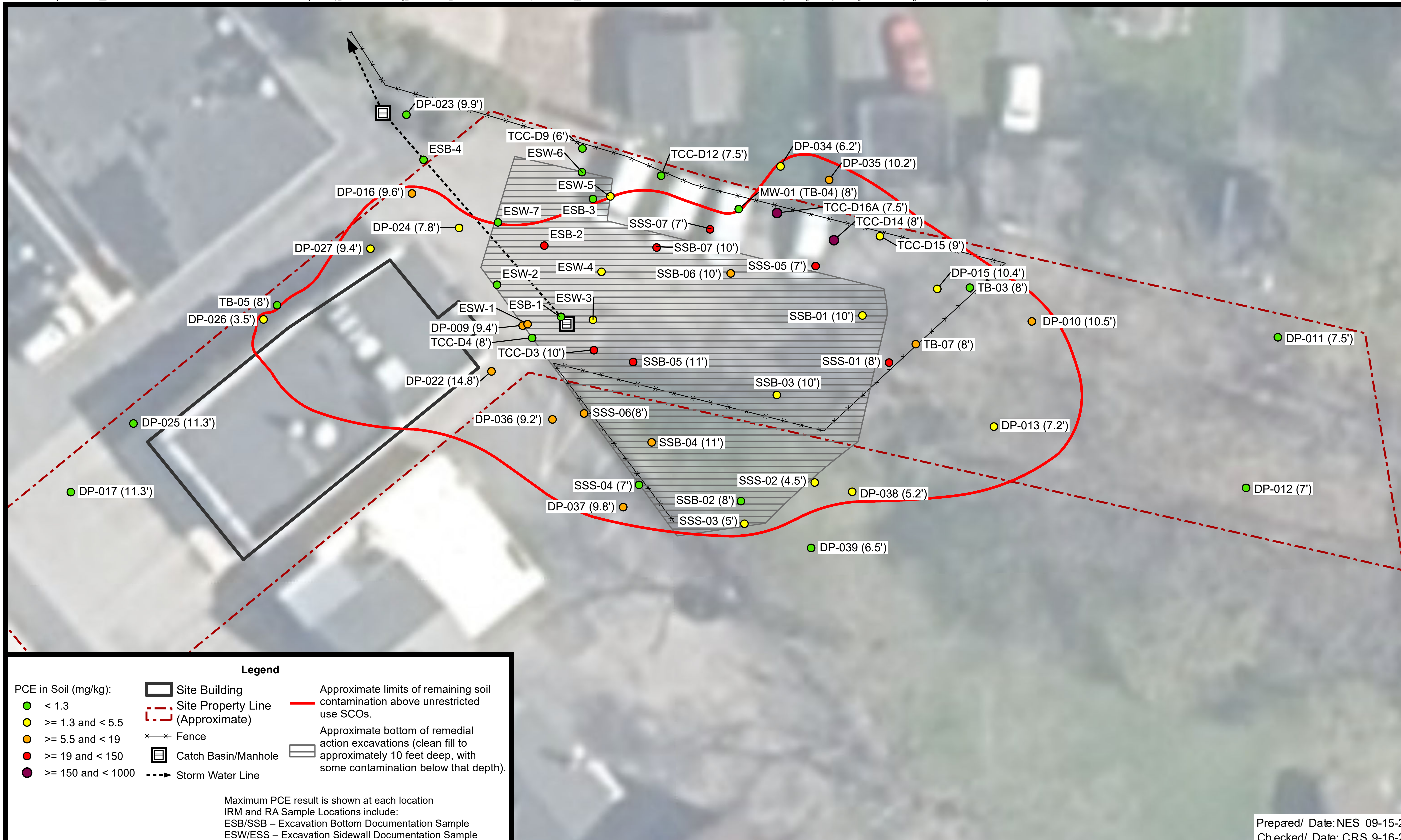
MACTEC

GROUNDWATER PCE CONCENTRATIONS
MAY 2019

Project 3612132267

Figure 5

Document: P:\Projects\NYSDEC__General NYSDEC Information D009809\Database\GIS\Town and Country GIS\Map_Documents\Remaining_Contamination_11x17LS.mxd PDF: P:\Projects\NYSDEC__General NYSDEC Information D009809\Database\GIS\Town and Country GIS\Figures\May 2022\Figure 2.1 - Remaining PCE Soil Contamination.pdf 09-15-2022 5:24 PM nathan.soule



Legend

PCE in Soil (mg/kg):
- < 1.3
- >= 1.3 and < 5.5
- >= 5.5 and < 19
- >= 19 and < 150
- >= 150 and < 1000

- Site Building
- Site Property Line (Approximate)
- Fence
- Catch Basin/Manhole
- Storm Water Line

- Approximate limits of remaining soil contamination above unrestricted use SCOs.
- Approximate bottom of remedial action excavations (clean fill to approximately 10 feet deep, with some contamination below that depth).

Maximum PCE result is shown at each location
IRM and RA Sample Locations include:
ESB/SSB – Excavation Bottom Documentation Sample
ESW/ESS – Excavation Sidewall Documentation Sample
Other locations from RI and previous investigations.
(8') = sample depth in feet

Image Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Prepared/ Date: NES 09-15-22
Checked/ Date: CRS 9-16-22

TOWN AND COUNTRY DRY CLEANERS
SITE NO. 828149
BRIGHTON, NEW YORK

MACTEC

REMAINING PCE SOIL CONTAMINATION

Project 3616206122

Figure 2.1

APPENDIX A – LIST OF SITE CONTACTS

Below is a list of Pertinent Site Contacts.

Name	**Contact Information**	**Phone/Email Address**
Site Owner	Phil and Loretta Gulian 2308 Monroe Ave, LLC 7 Glenmore Circle, Pittsford, NY 14534	pgulian@hotmail.com
Remedial Party	Jeffrey Dyber NYSDEC -DER 625 Broadway Albany NY 12233-7017	(518) 402-9621 jeffrey.dyber@dec.ny.gov
NYSDEC DER Project Manager	Jasmine Stafansky NYSDEC -DER 625 Broadway Albany NY 12233-7020	(518) 402-9813; jasmine.stafansky@dec.ny.gov

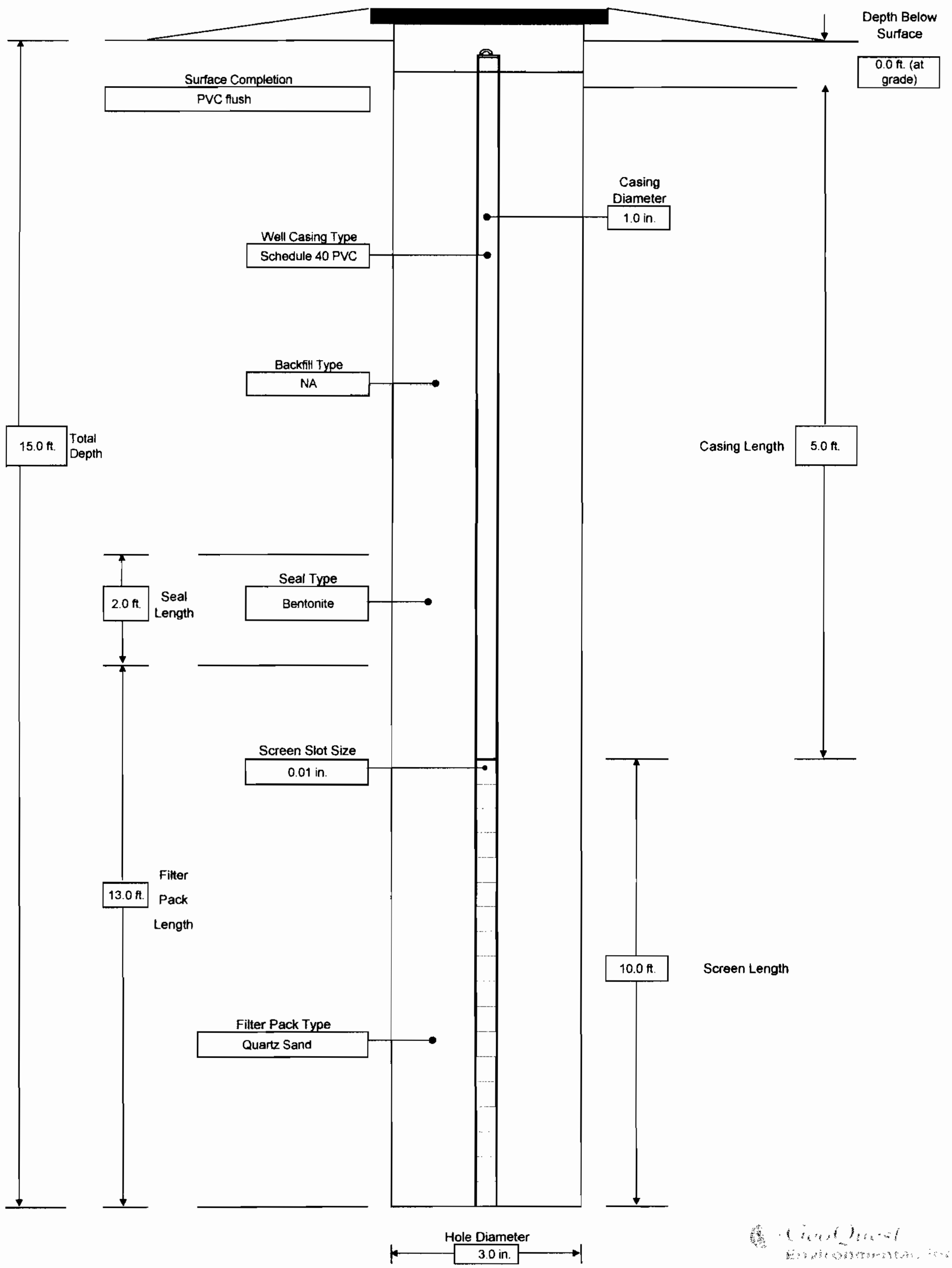
APPENDIX B – GROUNDWATER MONITORING WELL CONSTRUCTION LOGS

(Not available for MW-1, MW-8 and MW-10)

Project:	Phase II ESA, 2290 Monroe Ave., Brighton, New York	**Well Name:**	GEMW-1
Job No.:	110106	**Date Installed**	11/16/06

Well Completion Log

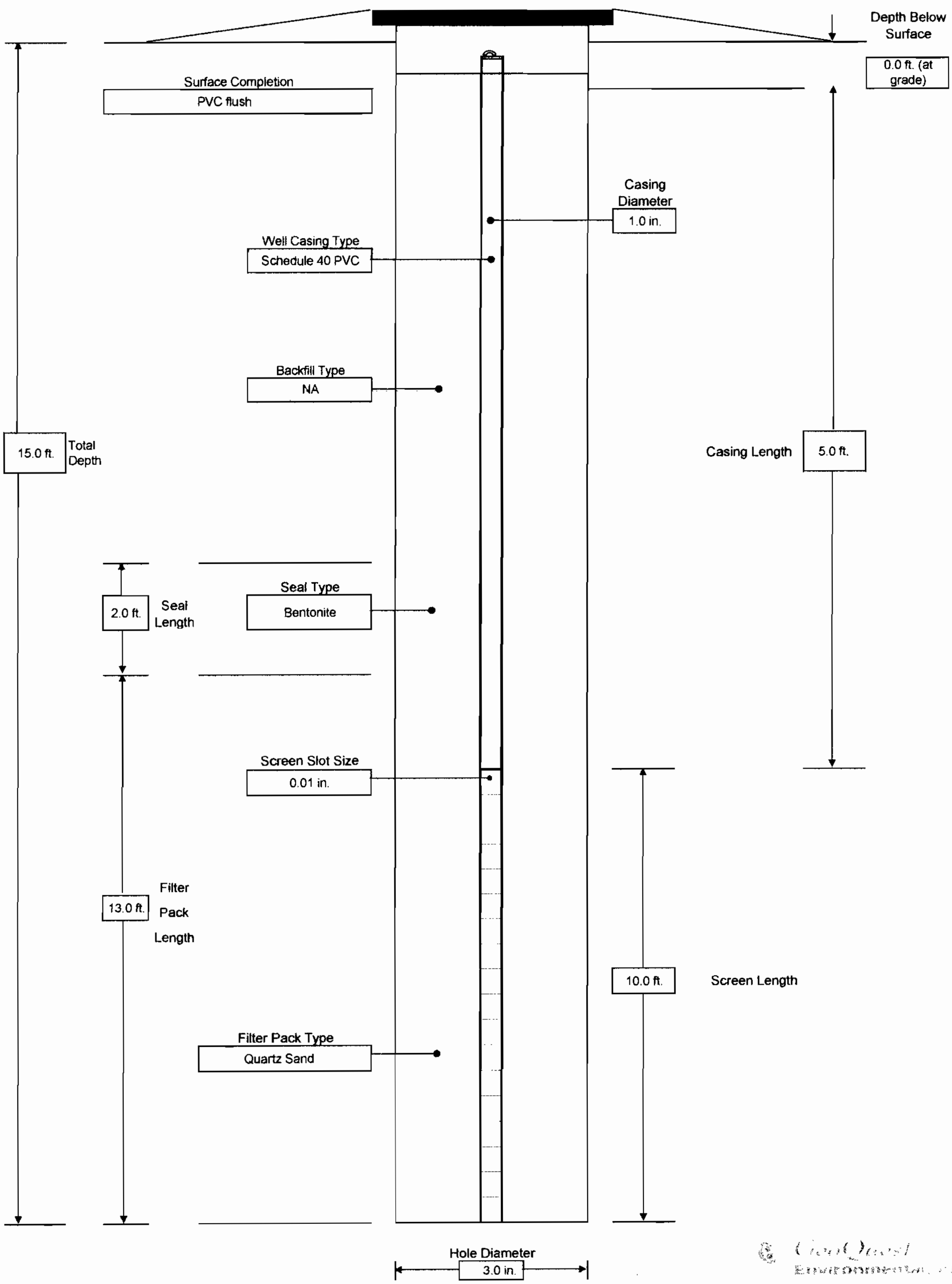
Development:	Removed five well volumes of water and three well volumes prior to sampling.
Formation of Completion:	Overburden
Comments:	Completed 1-inch diameter PVC cap that is flush with ground surface.
Driller:	MARCOR Remediation, Inc. - M. Manivong
GW Depth / Date:	6.67 feet - 11/16/06
Top of Casing Elevation:	NA.
Survey Date:	NA.
Drill Method	Geoprobe direct push



GEMW-2

Well Completion Log

Project:	Phase II ESA, 2290 Monroe Ave., Brighton, New York
Job No.:	110106
Well Name:	GEMW-2
Date Installed	11/16/06
Development:	Removed five well volumes of water and three well volumes prior to sampling.
Formation of Completion:	Overburden
Comments:	Completed 1-inch diameter PVC cap that is flush with ground surface.
Driller:	MARCOR Remediation, Inc. - M. Manivong
GW Depth / Date:	7.76 feet - 11/16/06
Top of Casing Elevation:	NA.
Survey Date:	NA.
Drill Method	Geoprobe direct push



PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-10

Project Name:	Town and Country - RI/FS	Date Started:	May 20 2013
Project Location:	Rochester, New York	Date Completed	May 20 2013
Project Number:	3612132267	Logged By:	Brandon Shaw
Task Number	02	Checked By:	JR
Subcontractor:	Nothnagle	Checked Date:	6/6/13
Drilling Method:	Direct Push		
Development Method:	Paristaltic Pump	Development Date:	05-29-13
Bucking Posts/Ballards:	NA		

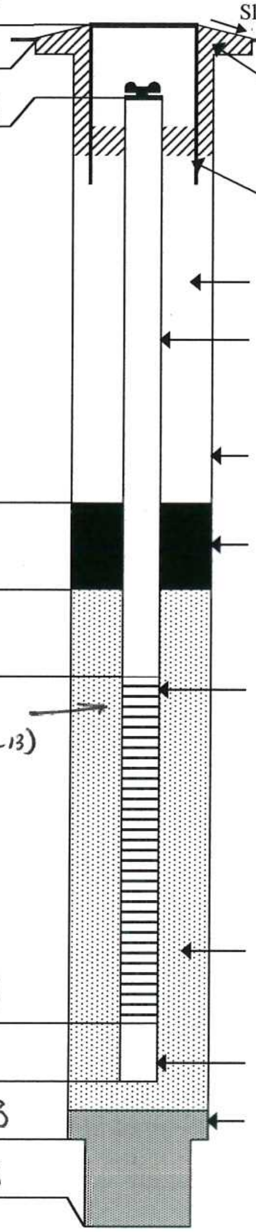
Notes: Silt/clay interval from ~10.8' to 15' bgs - screened above interval
Depth to water: 4.47 (BTOR) 05-29-13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 477.53

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	0	477.84
Ground Surface Elevation	—	477.84
Riser Pipe (Top)	0.25	477.53
Top of Well Seal	~1'	476.8
Top of Sand Pack	~3'	474.8
Top of Screen	3.7	474.1
Base of Screen	9.7	468.1
End Cap	9.8'	468.0
Drilled Depth	19.3'	458.3
Bottom of Exploration	19.3'	458.3
Bedrock Surface	unknown	



Description

Surface Seal Type:	Cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	sch 40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inches
Type of Seal:	Bentonite
Screen Type:	Slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~6'
Filter/Sand Pack Type:	Industrial quartz sand
Sump:	
Fallback/Backfill:	Bentonite

NOT TO SCALE

MACTEC
511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-11

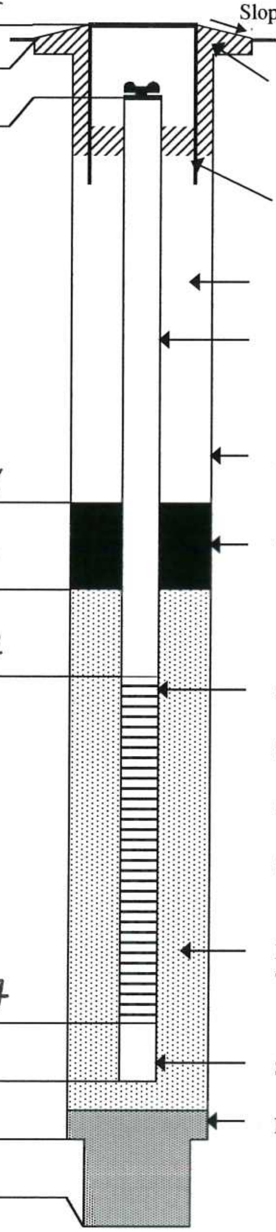
Project Name:	Town and Country - RI/FS	Date Started:	May 20 2013
Project Location:	Rochester, New York	Date Completed	May 20 2013
Project Number:	3612132267	Task Number	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Parastaltic Pump	Development Date:	NA
Bucking Posts/Ballards:	NA		
Logged By:	Brandon Shaw		
Checked By:	JR	Checked Date:	6/6/13

Notes: silt/clay interval from ~12.8' to 12.8' bgs → screened above that
Depth to water: Dry (>12.2' BTOR) 05-29-13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser
MP Elevation (ft): 478.05

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	478.37
Ground Surface Elevation	Ø	478.37
Riser Pipe (Top)	0.32	478.05
Top of Well Seal	~1'	477.4
Top of Sand Pack	~3'	475.4
Top of Screen	4.7'	473.7
Base of Screen	12.7'	465.7
End Cap	12.8'	465.6
Drilled Depth	19'	459.4
Bottom of Exploration	19'	459.4
Bedrock Surface	unknown	



Description

Slope Away

Surface Seal Type:	cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Bentonite
Screen Type:	slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~8'
Filter/Sand Pack Type:	Industrial Quartz sand
Sump:	
Fallback/Backfill:	Bentonite

NOT TO SCALE

MACTEC
511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-12

Project Name:	Town and Country - RI/FS	Date Started:	May 20 2013
Project Location:	Rochester, New York	Date Completed	May 20 2013
Project Number:	3612132267	Task Number	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Paristaltic Pump	Development Date:	05-29-13
Bucking Posts/Ballards:	NA		
Logged By:	Brandon Shaw		
Checked By:	JR	Checked Date:	6/6/13

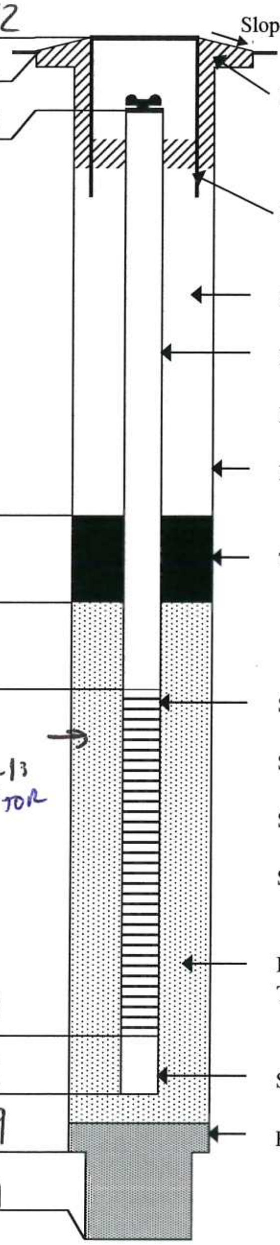
Notes: silt/clay interval not encountered in boring; so microwell installed @ bottom of boring; Depth to water: 11.61 (TOR) 05-29-13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 477.09

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	477.42
Ground Surface Elevation	Ø	477.42
Riser Pipe (Top)	0.31	477.09
Top of Well Seal	~1'	476.4
Top of Sand Pack	~9'	468.4
Top of Screen	10.7'	466.7
Base of Screen	20.7'	456.7
End Cap	20.8'	456.6
Drilled Depth	21.5'	455.9
Bottom of Exploration	21.5'	455.9
Bedrock Surface	Unknown	



Description

Surface Seal Type:	Cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	Slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~10'
Filter/Sand Pack Type:	00N Industrial quartz sand
Sump:	
Fallback/Backfill:	NA

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-15

Project Name:	Town and Country - RI/FS	Date Started:	May 21 2013
Project Location:	Rochester, New York	Date Completed	May 21 2013
Project Number:	3612132267	Task Number	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Paristaltic Pump	Development Date:	05-29-2013
Bucking Posts/Ballards:	NA		
Logged By:	Brandon Shaw		
Checked By:	JR	Checked Date:	6/6/13

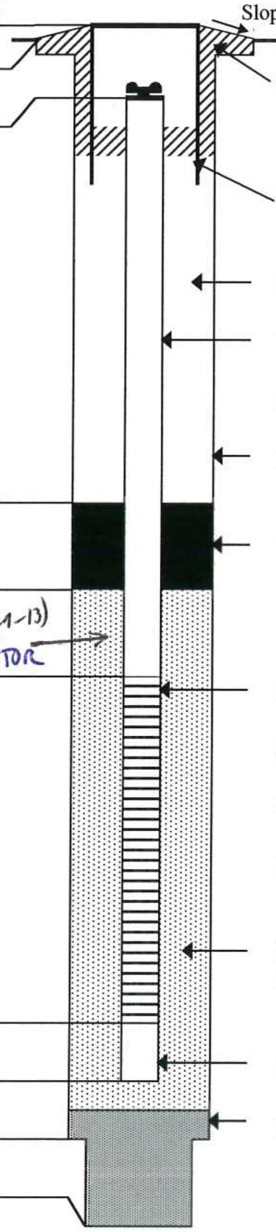
Notes: Silt/clay interval from 9.8' to 14.6' bgs — screened above the interval
Depth to water: 4.44' (BTOR) 05-29-2013

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 476.98

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	ø	477.25
Ground Surface Elevation	ø	477.25
Riser Pipe (Top)	0.27	476.98
Top of Well Seal	~1	476.2
Top of Sand Pack	~3	474.2
Top of Screen	~5.0	472.2
Base of Screen	10.0	467.2
End Cap	10.1	467.1
Drilled Depth	18.8'	458.4
Bottom of Exploration	18.8'	458.4
Bedrock Surface	unknown	



Description	
Surface Seal Type:	cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~5'
Filter/Sand Pack Type:	Industrial quartz 00N sand
Sump:	
Fallback/Backfill:	Bentonite

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-16

Project Name:	Town and Country - RI/FS	Date Started:	May 22 2013
Project Location:	Rochester, New York	Date Completed:	May 22 2013
Project Number:	3612132267	Task Number:	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Parastaltic Pump	Development Date:	05-29-13
Bucking Posts/Ballards:	NA	Logged By:	Brandon Shaw
Checked By:	JR	Checked Date:	6/6/13

Notes: silt/clay interval from: 9.4-11.4' bgs - installed microwell screen above that
Depth to water: 4.55' (05-29-2013)

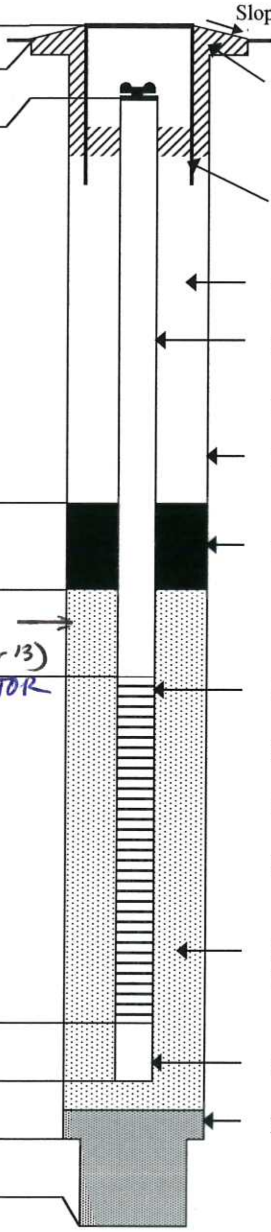
Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 478.77

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	479.06
Ground Surface Elevation	Ø	479.06
Riser Pipe (Top)	0.29	478.77
Top of Well Seal	~0.5	478.6
Top of Sand Pack	~3'	476.1
Top of Screen	5.3'	473.8
Base of Screen	10.3	468.8
End Cap	10.4	468.7
Drilled Depth	16.0'	463.1
Bottom of Exploration	16.0'	463.1
Bedrock Surface	unknown	—

DTW (05-29-13) 4.55' TOR



Description	
Surface Seal Type:	Cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	sch 40 pvc
Riser Pipe ID:	1-inch
Borehole Diameter:	~2.5-inch
Type of Seal:	Benseal
Screen Type:	Slotted pvc
Screen ID:	~1-inch
Screen Slot Size:	0.010
Screen Length:	~5'
Filter/Sand Pack Type:	00N Industrial Quartz sand
Sump:	
Fallback/Backfill:	Bentonite

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-17

Project Name:	Town and Country - RI/FS	Date Started:	May 24 2013
Project Location:	Rochester, New York	Date Completed	May 24 2013
Project Number:	3612132267	Task Number	2
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Parastaltic Pump	Development Date:	05-29-13
Bucking Posts/Ballards:	NA	Logged By:	Brandon Shaw
Checked By:	JR	Checked Date:	6/6/13

Notes: silty clay interval not encountered - Depth to water : 6.62' (BTOR) - 05-29-13

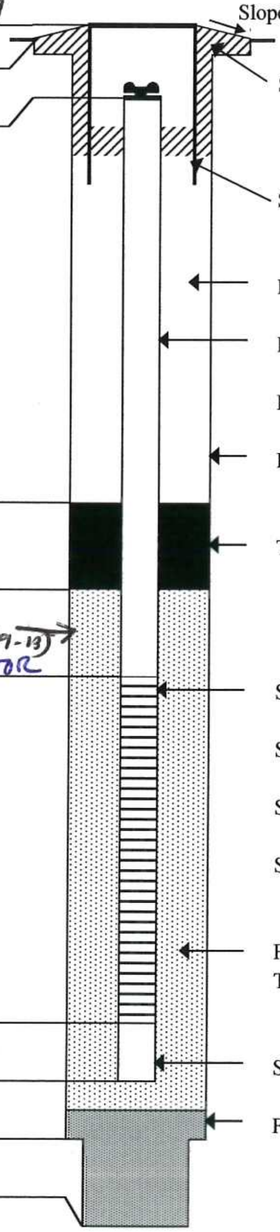
Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 479.50

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	∅	479.89
Ground Surface Elevation	∅	479.89
Riser Pipe (Top)	-0.35	479.50
Top of Well Seal	~0.5'	479.4
Top of Sand Pack	~5'	474.9
Top of Screen	6.8'	473.1
Base of Screen	16.8'	463.1
End Cap	16.9'	463.0
Drilled Depth	17.0'	462.9
Bottom of Exploration	17.0'	462.9
Bedrock Surface	unknown	/

DTW (05-29-13) 6.62' TOR



Description

Surface Seal Type:	cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	~1-inch
Riser Pipe ID:	sch 40 PVC
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	Slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~10'
Filter/Sand Pack Type:	OON Industrial Quartz sand
Sump:	
Fallback/Backfill:	native

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-18

Project Name:	Town and Country - RI/FS	Date Started:	May 24 2013
Project Location:	Rochester, New York	Date Completed:	May 24 2013
Project Number:	3612132267	Task Number:	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Paristaltic Pump	Development Date:	05-29-13
Bucking Posts/Ballards:	NA	Logged By:	Brandon Shaw
Checked By:	JR	Checked Date:	6/6/13

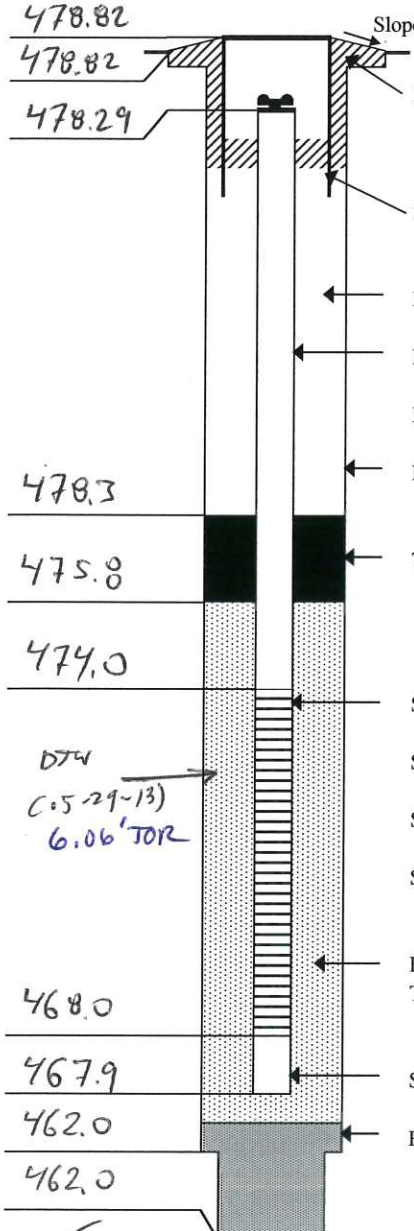
Notes: silty clay interval from 11' to 13' bgs - screened above the clay
Depth to water: 6.06' (BTOR) 05-29-13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 478.29

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	478.82
Ground Surface Elevation	Ø	478.82
Riser Pipe (Top)	0.38	478.29
Top of Well Seal	~0.5	478.3
Top of Sand Pack	~3'	475.8
Top of Screen	~4.8'	474.0
Base of Screen	~10.8	468.0
End Cap	~10.9	467.9
Drilled Depth	16.8'	462.0
Bottom of Exploration	16.8'	462.0
Bedrock Surface	Unknown	/



Description

Surface Seal Type:	cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	Slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~6'
Filter/Sand Pack Type:	00N Industrial Quartz sand
Sump:	
Fallback/Backfill:	Bentonite

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-19

Project Name:	Town and Country - RI/FS	Date Started:	May 23 2013
Project Location:	Rochester, New York	Date Completed	May 23 2013
Project Number:	3612132267	Task Number	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Parastaltic Pump	Development Date:	05-23-13
Bucking Posts/Ballards:	NA	Logged By:	Brandon Shaw
Checked By:	JR	Checked Date:	6/6/13

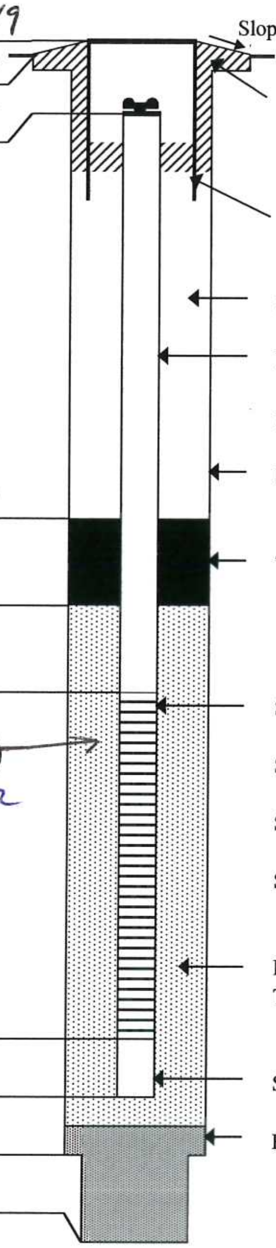
Notes: Silty Clay interval not observed
Depth to water: 5.90' (BTOR) 05-23-13
Depth to water: 4.98' (BTOR) 05-29-13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 475.15

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	475.49
Ground Surface Elevation	Ø	475.49
Riser Pipe (Top)	0.32	475.15
Top of Well Seal	0.5'	475.0
Top of Sand Pack	~2'	473.5
Top of Screen	3.2'	472.3
Base of Screen	13.2'	462.3
End Cap	13.3'	462.2
Drilled Depth	13.9'	461.6
Bottom of Exploration	13.9'	461.6
Bedrock Surface	Unknown	/



Description

Surface Seal Type:	cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 pvc
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	Slotted pvc
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~10'
Filter/Sand Pack Type:	00N Industrial quartz sand
Sump:	
Fallback/Backfill:	NA

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-20

Project Name:	Town and Country - RI/FS	Date Started:	May 23 2013
Project Location:	Rochester, New York	Date Completed	May 23 2013
Project Number:	3612132267	Task Number	02
Subcontractor:	Nothnagle	Drilling Method:	Direct Push
Development Method:	Parastaltic Pump	Development Date:	5-23-13
Bucking Posts/Ballards:	NA		
Logged By:	Brandon Shaw		
Checked By:	JR	Checked Date:	6/6/13

Notes: silty clay interval not observed
Depth to water: 10.99' (BTOR) 05-23-13
Depth to water: 12.21 (BTOR) 05-29-13

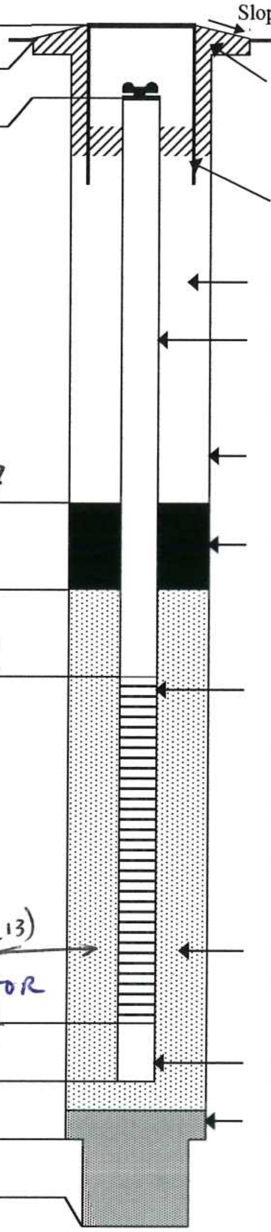
Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 473.80

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	474.21
Ground Surface Elevation	Ø	474.21
Riser Pipe (Top)	0.41	473.80
Top of Well Seal	~0.5'	473.7
Top of Sand Pack	~3'	471.2
Top of Screen	~5'	469.2
Base of Screen	15'	459.2
End Cap	15.1'	559.1
Drilled Depth	19.5'	454.7
Bottom of Exploration	19.5'	454.7
Bedrock Surface	unknown	/

DTW (05-29-13) 12.21' TOR



Description

Slope Away	
Surface Seal Type:	cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~10'
Filter/Sand Pack Type:	00N Industrial Quartz sand
Sump:	
Fallback/Backfill:	native material

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

PIEZOMETER CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: DP-21

Project Name:	Town and Country - RI/FS	Date Started:	May 23 2013 Date Completed May 23 2013
Project Location:	Rochester, New York	Logged By:	Brandon Shaw
Project Number:	3612132267 Task Number 02	Checked By:	JR Checked Date: 6/6/13
Subcontractor:	Nothnagle Drilling Method: Direct Push		
Development Method:	Paristaltic Pump Development Date: 05-23-13		
Bucking Posts/Ballards:	NA		

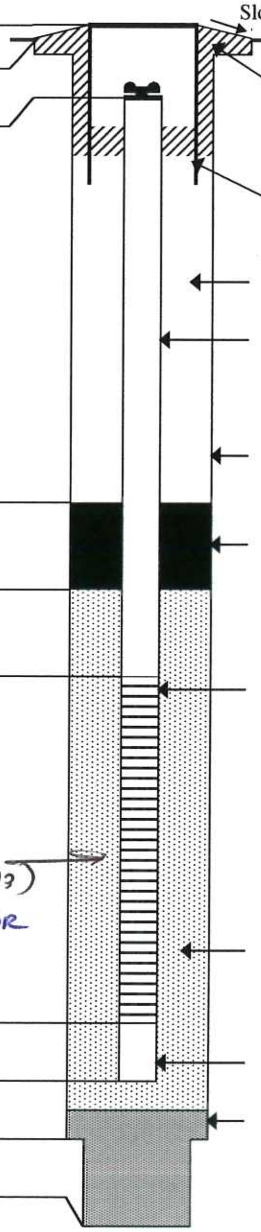
Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 468.15

Notes: Silty Clay interval not encountered
Depth to water ; 7.77' (BTOR) 05-23-13
Depth to water: 7.65' (BTOR) 05-29-13

Item	Depth BMP (ft) (BGS)	Elevation (ft)
Surface Casing Elevation	Ø	468.55
Ground Surface Elevation	Ø	468.55
Riser Pipe (Top)	0.43'	468.15
Top of Well Seal	0.5'	468.1
Top of Sand Pack	~2'	466.6
Top of Screen	2.7'	465.9
Base of Screen	10.7'	457.9
End Cap	10.8'	457.8
Drilled Depth	12.0'	456.6
Bottom of Exploration	12.0'	456.6
Bedrock Surface	unknown	—



DTW (05-29-13) 7.65' TOR

Description

Slope Away	
Surface Seal Type:	Cement
	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	1-inch
Borehole Diameter:	2.5-inch
Type of Seal:	Benseal
Screen Type:	Slotted PVC
Screen ID:	1-inch
Screen Slot Size:	0.010
Screen Length:	~8'
Filter/Sand Pack Type:	00N Industrial Quartz sand
Sump:	
Fallback/Backfill:	native

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-2B

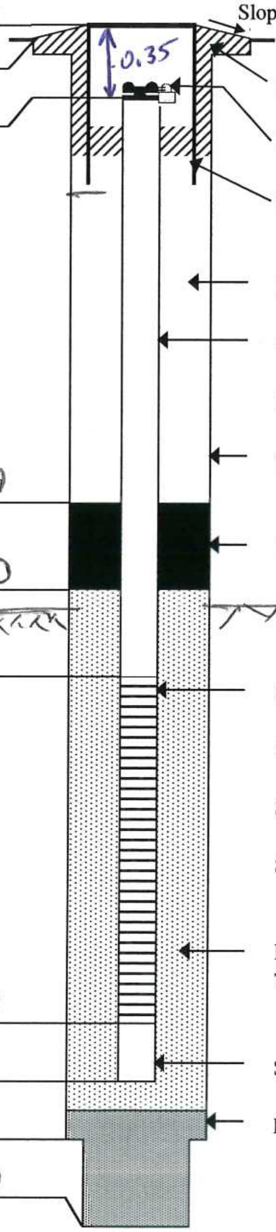
Project Name:	Town & country Rifes	Date Started: 06-28-13	Date Completed: 06-28-13
Project Location:	Rochester, New York	Logged By:	B. Shaw
Project Number:	7612132267 / Task Number 02	Checked By: [signature]	Checked Date: 7/18/13
Subcontractor:	Geologic NY	Drilling Method: Drive wash / roller bit	
Development Method:	Pump & Surge	Development Date: 7/2/13	
Bucking Posts/Ballards:	NA		
Notes:	Depth to water = 4.54' TOR 7/2/13		

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 476.71

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	∅	477.06
Ground Surface Elevation	∅	477.06
Riser Pipe (Top)	0.35' BGS	476.71
Top of Well Seal	~9' BGS	467.0
Top of Sand Pack	~16' BGS	460.0
Top of Screen	~18' BGS	458.0
Base of Screen	~23' BGS	453.0
End Cap	~23' BGS	453.0
Drilled Depth	~23' BGS	453.0
Bottom of Exploration	~23 BGS	453.0
Bedrock Surface	~17.5' BGS	458.5



Description	
Surface Seal Type:	concrete
Lock Identification	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	#ON Industrial quartz
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	2-inch
Borehole Diameter:	7-inch
Type of Seal:	3/8 Hole plug Bentonite
Screen Type:	Slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010
Screen Length:	~5'
Filter/Sand Pack Type:	#ON Industrial Quartz
Sump:	0.1'
Fallback/Backfill:	native

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-13

Project Name:	Town & Country RI/FS	Date Started:	07-02-13
Project Location:	Rochester, New York	Date Completed:	07-02-13
Project Number:	3612132267	Logged By:	B. Shaw
Task Number	02	Checked By:	[signature]
Subcontractor:	Geologic NY	Checked Date:	7/17/13
Drilling Method:	HSA		
Development Method:	Pump & surge		
Development Date:	07-02-13		
Bucking Posts/Ballards:	NA		

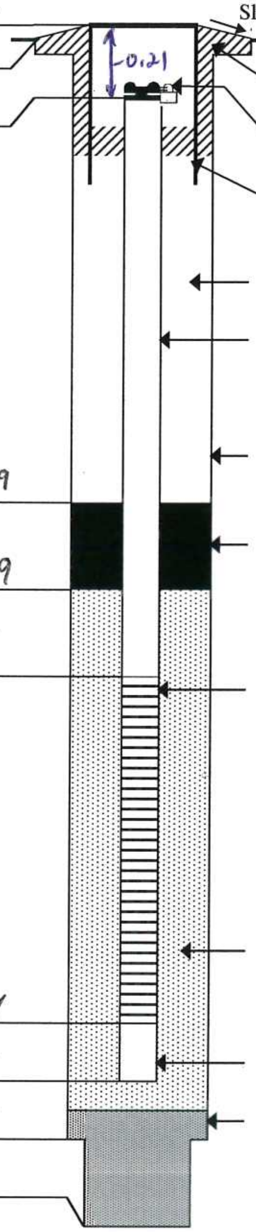
Notes: Depth to water:
(*) installed to replace DP-13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 480.36

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	+2.97	480.57
Ground Surface Elevation	0	477.39
Riser Pipe (Top)	+ 0.21' BGS	480.36
Top of Well Seal	0.5' BGS	476.89
Top of Sand Pack	3' BGS	474.39
Top of Screen	~5' BGS	472.4
Base of Screen	~10' BGS	467.4
End Cap	~10' BGS	467.4
Drilled Depth	~10' BGS	467.4
Bottom of Exploration	~10' BGS	467.4
Bedrock Surface	unknown	



Description

Surface Seal Type:	concrete
Lock Identification	NA
Stickup Casing Diameter:	4-inch
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	2-inch
Borehole Diameter:	8 1/4-inch
Type of Seal:	3/8-inch Holeplug Bentonite
Screen Type:	slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010"
Screen Length:	~5'
Filter/Sand Pack Type:	*0N Industrial quartz
Sump:	0.1'
Fallback/Backfill:	NA

NOT TO SCALE

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FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-13B

Project Name:	Town & Country RI/FS	Date Started: 07-01-2013	Date Completed: 07-02-13
Project Location:	Rochester, New York	Logged By:	B. Shaw
Project Number:	3612132267	Task Number: 02	Checked By: J. Rawcliffe — Checked Date: 7/17/13
Subcontractor:	Geologic NY	Drilling Method: Drive/wash & Rollerbit	
Development Method:	Pump & Surge	Development Date: 7/2/13	
Bucking Posts/Ballards:	NA		

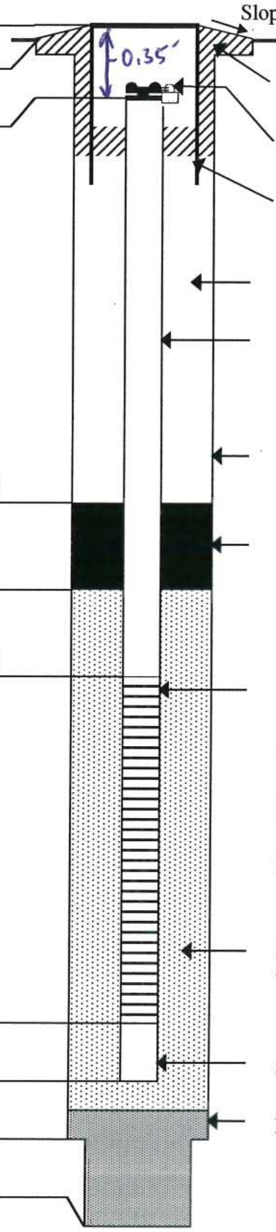
Notes: Depth to water = 9.05 TOR 7/2/13

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 480.37

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	+2.9	480.72
Ground Surface Elevation		477.8
Riser Pipe (Top)	0.35' BGS	480.37
Top of Well Seal	0.5' BGS	477.3
Top of Sand Pack	~16' BGS	461.8
Top of Screen	~18' BGS	459.8
Base of Screen	~23' BGS	454.8
End Cap	~23.2' BGS	454.6
Drilled Depth	~23.5' BGS	454.3
Bottom of Exploration	~23.5' BGS	454.3
Bedrock Surface	~18.5' bgs	459.3



Description

Surface Seal Type:	Concrete
Lock Identification	
Stickup Casing Diameter:	3-inch
Backfill/Grout Type:	NA
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	2-inch
Borehole Diameter:	4-inch
Type of Seal:	3/8" Holeplug Bentonite
Screen Type:	slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010
Screen Length:	~5'
Filter/Sand Pack Type:	#0N Industrial Quartz
Sump: 0.2'	
Fallback/Backfill:	Native

NOT TO SCALE

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511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-16B

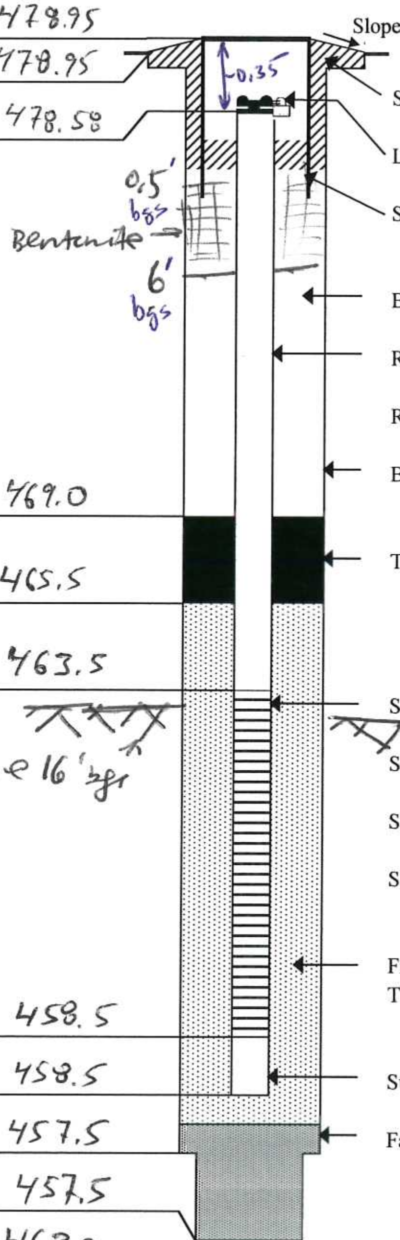
Project Name:	Town & County RI/FS	Date Started:	06-27-2013
Project Location:	Rochester, New York	Date Completed:	07-02-13
Project Number:	3612132267	Logged By:	B. Shaw
Task Number	02	Checked By:	J Rudiff
Subcontractor:	Geologic NY	Checked Date:	7/17/13
Drilling Method:	Drive + wash; HQ core		
Development Method:	Pump & surge	Development Date:	07-02-2013
Bucking Posts/Ballards:	NA		
Notes:	Depth to water = 6.45' TOR 7/2/13		

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 478.58

Item	Depth BMP (ft) bgs	Elevation (ft)
Surface Casing Elevation	⌀	478.95
Ground Surface Elevation	⌀	478.95
Riser Pipe (Top)	0.35' BGS	478.58
Top of Well Seal	10' BGS	469.0
Top of Sand Pack	13.5' BGS	465.5
Top of Screen	15.5' BGS	463.5
Base of Screen	20.5' BGS	458.5
End Cap	20.5' BGS	458.5
Drilled Depth	21.5' BGS	457.5
Bottom of Exploration	21.5' BGS	457.5
Bedrock Surface	~16' BGS	463.0



Description	
Surface Seal Type:	Concrete
Lock Identification	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	#0N Industrial Quartz
Riser Pipe Type:	sch 40 PVC
Riser Pipe ID:	2-inch
Borehole Diameter:	4-inch
Type of Seal:	3/8-inch hole plug bentonite
Screen Type:	Slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010"
Screen Length:	~5'
Filter/Sand Pack Type:	#0N Industrial quartz
Sump:	
Fallback/Backfill:	Native

NOT TO SCALE

MACTEC
511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-17B

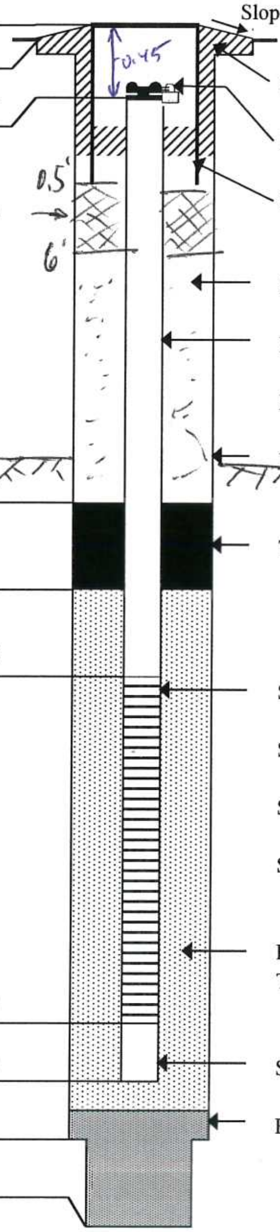
Project Name:	Town & Country RI/FS	Date Started: 06-26-13	Date Completed: 06-26-13
Project Location:	Rochester, New York	Logged By:	B. Shaw
Project Number:	361213226 7	Task Number: 02	Checked By: [signature] Checked Date: 7/18/13
Subcontractor:	Geologic NY	Drilling Method: Drive+wash / Hx core	
Development Method:	pump & surge	Development Date: 6/27/13	
Bucking Posts/Ballards:	NA		
Notes:	Depth to water := 7.07' TOR 6/27/13		

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 479.35

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	ø	479.75
Ground Surface Elevation	ø	479.75
Riser Pipe (Top)	0.45' BGS	479.35
Top of Well Seal	~19' BGS	460.8
Top of Sand Pack	~21' BGS	458.8
Top of Screen	~22.8' BGS	457.0
Base of Screen	~27.8' BGS	452.0
End Cap	27.8' BGS	452.0
Drilled Depth	28.0' BGS	451.8
Bottom of Exploration	28.0' BGS	451.8
Bedrock Surface	17.5' BGS	462.3



Description

Surface Seal Type:	concrete
Lock Identification:	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	#0N Industrial Quartz
Riser Pipe Type:	sch 40 PVC
Riser Pipe ID:	2-inch
Borehole Diameter:	~4-inch
Type of Seal:	3/8-inch Holeplug Bentonite
Screen Type:	Slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010"
Screen Length:	~5'
Filter/Sand Pack Type:	#0N Industrial Quartz
Sump:	0.1'
Fallback/Backfill:	native / bedrock

NOT TO SCALE

MACTEC
511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-19B

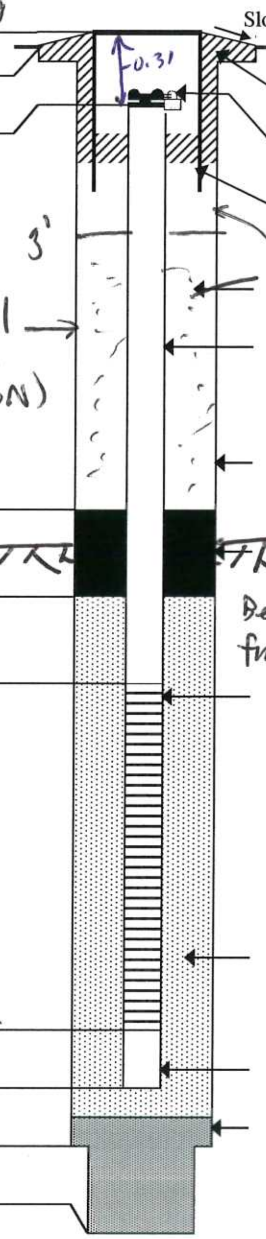
Project Name:	Town & country RI/FS	Date Started:	June 25, 2013
Project Location:	Rochester, New York	Date Completed:	June 26, 2013
Project Number:	3612132267	Logged By:	B. Shaw
Task Number	02	Checked By:	J. Rawcliffe
Subcontractor:	Geologic NY	Checked Date:	7/18/13
Drilling Method:	Drive wash & Roller bit		
Development Method:	pump & surge	Development Date:	6/27/13
Bucking Posts/Ballards:	NA		
Notes:	Depth to water: = 5.94' TOR 6/27/13		

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 475.35

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	Ø	475.69
Ground Surface Elevation	Ø	475.69
Riser Pipe (Top)	0.31' BGS	475.35
Top of Well Seal	12' BGS	463.7
Top of Sand Pack	14.5' BGS	461.2
Top of Screen	~16.5' BGS	459.2
Base of Screen	~21.5' BGS	454.2
End Cap	~21.5' BGS	454.2
Drilled Depth	~21.5' BGS	454.2
Bottom of Exploration	~21.5' BGS	454.2
Bedrock Surface	13.9' BGS	461.8



Description	
Surface Seal Type:	Concrete
Lock Identification	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	Native / grout
Riser Pipe Type:	Sch 40 PVC
Riser Pipe ID:	2-inch
Borehole Diameter:	3 7/8-inch
Type of Seal:	3/8-inch Holeplug Bentonite
Screen Type:	Slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010"
Screen Length:	~5'
Filter/Sand Pack Type:	#0N Industrial Quartz
Sump:	0.2'
Fallback/Backfill:	NA

NOT TO SCALE

MACTEC
511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

WELL CONSTRUCTION DIAGRAM FLUSHMOUNT

LOCATION ID: MW-21B

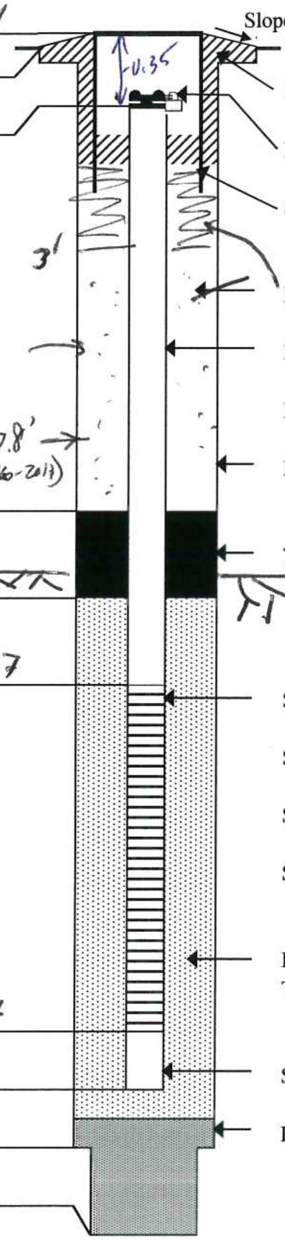
Project Name:	Town & Country RI/FS	Date Started:	June 24, 2013
Project Location:	Rochester, NY	Date Completed:	June 25, 2013
Project Number:	3612132267	Logged By:	B. Shaw
Task Number	02	Checked By:	[signature]
Subcontractor:	Geologic NY	Checked Date:	7/18/13
Drilling Method:	Drive & wash & Roller bit		
Development Method:	surge & pump	Development Date:	06-26-2013
Bucking Posts/Ballards:	NA		
Notes:	Depth to water: 7.52' (BTOR) 6/26/13		

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): 468.38

Item	Depth BMP (ft) (bgs)	Elevation (ft)
Surface Casing Elevation	ø	468.74
Ground Surface Elevation	ø	468.74
Riser Pipe (Top)	0.35 BGS	468.38
Top of Well Seal	9' BGS	459.7
Top of Sand Pack	13' BGS	~~455.7~~ 455.7
Top of Screen	15' BGS	453.7
Base of Screen	~20' BGS	448.7
End Cap	~20' BGS	448.7
Drilled Depth	~20' BGS	448.7
Bottom of Exploration	~20' BGS	448.7
Bedrock Surface	~12' BGS	456.7



Description

Surface Seal Type:	concrete
Lock Identification	NA
Stickup Casing Diameter:	NA
Backfill/Grout Type:	native soil & grout
Riser Pipe Type:	Sch 40
Riser Pipe ID:	2-inch
Borehole Diameter:	3 7/8-inch
Type of Seal:	3/8-inch Hole plug (bentonite)
Screen Type:	slotted PVC
Screen ID:	2-inch
Screen Slot Size:	0.010"
Screen Length:	~5'
Filter/Sand Pack Type:	#0N Industrial Quartz
Sump:	~0.2'
Fallback/Backfill:	NA

NOT TO SCALE

MACTEC
511 Congress Street, Portland Maine 04101

FIGURE 4.8
WELL/PIEZOMETER CONSTRUCTION DIAGRAM - FLUSHMOUNT
NYSDEC QUALITY ASSURANCE PROJECT PLAN

APPENDIX C – EXCAVATION WORK PLAN (EWP)

EXCAVATION WORK PLAN (EWP)

C-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC which may include submitting a change of use.

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 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;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 CFR 1910.120;
- A copy of the contractor's health and safety plan (HASP), in electronic format, if it differs from the HASP provided in Appendix H of this SMP;
- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

C-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). 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. Further discussion of off-site disposal of materials and on-site reuse is provided in Section D-7 of this Appendix.

C-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 the NYSDEC.

C-4 MATERIALS EXCAVATION AND LOAD-OUT

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

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).

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.

C-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.

A materials transport plan describing the trucking routes and indicated on mapping will be provided to the NYSDEC for approval prior to the start of excavation activities. 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; (f) overall safety in transport; and (g) community input.

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.

C-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, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2. Material that does not meet Unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

C-7 MATERIALS REUSE ON-SITE

'Reuse on-site' means reuse on-site of material that originates at the site and which does not leave the site during the excavation. Material reuse on-site will comply with the requirements of NYSDEC DER-10 Section 5.4(e)4.

Prior to the reuse of materials on-site, a reuse plan will be submitted for approval to the NYSDEC. The following topics should be covered in the materials re-use plan:

- Procedure for determining if reuse is appropriate;
- Sampling (methods and analytical);
- Stockpile segregation scheme for on-site reuse; and
- Size of stockpiles, location (figure).

The qualified environmental professional 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 soil layer, within landscaping berms, or as backfill for subsurface utility lines.

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.

C-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, 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.

C-9 SITE RESTORATION

After the completion of soil removal and any other invasive activities, a demarcation layer, consisting of orange snow fencing material, 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. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

C-10 BACKFILL FROM OFF-SITE SOURCES

A plan for using backfill from off-site sources shall be submitted to the NYSDEC for approval prior to placement of material. This plan shall describe all methods for the import, handling and placement of backfill material from off-site. The requirements for backfill used at the site shall be consistent with the backfill requirements provided in DER-10.

The plan should contain the following:

- Source area approval process
  - Sources of backfill material
- Source area background check
- DOT Certification
  - Chemical sampling
- Analytes
- Frequency
  - Imported Soil Chemical Quality Standards
- Applicability of protection of groundwater SCOs
- Applicability of protection of ecological resources SCOs
- Stockpile procedures for imported backfill material
  - Size of stockpiles, cover, etc.

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

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). Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this site, will not be imported onto the site without prior approval by NYSDEC. Solid waste will not be imported onto the site.

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

C-11 STORMWATER POLLUTION PREVENTION

Prior to the start of excavation, a Stormwater Pollution Prevention Plan (SPPP) that conforms to the requirements of the NYSDEC Division of Water guidelines and NYS regulations will be required. Once an SPPP has been compiled, it shall be included as part of the update to the SMP and EWP.

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.

C-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.

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, TCL pesticides and PCBs), unless the site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. Reportable quantities of petroleum product will also be reported to the NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

C-13 COMMUNITY AIR MONITORING PLAN

Prior to the start of excavation activities a Community Air Monitoring Plan (CAMP) that is in conformance with DER-10 will be required. The CAMP, at a minimum, should include:

- Details of the perimeter air monitoring program;
- Action levels to be used;
- Methods for air monitoring ;
- Analytes measured and instrumentation to be used;
- A figure of the location(s) of all air monitoring instrumentation. A figure showing specific locations must be presented for monitoring stations based on generally prevailing wind conditions, with a note that the exact locations to be monitored on a given day will be established based on the daily wind direction.

Prevailing wind locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations.

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

C-14 ODOR CONTROL PLAN

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

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to 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.

C-15 DUST CONTROL PLAN

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

- 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.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

C-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 D – HEALTH AND SAFETY PLAN

Site-Specific Health and Safety Plan
Short Form

Site:	Town and Country Dry Cleaners NYSDEC Site# 828149	Job #/Task #	3617207506.02.****
Street Address:	2308 Monroe Avenue, Brighton NY		
Proposed Date(s) of Investigation:	3/1/21 to 8/1/21		
Prepared by:	Chuck Staples	Date:	1/8/2021
*Approved by:		Date:	
Site Description: **(attach map)**	Dry Cleaner in mixed commercial/residential area.		
Comments:	Remedial construction oversight and documentation soil sampling.		

*Approval also serves as certification of a Hazard Assessment as required by 29 CFR 1910.132

Overall Project Characterization "Color" (See SMARTool Form):

- [ ] Green
- [x] Yellow
- [ ] Orange 1
- [ ] Orange 2
- [ ] Orange 3
- [ ] Red

Tasks:

Wood	Sub	Task Description	AHA Attached?
☑	☐	Travel to Site-Journey Management Plan	☑
☑	☐	Travel to/from office or project site, during covid-19	☑
☑	☐		☑
☐	☐		☐

High Hazard Activities:

Wood	Sub	Activity	Wood	Sub	Activity
☐	☐	Confined space entry	☐	☑	Operating drill rig
☐	☐	Entering excavations	☐	☑	Operating other heavy equipment
☐	☐	Hot work	☐	☐	Using aerial lift
☐	☐	Lockout/tagout	☐	☐	Working from scaffolding
☐	☐	Operating forklift	☐	☐	Working at heights >6 feet

Stand up for Safety:

The above tasks could expose Wood E&IS employees and subcontractors to hazards associated with the following Stand up for Safety Initiatives:

- [x] Driving
- [ ] Dropped Objects
- [ ] Energy Isolation (Lockout/Tagout)
- [ ] Working at Height

Life Saving Rules:

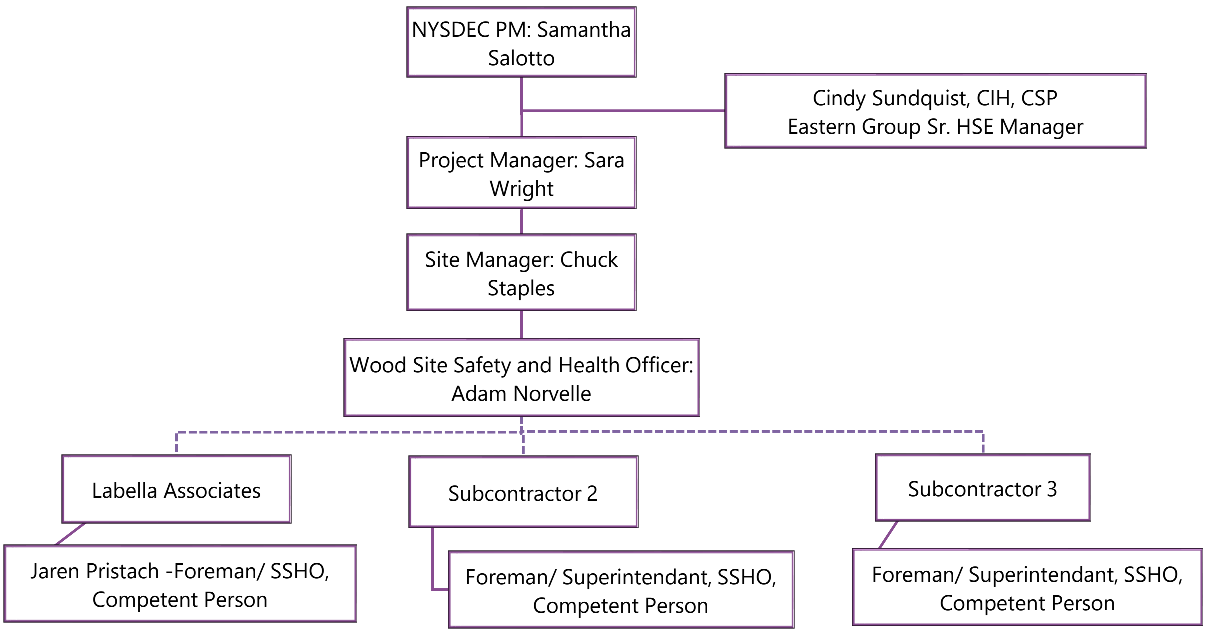
The following Wood Life Saving Rules potentially apply to the work being conducted at the site:

- [ ] **Bypassing Safety Controls** - Obtain authorization before overriding or disabling safety controls
- [ ] **Confined Space** - Obtain authorization before entering a confined space
- [x] **Driving** - Follow safe driving rules
- [ ] **Energy Isolation** - Verify isolation and zero energy before work begins

Site-Specific Health and Safety Plan
Short Form

- ☐ **Hot Work** - Control flammables and ignition sources
- ☐ **Line of Fire** - Keep yourself and others out of the line of fire
- ☐ **Safe Mechanical Lifting** - Plan lifting operations and control the area
- ☑ **Work Authorization** - Work with a valid permit when required
- ☐ **Working at Height** - Protect yourself against a fall when working at height

Project Organization Chart:



Dates of Required Training and Medical Surveillance:

Add additional training topics, as required. **Verify training in online training database**: **LINK**

Name:	Adam Norvelle				
Job duties:	**Site Manager**	**SSHO**	Field Crew		
	Dates	**Dates**	**Dates**	**Dates**	**Dates**
Medical Surveillance					
-Exam Type (A3, B, C)					
40-Hour Initial					
8-Hour Supervisor[2]					
8-Hour Refresher					
First Aid[1]					
CPR[1]					
Hazard Communication					
Fire Extinguisher					
Fall Protection Authorized User					

[1] At least one worker must be trained in First Aid/CPR

[2] Required for Site Manager and Site Health and Safety Officer

[3] **Medical Surveillance Exam A has no respiratory clearance so can only be used for Level D PPE.** . Exam A (basic HAZWOPER), Exam B (respirator & HAZWOPER under 40 years old), Exam C (respirator & HAZWOPER over 40 years old), Exam E (DOT), Exam F (asbestos monitoring), Exam G (lead monitoring) etc. **Contact HSE Coordinator or Cindy Sundquist to determine type of exam employee received.**

Site-Specific Health and Safety Plan
Short Form

GOALS/TARGETS:

The following goals/targets have been established for the project:

- ☑ Zero OSHA Recordable Incidents
- ☑ Weekly HSE Inspections (documented)
- ☐ XX Leadership (PM) HSSE Inspections
- ☐ XX HEART observations per day/week/month
- ☐

Meetings:

The following meetings will be held at the site:

Meeting	Lead by		Frequency				
	Wood	Sub	Initial	Daily	Weekly	Monthly	As Needed
☑ Project Kick-off [1]	☑	☐	☑	☐	☐	☐	☐
☑ Tailgate [2]	☐	☐	☐	☑	☐	☐	☐
☐ Safety Committee [1]	☐	☐	☐	☐	☐	☐	☐
☐ Incident Reviews [1]	☑	☐	☐	☐	☐	☐	☑
☐ E&IS Monthly Safety Topics [1]	☐	☐	☐	☐	☐	☐	☐
☐ HSSE Closeout Meetings [1]	☑	☐	☐	☐	☐	☐	☑
☐	☐	☐	☐	☐	☐	☐	☐

[1] Attended by subcontractor management representative

[2] Attended by all subcontractor employees and supervisors.

Inspections:

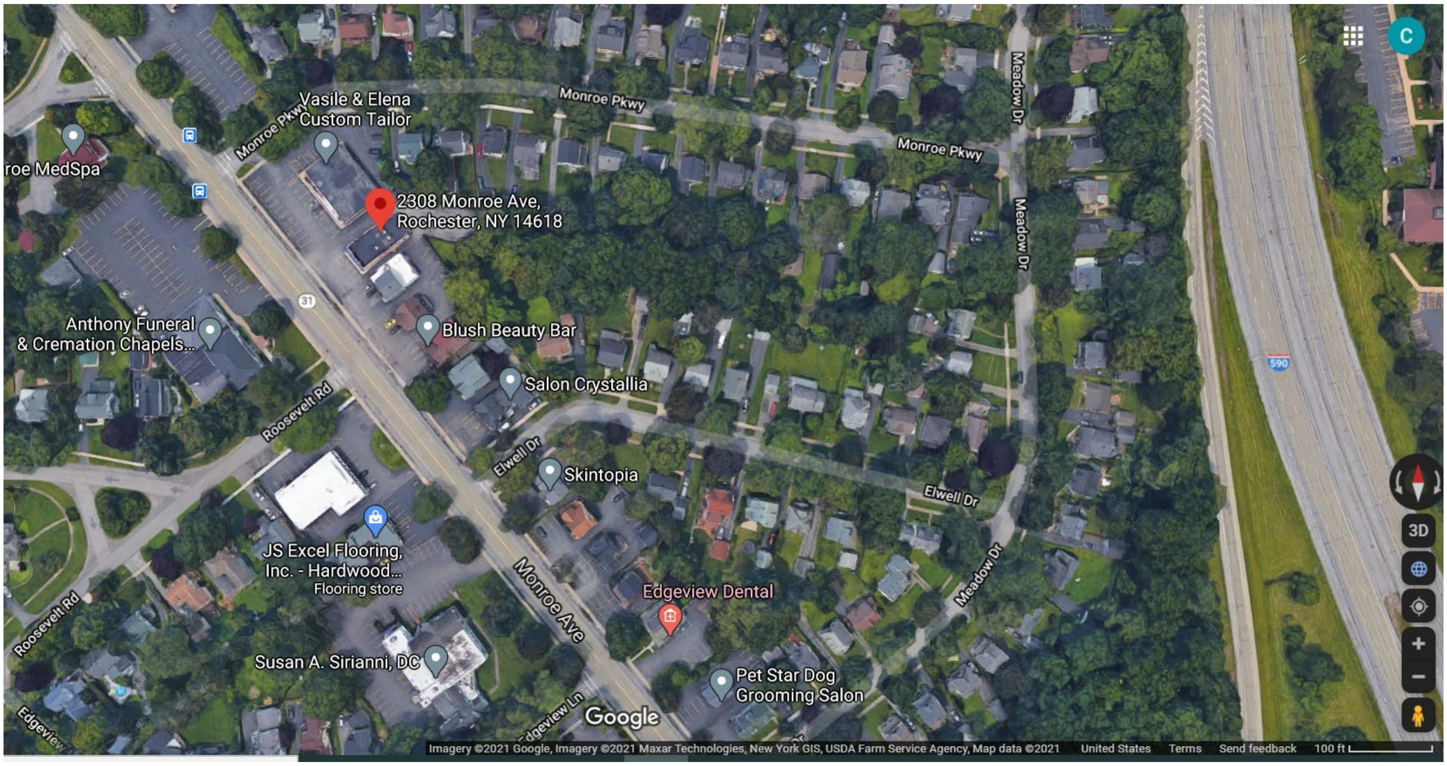
Regular inspections will be conducted by Wood E&IS and/or subcontractor personnel. Inspections will be documented, and corrective actions established for all findings. Corrective actions will be tracked to closure. HEART observations will be entered into the HEART database.

Inspection Type	Lead by		Frequency			
	Wood	Sub	Daily	Weekly	Monthly	Before Use
☐ HSE (Visual)	☑	☐	☑	☐	☐	☐
☐ HSE (Documented)	☑	☐	☑	☐	☐	☐
☐ Leadership HSE (e.g., PM)	☐	☐	☐	☐	☐	☐
☐ Scaffolding	☐	☐	☐	☐	☐	☐
☑ Excavations	☑	☐	☑	☐	☐	☐
☑ Heavy Equipment	☑	☐	☑	☐	☐	☑
☑ PPE	☑	☐	☑	☐	☐	☑
☑ Tools/Equipment	☐	☐	☐	☐	☐	☑
☑ HEART/Observations	☑	☐	☑	☐	☐	☐
☐ PFAS Equipment (Fall Protection)	☐	☐	☐	☐	☐	☐
☐	☐	☐	☐	☐	☐	☐

Site-Specific Health and Safety Plan
Short Form

INSERT SITE MAP(s) HERE

2308 Monroe Ave, Brighton, NY 14618



Journey Management Plan:

A Journey Management Plan will be developed to address non-routine/non-commute type travel to and from the project site. Considerations will include anticipated weather, work duration prior to travel, travel route, etc. See the Vehicle Travel – Journey Management Plan AHA. **Preliminary below – will be checked daily.**

JOURNEY MANAGEMENT PLANNING		
All projects with a field component must have a journey management plan completed for each work location. Complete the below as accurately as possible with your knowledge of the project, site location, time of year, etc. If there are significant changes to the scope of the project, or the conditions of travel, the plan must be updated, or new journey management plan must be completed. ***Not required for city or urban driving***		
	Points	**List Control Measures**
1. How many total hours will the driver have been on duty at the end of the journey? Note: Maximum 14 duty hours permitted. (12+ hours = 10 pts)	10	
2. Will the overall journey distance exceed 120 miles/~200km? (Yes = 10 pts)	10	
3. Will the journey require driving in wet, flooded, icy, and/or snowy roads? (Yes = 10 pts)		
4. Will the journey require driving in conditions that limit visibility (dark, fog, snow, hail, etc.)? (Yes = 10 pts)	10	Possible
5. Will the journey require driving overnight (after 9pm - 5am)? (Yes = 10 pts)765		
6. Is the driver familiar with the route for this journey? (No = 5 pts)		
7. How many hours of sleep has the driver had in the past 24 hours? (If < 8 hrs = 5 pts)		
8. Will there be a passenger in the vehicle during the journey? (No = 5 pts)	5	
9. Is heavy traffic congestion expected during the journey? (Yes = 5 pts)		
10. Was a pre-trip inspection performed (walk around, towing, load securement, etc.)? (No = 5 pts)		
11. Is the vehicle towing a heavy or oversized load OR permit required? (Yes = 5 pts)		
12. Will the driver encounter unpaved or mountainous road conditions? (Yes = 5 pts)		
13. In case of emergency, will the driver have suitable means of communication? (No= 5 pts)		
14. Are there elevated security risks associated with this journey? (Yes = 5 pts)	5	Covid
15. Is there an elevated risk of striking an animal on the roadway during this journey? (Yes = 5 pts)		
TOTAL	40	**Low Risk = 0-25 pts, Medium Risk = 30-55 pts requires mitigation, High = 60 or more requires Management Approval**
Workers must also establish a check in/check out system for any project where there is significant driving and where they will not be returning to the office at the end of the day. This process should be documented.		

Known or Suspected Contaminants (include PELs/TLVs): LINK to COC Library

Contaminants of Concern (COC) (Attach Fact Sheets*)	Maximum Concentrations		PEL/TLV**
	Soil (mg/kg)	Water/Groundwater (µg/l)	
PCE	2000 mg/kg	69,000	100 ppm/25 ppm
TCE	1.5 mg/kg	420	100 ppm/10 ppm
Cis, 1,2-DCE	1.1 mg/Kg	770	200 ppm/200 ppm
Vinyl Chloride	ND	200	1 ppm

*Workers must be made aware of the signs, symptoms, and first aid for each COC. Information is located on the COC fact sheets.
**See (LINK) for OSHA PELs and ACGIH TLVs

Air Monitoring Action Levels: FOR INFORMATION PURPOSES – Monitoring being conducted by others

PID/FID Reading[1]	Detector Tube[1]	Dust Meter[1]	LEL[2]/O_2[1]	Action
< 9 ppm	<0.5 ppm Vinyl Chloride			Continue Monitoring and working
< 9 ppm	>0.5 ppm Vinyl Chloride			Cease work, reevaluate
> 9 ppm	<0.5 ppm Vinyl Chloride			Cease work, reevaluate

[1] Sustained readings measured in the breathing zone
[2] Readings at measured at the source (borehole, well, etc.)

AHAs:

Check and attach all that apply (add applicable AHAs not already listed) (**LINK to AHA Library**):

Activity Specific AHAs:

- ☑ Mobilization/Demobilization and Site Preparation
- ☑ Vehicle Travel – Journey Management Plan
- ☑ Field Work - General
- ☑ Field Work - Oversight
- Decontamination
- ☐ Utility Clearance Activities
- ☑ Groundwater Sampling
- ☑ Soil Sampling
- ☐ Geoprobe
- ☑ Vehicle Travel during Covid
- ☐

Hazard Specific AHAs:

- ☐ Insect Stings and Bites
- ☐ Gasoline
- ☑ Working with Preservatives (Acids)
- ☐
- ☐
- ☐
- ☐
- ☐
- ☐
- ☐
- ☐

PPE and Monitoring Instruments:

Initial Level of PPE *

☑ Level D ☑ Modified Level D ☐ Level C

* Cannot use Short Form HASP for Level B or A or Confined Space Entry work

Standard PPE

☑ Hard Hat ☑ Safety boots ☑ Safety glasses ☑ High visibility vest/clothing

Eye and Face Protection

☐ Face shield ☐ Vented goggles ☐ Unvented goggles ☐ Indirect vented goggles

Hearing Protection

☐ None ☑ Ear plugs (as required) ☐ Ear Muffs ☐ Ear plugs and muffs

Respiratory Protection

☐ None ☑ Upgrade Only ☐ Dust mask ☐ Full Face APR ☐ Half Face APR

Cartridge Type: e.g., MSA GMC Change Cartridges: After 8-hr of use

Protective Clothing

☑ Work uniform ☐ White uncoated Tyvek® ☐ Poly-coated Tyvek® ☐ Saranex®
☐ Boot covers ☐ Reflective vest/clothing ☐ Chaps or Snake Legs ☐ Other: ______

Hand Protection

☐ None ☐ Cotton gloves ☐ Leather gloves ☐ Glove liners ☐ Cut-resistant gloves ☐ Other: ______
☑ Outer Gloves: List Type: Nitrile ☐ Inner Gloves: List Type: ______

Monitoring Instruments Required*

Periodic monitoring shall be conducted when the possibility of an IDLH condition or flammable atmosphere has developed or when there is indication that exposures may have risen over permissible exposure limits or published exposure levels since prior monitoring. Situations where it shall be considered whether the possibility that exposures have risen are as follows:

- When work begins on a different portion of the site.
- When contaminants other than those previously identified are being handled.
- When a different type of operation is initiated (e.g., drum opening as opposed to exploratory well drilling.)
- When employees are handling leaking drums or containers or working in areas with obvious liquid contamination (e.g., a spill or lagoon.)

☐ LEL/O2 Meter ☑ PID: ☑ 10.0/10.6 eV Lamp ☐ 11.7 eV Lamp ☐ FID ☐ Hydrogen Sulfide meter ☐ Carbon Monoxide meter

☐ Dräger Pump (or equivalent) ☐ Dust Meter: ☐ Respirable dust ☐ Total dust ☐ Other: ______

List Tubes: ______

*Monitoring instruments will be calibrated daily in accordance with manufacturer's instructions. Results will be recorded in the field logbook.

Chemicals Brought to the Site:

List all chemicals brought to the site (e.g., preservatives, decon solutions, calibration gases, gasoline, etc.).

Product Identifier: (Note: Name listed below must match name on label and SDS)	**SDS Attached?**
METHANOL	☑
ALQUINOX	☑
	☐
	☐
	☐

Chemicals will be kept in their original containers. If transferred to another container, aside from day use by one individual, the new container will be clearly labeled with the name of the chemical (product identifier), signal word, hazard statement, pictogram(s), precautionary statement, and name, address and telephone number of the chemical manufacturer, importer or other responsible party.

Work Zones:

The work zones will be defined relative to the location of the work activity. The Exclusion Zone is considered the area within a 10-foot diameter of the sampling location. The Contamination Reduction Zone is considered to be the area with in a 20-foot diameter of the sampling location. The Decontamination Zone is to be located upwind of the work area. Work zones will be maintained through the use of:

- ☐ Warning Tape
- ☑ Cones and Barriers
- ☑ Visual Observations

Decontamination Procedures and Equipment:

Note: See Decontamination AHA for further information

Level D Decontamination Procedures

Decontamination Solution:	Detergent and Water
Station 1: Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2: Outer Boots, and Gloves Wash and Rinse (if worn)	Scrub outer boots, and outer gloves decon solution or detergent water. Rinse off using copious amounts of water.
Station 3: Outer Boot and Glove Removal (if worn)	Remove outer boots and gloves. Deposit in plastic bag.
Station 4: Inner glove removal	Remove inner gloves and place in plastic bag.
Station 5: Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

Modified Level D and Level C PPE Decontamination Procedures

Decontamination Solution:	Detergent and Water
Station 1: Equipment Drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, etc. on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, a cool-down station may be set up within this area.
Station 2: Outer Garment, Boots, and Gloves Wash and Rinse	Scrub outer boots, outer gloves, and splash suit with decon solution or detergent water. Rinse off using copious amounts of water.
Station 3: Outer Boot and Glove Removal	Remove outer boots and gloves. Deposit in container with plastic liner.

Station 4: Canister or Mask (Level C only) Change	If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers are donned, joints are taped, and worker returns to duty.
Station 5: Boot, Gloves and Outer Garment Removal	Boots, chemical resistant splash suit, and inner gloves are removed and deposited in separate containers lined with plastic.
Station 6: Face Piece Removal (Level C only)	Facepiece is removed. Avoid touching face with fingers. Facepiece is deposited on plastic sheet.
Station 7: Field Wash	Hands and face are thoroughly washed. Shower as soon as possible.

Site Communication:

- [x] Verbal
- [ ] Two-way radio
- [x] Cellular telephone
- [x] Hand signals
  - Hand gripping throat ---------- Out of air, can't breathe
  - Grip partner's wrist or both hands around waist ---------- Leave area immediately
  - Hands on top of head ---------- Need assistance
  - Thumbs up ---------- OK, I am all right, I understand
  - Thumbs down ---------- No, negative
- [ ] Horn
- [ ] Siren
- [ ] Other: ____________________

EMERGENCY CONTACTS

NAME	TELEPHONE NUMBERS		DATE OF PRE-EMERGENCY NOTIFICATION (if applicable)
Fire Department:	911		
Hospital: Monroe County Hospital	585-760-6500		
WorkCare (Early case management)	888-449-7787		
Police Department:	911		
	Office	**Cell**	
Site Safety and Health Officer: Adam Norvelle	(518) 372 0905 x103	(518) 709 9672	
Client Contact: Samantha Salotto	(518) 402-9903	(518) 956-3794	
Project Manager: Sara Wright	(207) 828-3429		
*Eastern and LA Group Sr. HSE Manager: Cindy Sundquist	207-828-3309	207-650-7593 (Cell) 207-892-4402 (Home)	
Corporate SVP of HSE: Vlad Ivensky	610-877-6144	484-919-5175 (Cell) 215-947-0393 (Home)	
EPA/DEP (if applicable):			
Other: Ambulance	911		

*See Incident Flow Chart for additional Group HSE Manager's Contact Information

Emergency Equipment:

The following emergency response equipment is required for this project and shall be readily available:

- [x] Field First Aid Kit (including bloodborne pathogen kit/supplies)
- [ ] Fire Extinguisher (ABC type)
- [ ] Eyewash (Note: 15 minutes of free-flowing fresh water)
- [ ] Other: ______________________________

Emergency Procedures:

- The SSHO (or alternate) should be immediately notified via the on-site communication system. The HSO assumes control of the emergency response.
- The SSHO notifies the Project Manager and client contact of the emergency.
- If the emergency involves an injury to a Wood employee, the HSE Coordinator or Site Manager are to implement the Wood Early Injury Case Management program. See procedures and Flow Diagram below:

- If applicable, the SSHO shall notify off-site emergency responders (e.g. fire department, hospital, police department, etc.) and shall inform the response team as to the nature and location of the emergency on-site.
- If applicable, the SSHO evacuates the site. Site workers should move to the predetermined evacuation point (See Site Map).
- For small fires, flames should be extinguished using the fire extinguisher but only if trained within the past year. Use the **PASS** method (**P**ull the pin, **A**im at the base of the fire, **S**queeze the trigger, use a **S**weeping motion to put out the fire) when extinguishing fires. Large fires should be handled by the local fire department.
- In an unknown situation or if responding to toxic gas emergencies, appropriate PPE (e.g., level C or B PPE - if available), should be donned. If appropriate PPE is unavailable, site workers should evacuate and call in emergency personnel.
- For chemical spills, follow the job specific AHA and SDS for spill containment and spill handling procedures.
- If chemicals are accidentally spilled or splashed into eyes or on skin, use eyewash bottle/station for the eyes and wash affected area. Site worker should shower as soon as possible after incident.
- If the emergency involves toxic gases, workers will back off and reassess. Prior to re-entering the work zone, the area must be determined to be safe, that the required PPE and air monitoring equipment is available. Entry is prohibited if PPE or air monitoring equipment is inadequate.
- An injured worker shall be decontaminated appropriately.
- Within 24 hours after any emergency response, the initial Incident Analysis Report shall be completed and submitted to the Group Sr. HSE Manager. If the injury involves vehicles or overhead/underground utilities, also complete the Vehicle Incident Report (VIR) and Ground Disturbance Report (GDR), respectively. When the use of drugs or alcohol cannot be ruled out as a factor in the incident, contact P&O to determine if post accident drug testing is required.

Wood E&IS Early Injury Case Management Program

NON-EMERGENCY INCIDENT	EMERGENCY INCIDENT
Steps 1 & 2 must be completed before seeking medical attention other than local first aid. 1. Provide first-aid as necessary. Report the situation to your immediate supervisor AND HSE coordinator (all incidents with the apparent starting event should be reported within 1 hour of occurrence). 2. Injured employee:	1. Provide emergency first aid. Supervisor on duty must immediately call 911 or local emergency number; no employee may respond to outside queries without prior authorization. Any outside media calls concerning this incident must be referred immediately to Lauren Gallagher at 602-757-3211. 2. Once medical attention is sought and provided, the supervisor must:
Call WorkCare 24/7 Hotline* **(888) II-XPRTS or (888) 449-7787**	
WorkCare will assess the situation and determine whether the incident requires further medical	WorkCare will be responsible for performing the following:

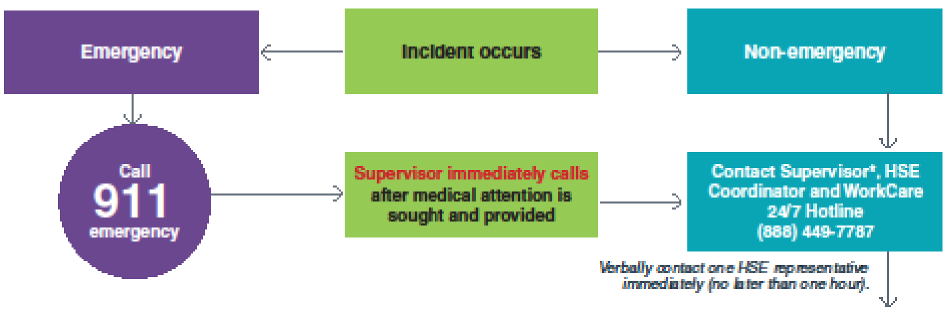
attention. During this process, WorkCare will perform the following: • Explain the process to the caller. • Determine the nature of the concern. • Provide appropriate medical advice to the caller. • Determine appropriate path forward with the caller. • Maintain appropriate medical confidentiality. • Help caller to execute path forward, including referral to the appropriate local medical facility. • Send an email notification to the Corporate HSE Department.	• Contact the treating physician. • Request copies of all medical records from clinic. • Send an email update to the Corporate HSE Department.
3. IMMEDIATELY after contacting WorkCare send a brief email notification AND inform verbally (direct contact is required) ONE of HSE corporate representatives See Figure 11.3. 4. Make all other local notifications and client notifications. 5. Local Supervisor, HSE Coordinator, SSHO and any applicable safety committees to complete preliminary investigation, along with the initial Incident Report within 24 hours. 6. Corporate Loss Prevention Manager to complete Worker's Compensation Insurance notifications as needed. 7. Corporate HSE to conduct further incident notifications, investigation, include in statistics, classify, and develop lessons learned materials. * - **NOTE: Step 2 is only applicable to the North-American operations and to incidents involving WOOD personnel. High potential near misses, subcontractors' incidents, regulatory inspections, spills and property damages above $1,000 should be reported immediately, following directions from Step 3.**	

Site Specific Emergency Procedures are as follows:

INCIDENT FLOW CHART

Incident flow chart

Call immediately



E&IS Corporate HSE department contact list

Name/email	Office location	Contact information
Bruce Voss bruce.voss@woodplc.com	Cathedral City, CA	760.202.3737 (office) 951.897.6381 (cell)
Chad Barnes chad.barnes@woodplc.com	Phoenix, AZ	602.733.6000 (office) 480.495.9846 (cell)
Cindy Sundquist cynthia.sundquist@woodplc.com	Portland, ME	207.828.3309 (office) 207.650.7593 (cell) 207.892.4402 (home)
Gabe Sandholm gabe.sandholm@woodplc.com	Minneapolis, MN	612.252.3785 (office) 206.683.9190 (cell)
Lori Dowling lori.dowling@woodplc.com	Prince George, BC	250.564.3243 (office)
Philip Neville philip.neville@woodplc.com	Thorold, ON	905.687.6616 (office) 905.380.4465 (cell)
Tim Kihn tim.kihn@woodplc.com	Edmonton, AB	780.944.6363 (office) 780.717.5058 (cell)
Vladimir Ivensky (can call 24/7) vladimir.ivensky@woodplc.com	Plymouth Meeting, PA	610.877.6144 (office) 484.919.5175 (cell) 215.947.0393 (home)
Kirby Lastinger kirby.lastinger@woodplc.com	Lakeland, FL	836-667-2345 x207 (office) 863-272-4775 (cell)
Stephen Paxton stephen.paxton@woodplc.com	Kennesaw, GA	770-499-6842 (office) 678-270-0980 (mobile)
Chris Miele christopher.miele@woodplc.com	Capital Projects - Kirkland, WA	425-368-0946 (office) 425-864-9011 (mobile)

High potential near misses, workplace violence/harassment and security incidents, subcontractor incidents, regulatory inspections, spills, and property damage should be reported immediately to one of the above HSE Representatives.

*Supervisor Responsible For:

- D&A Testing Coordination as per client and Wood E&IS requirements, Local/Client Notifications, and Completing Initial IAR within 24 hours and forwarding to Corporate HSE.

E&IS, North America | Rev. Dec 2017

Field Team Review:

I acknowledge that I understand the requirements of this HASP, and agree to abide by the procedures and limitations specified herein. I also acknowledge that I have been given an opportunity to have my questions regarding the HASP and its requirements answered prior to performing field activities. Health and safety training and medical surveillance requirements applicable to my field activities at this site are current and will not expire during on-site activities.

Name: ______________________________ Date: ______________

Name: ______________________________ Date: ______________

Name: ______________________________ Date: ______________

Name: ______________________________ Date: ______________

Name: ______________________________ Date: ______________

Routes to Emergency Medical Facilities:

HOSPITAL(for immediate emergency treatment):

Facility Name: Monroe Community Hospital

Address: 435 East Henrietta Road, Rochester New York 14620

Telephone Number: (585)760-6500

DIRECTIONS TO PRIMARY HOSPITAL (attach map): SEE ATTACHED

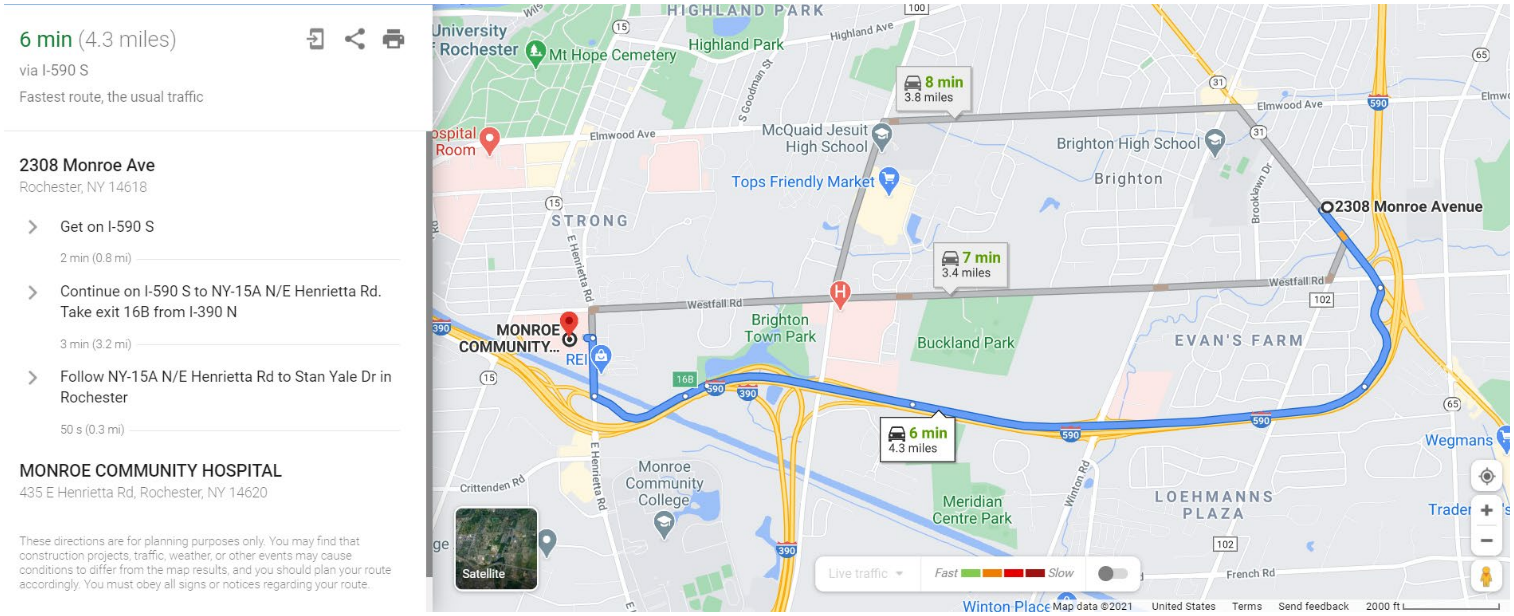
CLINIC (for non-emergency medical treatment)

Facility Name: Highland Hospital

Address: 1000 South Ave, Rochester, New York 14620

Telephone Number: (585)473-2200

DIRECTIONS TO CLINIC (attach map): SEE ATTACHED MAP



Wood HSSE Management System "Blue Book:"

The Wood HSSE management system is defined by the HSSE Management System Standard -the Blue Book. It consists of fifteen elements that set mandatory minimum standards for the management of HSSE across Wood. These minimum standards define how Wood leads, plans and organizes itself to ensure HSSE risks are controlled and to deliver continuous improvement in HSSE performance. The Blue Book is supported by Wood HSSE standards, procedures, guidelines and tools which provide further direction and advice on how to comply with the Blue Book's requirements.

Wood's core ***Vision*** is to:

Inspire with ingenuity, partner with agility, create new possibilities…
The Wood ***Values*** are:

- ***Care*** -Working safely, with integrity, respecting and valuing each other and our communities
- ***Commitment*** - Consistently delivering to all our stakeholders
- ***Courage*** - Pushing the boundaries to create smarter, more sustainable solutions

The Wood HSSE management system helps translate our Vision and Values into action by:

- Providing structure and consistency in the way we manage HSSE
- Focusing our attention on risk management, ensuring compliance and undertaking assurance activities
- Supporting the development of a positive HSSE culture which in turn supports the management system
- Providing a framework for continuous improvement

Refer to the Wood "Blue Book" for additional information (LINK).

Wood E&IS HSE Management System Manual and California IIPP):

The Wood E&IS Health, Safety, Security and Environment (HSSE) Management System Manual and California Injury and Illness Prevention Plan (IIPP) describes the HSSE system and tools developed & implemented at Wood E&IS. The manual addresses HSSE requirements for offices, laboratories and projects, including those of various duration, scale, location, and jurisdiction.

Wood E&IS's Safety philosophy as it pertains to all work conducted whether in the office, laboratory or in the field is:

- All incidents and injuries can be prevented.
- Management and staff are responsible for preventing injuries and occupational illnesses.
- Occupational safety and health are part of every employee's total job performance.
- Working safely is a condition of employment.
- All workplace hazards can be safeguarded.
- Training employees to work safely is essential and is the responsibility of management/supervision.
- Prevention of personal injuries and incidents and protection of environment is good business.

These principles tie into the Wood plc Health, Safety, Security and Environment (HSSE) Policy Statement:

Our HSSE Policy

At Wood, we care for our people and the environment. We ensure that our people have a safe, healthy and secure workplace; this is a fundamental right. This policy explains how we provide this.

We will:

- Care for our people.
- Identify and manage hazards to eliminate or mitigate resultant risks.
- Prevent injury, ill-health, pollution and loss resulting from our activities.
- Be responsible in our approach to protecting the environment and minimising our impacts.
- Deliver continual improvement in our health, safety, security and environmental performance.

Name Robin Watson
Position Chief Executive
Date 01 January 2019

We do this by:

- Ensuring we have exemplary HSSE leadership and management.
- Having effective, efficient and applied HSSE management systems.
- Understanding and complying with all legal, industry and other external requirements.
- Establishing and attaining clear HSSE objectives.
- Learning lessons from our incidents and preventing reoccurrence.
- Engaging with our people on HSSE issues.
- Working with our customers, regulators and others to promote continuous improvement.
- Training our people to be competent and safe in undertaking their roles.
- Helping our supply chain and partners to meet our own policy obligations.
- Promoting a positive HSSE culture that drives HSSEA improvement.
- Encouraging anyone to stop a job if they perceive any HSSE shortfall.

We commit ourselves to this Policy.

We will review annually, or where significant changes impact our business.

Policy No: HSE-POL-100001
Revision: 2
Date: 01 January 2019

Content property of Wood. This document is uncontrolled once printed. Check Wood Management System for the current version.

Wood Safety Shield:

A metaphor for protection - pulls together our HSSE processes and procedures to drive a simplistic and consistent message to our workforce around HSSE.

Aligned with our values, the three elements of the shield are:

- Prepare: It takes commitment to prepare.
- Engage: It takes care to engage.
- Intervene: It takes courage to intervene.

The Safety Shield seeks to educate, inform, monitor, improve and recognize our employees.

wood.
Safety Shield
Prepare. Engage. Intervene.

Six Safety Essentials:

The Six Safety Essentials are designed to support the safe execution of work in all our operating locations with the development of a "common set of behaviors" that we can all share. Wood, in our goal to be recognized as a world-class leader in HSSE safety must strive to ensure our daily overall consistency of HSE standards, leadership and performance.

When performing work at the site, the Wood **Six Safety Essentials** will be followed:

- Always Take Care
- Follow the Rules
- Do a Risk Assessment
- You Must Intervene
- Manage Any Change
- Wear the Correct PPE

Wood Nine Life Saving Rules:

The Life Saving Rules are Wood's minimum standard - it is an expectation that everyone must comply with the rules. Everyone needs to understand that:

- You must comply with the Life Saving Rules because non-compliance could result in serious injury or fatality to you or your colleagues
- If you breach a Life Saving Rule you may be subject to disciplinary action.

Supervisors and Managers must understand that:

- Breaking the Life Saving Rules will not be tolerated - no matter how urgent or important a task is.

- You have a duty to ensure that people undertaking a task have the right instruction, equipment and training to comply with the Life Saving Rules.


Bypassing Safety Controls


Confined Space


Driving


Energy Isolations


Hot Work


Line of Fire


Safe Mechanical Lifting


Work Authorization


Working at Height

Stand Up for Safety:

Wood's Stand up for Safety initiative focuses on four hazards that were identified by analyzing Wood's HSE incidents and High Potential events. These are four are areas of primary concern and are hazards that Wood employees face collectively as a global business. These four hazardous areas are:

- Dropped objects
- Driving
- Working at Height
- Process Safety

Extra attention will be paid to these four key areas if applicable when working on the project site.

HEART:

HEART

HEART is the corporate observation reporting system that all Wood employees are to use to report safety or environmental observations.

To enter a HEART observation, use the following link: https://cfapps.Woodfw.com/HEART/

HEART is also accessible from mobile devices. Click here for instructions on how to access HEART from a mobile device.

A manual HEART observation form can be accessed from here.

HEART

☐ Unsafe Act ☐ Unsafe Condition
☐ Safe Behaviour ☐ Safe Condition

☐ Wood ☐ Sub-contractor ☐ Client ☐ Third Party

Observer name		Observer email	
Observation date		Observation time	
Business Unit		Business Group	
Project/Office		Site/Office name	
Exact location of observation			
If Safe Behaviour state name of individual or team			

Details of safety observation

Immediate action taken/recommended

☐ Do you require feedback?

Form No: HSE-FOR-100705
Rev/Date: 0 17 January 2019

Category *Select one*

Work environment	**Integrity management**
Fire & fire protection	Accountability
Furniture & work equipment	Management of change
Housekeeping	Competence
Lighting & noise	Emergency response
Office security	Hazard evaluation & risk management
Traffic routes & parking areas	Incident investigation & management
Temperature & ventilation	Protective systems
Job factors	**Procedures & instructions**
Safety critical communications	Adequate / Inadequate
Fatigue / Workload	Implemented / Not implemented
Management of change	Followed / Not followed
Training & competence	Understood / Not understood
Contractor site safety	**Travel & safety away from workplace**
Barrier / Segregation	Electricity
Safety awareness & behaviour	Tools & equipment
Procedure implementation	Falls & slips
Safety induction & briefings	Fire safety
Housekeeping	Manual handling
Safety planning	Personal security
Personal Protective Equipment (PPE)	Sport & leisure
Signage & instructions	Transportation
Environment	**Tools & equipment**
Energy usage	Safe / Unsafe condition
Waste & recycling	Correct / Incorrect use
Water usage	Correct / Incorrect tool for the job

HEART conversation 5 step process

- Prepare
- Observe
- Initiate - Introduce yourself; Praise good behaviour; Listen; Ask open questions
- Agree and commit
- Record and close out

Typical questions

- How can you and your workmates get hurt?
- What type of accident may happen?
- How can you and others avoid getting hurt?
- What if something unexpected happens?
- What have you done to prevent you and your colleagues getting hurt?
- How and when was the pre-job safety discussion (toolbox talk) conducted?
- What are the job specifics/team composition changes that occurred since you started?
- How has the work environment changed since you started?
- How can this job be done more safely?

Tailgate Safety Meeting Form

Check One:

☐ Initial Kickoff Safety Meeting ☐ Regular/Daily Tailgate Safety Meeting ☐ Unscheduled Tailgate Safety Meeting

Date: ____________________ Site: ____

Site Manager: ____________________ Site Health and Safety Officer: ____________________
Print *Print*

Planned Activities: ____

____

____

Order of Business

Topics Discussed (Check all that apply)

☐ Scope of Work
☐ Site History/Site Layout
☐ Personnel Responsibilities
☐ Training Requirements
☐ Hazard Analysis of Work Tasks (chemical, physical, biological and energy health hazard effects)
☐ Applicable SOPs (e.g., Hearing Conservation Program, Safe Driving, etc.)
☐ Safe Work Practices
☐ Engineering Controls
☐ Chemical Hazards and Controls
☐ Signs and symptoms of over exposure to site chemicals
☐ Medical Surveillance Requirements
☐ Action Levels
☐ Monitoring Instruments and Personal Monitoring
☐ Perimeter Monitoring, Type and Frequency
☐ PPE Required/PPE Used
☐ Define PPE Levels, Donning, Doffing Procedures

☐ Decontamination Procedures for Personnel and Equipment
☐ Physical Hazards and Controls (e.g., overhead utility lines)
☐ Anticipated Weather (snow, high winds, rain)
☐ Temperature Extremes (heat or cold stress symptoms and controls)
☐ Biological Hazards and Controls (e.g., poison ivy, spiders)
☐ Site Control (visitor access, buddy system, work zones, security, communications)
☐ Sanitation and Illumination
☐ Logs, Reports, Recordkeeping
☐ Incident Reporting Procedures
☐ Near Misses/Hazard ID including worker suggestions to correct and work practices to avoid similar occurrences
☐ General Emergency Procedures (e.g., locations of air horns and what 1 or 2 blasts indicate)
☐ General Emergency Response Procedures (e.g., earthquake response, typhoon response, etc.)
☐ Medical Emergency Procedures (e.g., exposure control precautions, location of first aid kits, etc.)
☐ Route to Hospital and Medical Care Provider Visit Guidelines
☐ Site/Regional Emergency Response Procedures (e.g., exposure control precautions, location of first aid kits, etc.)
☐ Hazardous Materials Spill Procedures

PPE required for the tasks to be conducted: ____

____

____

Required Permits: ____

____

Site Access or other issues: ____

____

Tailgate Safety Meeting Form

Safety Suggestions by Site Workers: ______________________________

____

____

Action Taken on Previous Suggestions: ______________________________

____

____

Injuries/Incidents/Personnel Changes since last meeting: ______________________________

____

____

Observations of unsafe work practices/conditions that have developed since previous meeting: ______________

____

____

Location of (or changes in the locations of) evacuation routes/safe refuge areas: ______________

____

____

Additional Comments: ______________________________

____

Attendee signatures below indicate acknowledgment of the information and willingness to abide by the procedures discussed during this safety meeting

Name (Print)	Company	Signature

Meeting Conducted by: ______________________________ Title: ______________
Print

Signature: ______________________________ Time: ______________
Print

PPE Selection Guidelines

When selecting the appropriate PPE for the job, consider the following:

- **Safety glasses** – general eye protection – source of hazard, typically coming from straight on, required at most sites
- **Tinted Safety Glasses** – same as above, but when working in direct sunlight. May need two both tinted and untinted if working in both sunlight and shade/overcast skies.
- **Safety goggles** – needed for splash hazard, more severe eye exposures coming from all directions. Non-vented or indirect venting for chemical splash, non-vented for hazardous gases or very fine dust, vented for larger particulates coming from all directions.
- **Face shield** – needed to protect face from cuts, burns, chemicals (corrosives or chemicals with skin notation), etc.
- **Safety boots** – needed if danger of items being dropped on foot that could injure foot
- **Hard hat** – danger from items falling on head or bumping head against objects – any overhead work, tools, equipment, etc. that is above the head and could fall on head of item fails, or falls off work platform. Any work around low hanging equipment or structures. Typically required at most sites as a general PPE
- **Thin, chemical protective inner gloves** (e.g., thin Nitrile, PVC – do not use latex – many people are allergic to latex) –needed to protect hands from incidental contact with low risk contamination at very low concentrations (ppb or low ppm concentrations in groundwater or soil) or used in combination with outer gloves as a last defense against contamination. Need to specify type
- **Outer gloves** – thicker gloves (e.g., Nitrile, Butyl, Viton, etc.) – used when potential for high concentrations of contaminants (e.g., floating product, percent ranges of contaminant, opening drums, handling pure undiluted chemicals, etc.). Need to specify type.
- **Leather gloves, leather palm, cotton** – good in protecting hands against cuts – no protection from chemicals. May be used in combination with chemical protective gloves.
- **Boot Covers –** when there is contamination in surface soils or waking surface in general. When safety boots need protection from contact with contaminants.
- **White (uncoated) Tyveks** – protect clothing from getting dirty, good for protection against solid, non-volatile chemicals (e.g., asbestos, metals) – no chemical protection.
- **Polycoated Tyveks** – least protective of chemical protective clothing. Used when some risk of contamination getting on skin or clothing. Usually, lower ppm ranges of contaminants.
- **Saranex** – Greater protection against contamination than Polycoated Tyveks. Used to protect against PCBs or higher concentrations of contaminants in the soil or groundwater.
- **Other Chemical protective clothing** – if significant risk of dermal exposure, contact H&S to determine best kind.
- **Long sleeved shirts, long pants** – if working in areas with poison ivy/oak/sumac, poisonous insects, etc. and no chemicals exposure. May want to use uncoated Tyveks for work in areas where poisonous plants are known to be to protect clothing.
- **Cartridge Respirator (Level C PPE)** – Need to calculate change schedule (contact Division EH&S Manager for this) to determine length of use. To be able to use cartridge respirators, need to know contaminants, estimate levels to be encountered in the breathing zone, need to ensure that cartridge will be effective against COCs, and need to be able to monitor for COCs using PID, FID, Dräger tubes, etc.. If can't do any of these, then Level B PPE is probably going to be needed.
- **High Visibility Vest** – needed for any road work (within 15 feet of a road) or when working on a site with vehicular traffic or working around heavy equipment. Needed if work tasks would take employee concentration away from movement of vehicles and workers would have to rely on the other driver's ability to see the employee in order not to hit them. This includes heavy equipment as well as cars and trucks, on public roads or the jobsite. Not needed if wearing Polycoated Tyveks – as they are already high visibility.
- **Reflective Vest** – see above, but for use at night.
- **Hearing Protection** – needed if working at noise levels above 85 dBA on a time weighted average. If noise measurements are not available, use around noisy equipment, or in general, if you have to raise your voice to be heard when talking to someone standing two feet away.
- **Protective Chaps –** required when using a machete or chain saw or any other cut hazard to legs.

Incident Report Forms

APPENDIX E – QUALITY ASSURANCE PROJECT PLAN and SOPs

QUALITY ASSURANCE PROGRAM PLAN

AND

PROGRAM FIELD ACTIVITIES PLAN

Prepared for:

NEW YORK STATE DEPARTMENT OF CONSERVATION

STANDBY ENGINEERING SERVICES

CONTRACT Number D009809

Prepared by:

MACTEC Engineering & Geology P.C.

511 Congress Street, Suite 200

Portland, Maine 04101

APRIL 2020

REVISION 0

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REVIEWED AND APPROVED BY:

Jean Firth P.G. Contract Manager	Christian Ricardi, NRCC-EAC Quality Assurance Officer

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

A%	Acceptance Percentage
ASP	Analytical Services Protocol
ASTM	ASTM International
COC	Chain-of-Custody
%D	Percent Difference
DER	Division of Environmental Remediation
DO	Dissolved Oxygen
DQO	Data Quality Objective
DUSR	Data Usability Summary Report
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
FAP	Field Activities Plan
GC/FID	Gas Chromatograph/Flame Ionization Detector
HASP	Health and Safety Plan
MACTEC	MACTEC Engineering & Geology P.C.
MDL	Method Detection Limit
MS/MSD	Matrix Spike/Matrix Spike Duplicate
NYSDEC	New York Department of Environmental Conservation
NYSDOH	New York State Department of Health
ORP	Oxidation-Reduction Potential
PID	Photo-ionization Detector

GLOSSARY OF ACRONYMS AND ABBREVIATIONS (CONTINUED)

PM	Project Manager
QAPP	Quality Assurance Program Plan
QA/QC	Quality Assurance/Quality Control
QAO	Quality Assurance Officer
%R	Percent Recovery
RPD	Relative Percent Difference
SCG	standards, criteria and guideline
SOP	Standard Operating Procedure
TED	Technical Environmental Database
TSA	Technical Systems Audit
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound
WA	Work Assignment
XRF	X-ray Fluorescence Spectrometer

QAPP ANNUAL REVIEW DATES & SIGNATURES

Review Date	Revision No.	Signatures/Title	Explanation of Revisions
April 2020	0	NA	Contract D009809 original

1.0 INTRODUCTION

This Quality Assurance Program Plan and Program Field Activities Plan (QAPP) has been developed by MACTEC Engineering and Geology P.C. (MACTEC) to meet the requirements of the New York State Department of Environmental Conservation (NYSDEC) Division of Environmental Remediation (DER) Technical Guidance for Site Investigation and Remediation (DER-10 [NYSDEC, 2010]). This document follows the United States Environmental Protection Agency (USEPA) QAPP guidance (EPA Requirements for Quality Assurance Project Plans, March 2001; USEPA, 2001), and the NYSDEC Engineering Services Contract D009809. The purpose of this NYSDEC QAPP is to provide guidance for generating data that is of the precision, accuracy, and completeness necessary for the intended end use of the data.

In accordance with the USEPA QAPP guidelines (USEPA, 2001), this QAPP will be reviewed and updated at a minimum annually, or more frequently if needed.

Under the NYSDEC Engineering Services Contract, work assignments are issued that may require the performance of some, or all, of the following services:

- Site Characterization
- Phased Remedial Investigation/Feasibility Study
- Remedial Design
- Engineering Services During Construction
- Analytical Quality Assurance/Quality Control (QA/QC) Activities
- Site Response Activities/Interim Remedial Measures
- Site Management
- Citizen Participation Activities
- Health and Safety Plan (HASP) Review
- Potentially Responsible Party and Third Party Oversight
- Soil Vapor Intrusion

The purpose of this Program QAPP is to define general QA/QC processes that will be followed for a wide range of investigation and remedial activities. It is designed to be used with additional site and event specific planning documents. A site-specific Field Activities Plan (FAP) will be generated for each site that is investigated by MACTEC under Engineering Services Contract D009809. FAPs will include the majority of project-specific information contained in the NYSDEC Quality Assurance Project Plan Guidelines (NYSDEC, 2019) and follow the outline provided in Section 4.0 of this QAPP and will describe the site-specific information including a project description, scope of work, data quality objectives (DQOs), schedule, and health and safety plan for the proposed field activities. FAPs will be used in conjunction with and will reference this QAPP for data collection methods, laboratory methods, and data evaluation and assessment requirements. Unless otherwise stated, the term QAPP as used throughout this document will refer to this NYSDEC Program QAPP.

2.0 QUALITY ASSURANCE STATEMENT

This QAPP is a management tool to be used to generate data that is of the precision, accuracy, and completeness necessary for the intended end use. A key to being successful is having clear project objectives and a strong DQO analysis.

MACTEC is committed to maintaining the NYSDEC QAPP over its shelf-life by providing yearly updates on the document (incorporating appropriate modifications and additions identified during site-specific work), or as needed. Furthermore, MACTEC will prepare site specific FAPs for individual projects and understands the process includes the following:

- The FAP will be submitted to the NYSDEC project manager and will be approved prior to conducting site work;
- Project work will be performed in accordance with the processes and procedures described in the QAPP; and
- When field activities do not follow the standard procedures described in this QAPP the procedures will be provided in the relevant FAP.
- MACTEC has appointed a Quality Assurance Officer (QAO) to oversee and coordinate overall project quality for work under the NYSDEC Contract No. D009809 including overseeing and coordinating analytical programs.

2.1 ORGANIZATION

This section summarizes the organizational structure for NYSDEC projects.

2.2 PROJECT ORGANIZATIONAL CHART

Figure 3.1 is MACTEC's Project Organization Chart.

Subcontractors will be procured for field services such as excavation, drilling, and laboratory as needed.

2.3 PERSONNEL QUALIFICATIONS AND TRAINING

MACTEC will assign technical staff who have the appropriate training and qualifications relevant to specific projects. Staff training will at a minimum include the following activities:

- general briefings covering the aspects of the QA program and QAPP;
- site-specific briefings on FAPs;

- specific briefings on individual QA and QC procedures or activities;
- required reading of pertinent QA-related documents; and
- participation in appropriate training courses.

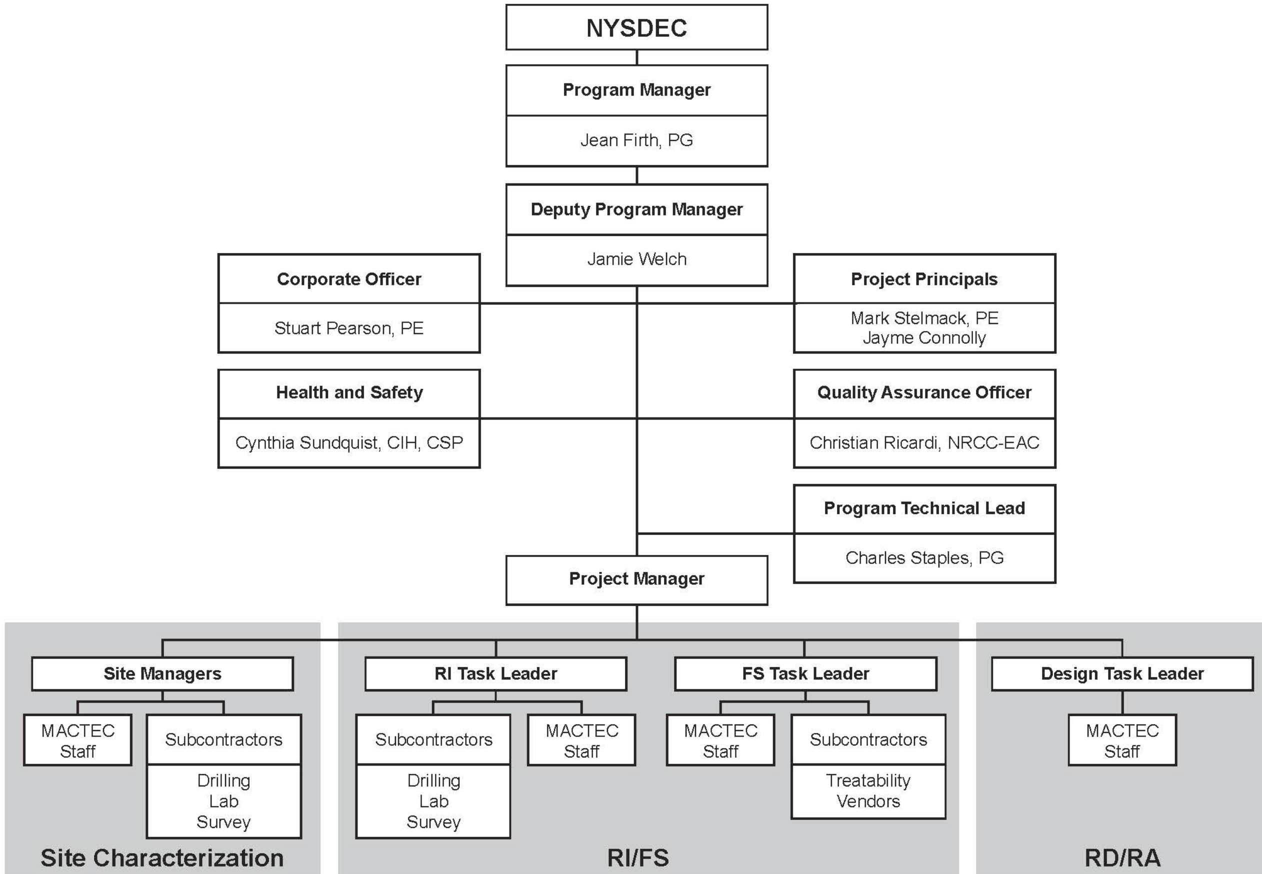
MACTEC personnel involved with hazardous waste site investigations are required to attend an approved 40-hour health and safety course prior to working on hazardous waste sites and attend annual 8-hour safety refreshers. In addition, staff will receive technical training periodically to review: (1) sampling procedures; (2) documentation procedures; (3) operational procedures; and (4) safety equipment use and function.

MACTEC will staff projects with capable, trained personnel. MACTEC typically uses a cross-section of junior-, middle-, and senior-level personnel to implement field sampling and investigation programs. By using this cross-section, personnel are placed in a position of responsibility to which they can respond. The MACTEC Project Manager will ensure that personnel working on their projects have the experience and training required to fulfill responsibilities needed for technical tasks for their projects.

2.4 SUPPORT SERVICES

To conduct certain Work Assignments (WAs), MACTEC will retain subcontractors (selected considering price and technical qualifications) to perform specialized services, such as sample analysis, drilling, and surveying. Before entering a subcontract relationship, MACTEC will evaluate the potential subcontractors' qualifications both technically and financially. Such evaluations may include visiting the subcontractors' business unit and conducting facility audits. MACTEC may conduct pre-bid meetings to explain potential tasks, site conditions that may be encountered, and the importance of each task to the project. MACTEC evaluations will be documented and recommendations will be presented to the NYSDEC for approval.

Contract documents are thoroughly discussed with the subcontractor, and are complete and detailed, including scopes of work, payment terms and conditions, penalties for poor performance, and applicable prime contract flow down clauses. Before awarding work, MACTEC will confirm the subcontractors' ability to accomplish the work on the required schedule. MACTEC requires periodic subcontractor progress reports (e.g., drillers' daily quantity sheets and documentation of internal technical reviews). Subcontractors must contact MACTEC if they anticipate difficulty in adhering to scope, schedule, or budget. For technical issues, the subcontractor's primary point of contact within MACTEC is the project manager (PM).



MACTEC

Figure 3.1
Organization Chart
NYSDEC Quality Assurance Program Plan

3.0 DATA QUALITY OBJECTIVES AND ANALYTICAL METHODS

3.1 DATA QUALITY OBJECTIVES

DQOs are qualitative and quantitative statements that specify the quality and quantity of data needed to support decisions during site assessments. DQOs are developed by considering the purpose of collecting the data and the intended use of the data. DQOs will establish the quality of data needed to meet the goal of the specific WAs and the intended end use of the data. DQOs will be developed for each site and presented in the FAP (Section 4.0). Data quality assessments are discussed in Section 9.0 of this QAPP.

3.2 ANALYSIS TYPE

The analytical data quality levels (field screening, field analysis, off-site laboratory analysis) for a WA will be site-specific and will be indicated in the FAP.

Field Screening. Field screening measurements are characterized by the use of portable instrumentation that can provide real time data to assist in the optimization of sampling point locations and for health and safety monitoring. Data can be generated indicating the presence or absence of certain contaminants, especially volatiles, at sampling locations. These measurements may include handheld photoionization detector (PID) for volatile organic compounds (VOCs) monitoring, and instruments used for measuring temperature, pH, specific conductance, dissolved oxygen (DO), and turbidity during water sampling as well as metals analysis via x-ray fluorescence (XRF). Calibration and data recording procedures for the field-testing instruments are described in applicable Standard Operating Procedures (SOPs) provided in Appendix A.

Field Analysis. Field analyses are characterized by the use of portable analytical instruments or field test kits that can be used on-site or in mobile laboratories stationed near a site. A detailed description of field analytical procedures will be included in each FAP. Depending on the project field analysis objectives, types of contaminants, sample matrix, and analytical procedure, either qualitative or quantitative data will be obtained. The data quality goal will be specified in each FAP. For sampling tasks requiring quantitative results, split samples for off-site laboratory analysis may be collected to evaluate the accuracy of the field analytical data. The confirmation sample process and data comparison goals will be identified in the FAPs.

Off-Site Laboratory Analysis. Off-site laboratory analyses are characterized by subcontract laboratory-generated data obtained using USEPA or NYSDEC-approved procedures. Laboratory services will be completed in accordance with the NYSDEC Analytical Services Protocol (ASP) [NYSDEC, 2005]. Analytical methods may include a MACTEC subcontracted lab using USEPA Contract laboratory Program Statement of Work methods, USEPA SW-846 (USEPA, 2015) methods, USEPA drinking water (500 series) methods and waste water methods (600 series) [40 CFR Part 136], Methods for the Chemical Analysis of Waters and Wastes (USEPA, 1983), Standard Method (APHA, 2017), ASTM-International procedures, or other approved testing procedures. Analytical methods and target analyte lists will be specified in the FAPs. Analyses will be completed by an analytical laboratory with New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certification.

4.0 PROGRAM FIELD ACTIVITIES PLAN

This section provides the general programmatic guideline for preparing the site specific FAP developed for each site investigated by MACTEC for the NYSDEC. The sample design, site data collection, analysis, and evaluation methods, and site figures will be provided in the FAP are described in the following sections.

4.1 TITLE AND SIGNATURE PAGE

This section includes the document title, NYSDEC Site Number and MACTEC Work Assignment Number, plan date and revision number, prepared for/prepared by information, and signature blocks for MACTEC personnel required to approve and sign the FAP, including, at a minimum, the Qualified Environmental Professional.

4.2 SECTION 1: INTRODUCTION

The introduction section:

- Identifies the NYSDEC Site Number and MACTEC Work Assignment Number;
- Indicates the FAP is prepared in accordance with NYSDEC DER-10 requirements;
- Identifies the FAP's association with the approved MACTEC Program QAPP (including a complete reference to the QAPP);
- Provides a statement indicating that the work described in the FAP will be performed in accordance with the processes and procedures described in the MACTEC Program QAPP;
- Includes other relevant information that sets the stage for the project.

4.3 SECTION 1.1: WORK ASSIGNMENT OBJECTIVES

This section describes the objectives of the FAP (will vary depending on if site characterization, remedial investigation, remedial design).

4.4 SECTION 1.2: SITE BACKGROUND

This section describes the site background, including location information, site history, and summary of previous investigations. Sufficient background information from a historic, scientific, and/or regulatory perspective will be provided to establish the current understanding of the site. Site figures (including a site location map) will also be included.

4.5 SECTION 2.0: PHYSICAL SITE SETTING

This section will describe the site physical setting, including climate, topography, surface and groundwater hydrology, and geology.

4.6 SECTION 3.0: CONCEPTUAL SITE MODEL

This section will include a brief description of the past uses of the site, geologic and hydrogeologic information, suspected types and sources of contaminants, migration pathways, and potential receptors.

4.7 SECTION 4.0: SCOPE OF WORK

This section describes the scope of work to be performed to meet the project objectives, including the data quality objectives for the field program. This section discusses the following:

1) the goal of the site assessment;
2) the end use of the data;
3) the data quality objectives needed for the project;
4) the level of data evaluation needed (e.g., Data Usability Summary Report [DUSR], chemist review); and
5) the applicable standards, criteria and guidelines (SCGs) that will be used to evaluate the data will be included to ensure that the reporting limits from the contracted laboratory are below those regulatory criteria.

If laboratory reporting limits are above regulatory criteria these will be specifically addressed and the effect on the objectives will be discussed.

Section 8 of this QAPP describes laboratory requirements and considerations to be used when preparing FAPs. In addition, this section will include a list of names, contact info, and roles of principal personnel on project, including subcontractor contacts.

4.8 SECTION 4.1: GENERAL FIELD ACTIVITIES

This section will include a description of general field activities to be conducted, including:

- health and safety
- mobilization, site access
- community air monitoring

- handling of investigation derived waste

4.9 SECTION 4.2: SITE INVESTIGATION ACTIVITIES

This section will include the following:

- A detailed description, including relevant site figures, of the work to be performed including identifying the media to be sampled, sampling locations, analyses to be performed, and the rationale for sampling locations/analysis;
- A detailed description of key field measurements (PID, low flow parameters, etc.), field analytical testing, and off-site laboratory testing to be performed;
- A detailed description of important conditions under which data should be collected (e.g., storm event, seasonal, flow conditions, etc.), if relevant;
- A site map showing site boundaries and the proposed sampling locations;
- An SOP reference table listing the field sampling SOPs, including sample handling and custody requirements that will be used for the project (Note: SOPs that will be used for the project that are not included in this QAPP will be attached as an appendix to the FAP.);
- An Analytical Methods/Quality Assurance Summary Table that will show, by medium, the parameters to be analyzed, the number of samples to be collected, the number and frequency of QA/QC samples (e.g., Matrix Spike/Matrix Spike Duplicate [MS/MSD], duplicates, blanks) to be collected, and the analytical methods;
- Tabulated listings of target analytes, method reporting limits, method detection limits; and applicable SCGs proposed for each media to be sampled or a reference to the QAPP;
- A table identifying containers, volumes, sample preservation, and holding times for each analytical method and matrix or a reference to QAPP Appendix E if applicable to the project sampling event;
- Identity of ELAP approved lab(s) to be used for analysis of samples;
- A description of the data reporting (i.e., Category A, Category B, or other) and data evaluation requirements (i.e., data validation, DUSR, Category A, or other).

4.10 SECTION 4.3: REPORTING AND SCHEDULE

This section will include a detailed description of the overall project evaluation process used to summarize, tabulate, interpret, present, and discuss the laboratory and field data, as well as the required deliverable to the NYSDEC.

In addition, this section will provide an overall project timeline for the work to be performed and deliverables to be submitted.

4.11 SECTION 5: REFERENCES

This section of each FAP will include a list of references used in developing the FAP. References may include the following, whose requirements, procedures and/or SCGs the MACTEC project team will follow when developing FAPs and planning and implementing project-specific investigations:

- DER-10 (NYSDEC, 2010a)
- 6 NYCRR PART 375 (NYSDEC, 2006)
- Title 6, Part 371 (NYCRR, 2019)
- CP-51 (NYSDEC, 2010b)
- Title 6, Part 700-706 (NYCRR, 2016)
- Ambient Water Quality Standards and Guidance Values (NYSDEC, 1998)
- Groundwater Sampling Guidance (USEPA, 2002)
- ASP (NYSDEC, 2005)
- Soil Vapor Intrusion Guidance (NYSDOH, 2006)
- Draft Procedures for Collection and Preparation of Aquatic Biota (NYSDEP, 2002)
- PFAS Sampling Guidelines (NYSDEC, 2020)
- 1,4-Dioxane and PFAS Sampling (NYSDEC, 2019a)
- QAPP Guidelines (NYSDEC, 2019b)

4.12 ATTACHMENTS

Attachments to the field activities plan will include:

- HASP, including a Community Air Monitoring Plan per DER-10 guidelines.
- Project Specific SOPs

5.0 STANDARD OPERATING PROCEDURES FOR FIELD ACTIVITIES

SOPs for field activities that will be used on NYSDEC WAs are provided in Appendix A and summarized on Table A1-1 (included with Appendix A).

Field data record forms are used to document activities conducted in the field including field measurement. Field data records for specific activities are included where appropriate with the SOP for that activity.

If all or part of an SOP cannot be followed due to unique site conditions or other limitations the SOPs will be used as general guidance and modifications to the SOPs will be documented in the FAP. If unplanned modifications are deemed necessary due to field circumstance, modifications will be documented in the field logbook or on field data record sheets. An evaluation of the impact of field modifications on data quality will be provided in the investigation/data report.

If an activity is performed that does not have a specific SOP provided in this QAPP, the procedures used will be included in the FAP.

6.0 FIELD EQUIPMENT

Equipment used during field activities may be owned by MACTEC or rented from various vendors.

6.1 PREVENTATIVE MAINTENANCE – FIELD EQUIPMENT

Equipment, instruments, tools, gauges, and other items owned by MACTEC and requiring preventive maintenance will be serviced in accordance with the manufacturer's recommendations. It will be the responsibility of MACTEC's Field Operations Support personnel to adhere to this maintenance schedule and to arrange for service as required prior to equipment being available for use. Service to the equipment, instruments, tools, gauges, etc. shall be performed by qualified personnel.

MACTEC will inspect and evaluate rented equipment prior to use in the field. Maintenance of field equipment from vendors is the responsibility of the vendors.

Maintenance records will be documented and traceable to the specific equipment, instruments, and tools. Critical spare parts will be stored for availability and use to reduce downtime. If an instrument needs to be replaced during the field program, replacement equipment will be obtained either from MACTEC's equipment supply or from an equipment rental vendor, depending on availability.

Anticipated field equipment maintenance and inspection procedures for NYSDEC WAs are presented in the specific SOPs included in Appendix A.

6.2 CALIBRATION AND CORRECTIVE ACTION – FIELD EQUIPMENT

Field analytical equipment will be checked and calibrated, if required, in accordance with the procedures and frequency summarized in the specific SOPs included in Appendix A. The calibration procedures will conform to manufacturer's standard instructions and equipment will be calibrated to within the allowable tolerances established by the manufacturer or listed in the specific SOPs included in Appendix A. If calibration criteria cannot be met, field personnel and the PM will determine whether a new instrument will be required, or if the data will still meet the DQOs. If the instrument is used, the deviations will be documented on the calibration record and on field forms where the specific instrument readings are recorded. Records of instrument calibration will be maintained by field personnel.

7.0 CONTROL OF SAMPLES AND FIELD RECORDS

This section describes how field and laboratory personnel will handle and track the sample custody and field data.

7.1 SAMPLE COLLECTION DOCUMENTATION

The following sections outline procedures that will be used by field and laboratory personnel to document project activities and sample collection procedures.

Field Notes

Documentation of field observations and sample collection activities will be recorded using a field logbook or on field sampling sheets. Copies of MACTEC's field data monitoring sheets/forms are included with the specific SOP in Appendix A.

For sampling and field activities, the following types of information should be included if appropriate:

- project name
- date
- time of logbook entries
- personnel/equipment
- weather conditions
- activities involved with the sampling
- site observations
- site sketches
- photo log

Field Documentation Management System

The original field sampling sheets will be maintained on-site during the field event. After the field program is completed, the field sampling sheets will be checked for completeness by qualified personnel and scanned into the project directory for later inclusion with the specific report generated.

7.2 SAMPLE HANDLING AND TRACKING SYSTEM

This section outlines the procedures that will be followed to identify and track samples taken during field activities.

Sample Identification

Existing monitoring wells or sampling locations, if present, will retain their existing nomenclature (i.e., MW-2B, etc.). New wells or locations used by MACTEC will typically use the following abbreviations by medium (additional nomenclature may be necessary):

AA	=	Ambient Air
IA	=	Indoor Air
SU	=	Sub-slab
DP	=	Direct Push/Geoprobe (groundwater/soil)
MW	=	Monitoring Well (groundwater)
PW	=	Pore Water
SB	=	Soil Boring (soil)
SD	=	Sediment
SS	=	Surface Soil
SV	=	Soil Vapor
SW	=	Surface Water
TP	=	Test Pit (soil)

Sample identifications for laboratory purposes will include the six digit NYSDEC site number, followed by the location nomenclature, followed by the three-digit depth (e.g., 828133-MW-2D022, for a groundwater sample collected from 22 feet below ground surface at well MW-2D). Care should be taken when completing field sample identifications on field data records, chains of custody, and sample labels so that similarly shaped letters and numbers (e.g., S and 5, O and 0, D and 0) are clearly marked.

Quality Assurance/Quality Control

QA/QC sample abbreviations may consist of the following:

D = Duplicate Sample

MS = Matrix Spike

MSD = Matrix Spike Duplicate

TB = Trip Blank

EB = Equipment Blank

The D, MS, and MSD abbreviations will follow the specific sample identification. For example, a duplicate sample for monitoring well number 2D collected at 22 feet will be designated as "828133-MW2D022D."

Trip blanks and equipment blanks will be numbered consecutively throughout each sampling event and the sample ID will include the sample date (e.g. trip blanks TB-1-041320; equipment blanks EB-1-041320).

Sample Handling

Samples will be stored on-site in coolers packed with ice until they are sent to the laboratory for analysis. Bottles will be packed snugly with packing materials to protect the containers from breakage. Ice will be added to the cooler, and the chain of custody (COC) form will be placed in the cooler prior to shipment. Samples will be placed in the coolers directly after sampling to prevent overexposure to sunlight and to keep them cool for preservation. Field personnel will be responsible for the security of the samples before they are shipped. Coolers and samples will be stored in a secure or monitored area on-site or in the sampler's vehicle until they are shipped to the laboratory.

Samples will either be shipped by overnight courier (e.g., FedEx priority or first overnight) or transported by vehicle to the laboratory for analysis. Coolers shipped to the laboratory will be sealed with a custody seal that has been signed and dated. In general, samples will be shipped or transported within twenty-four hours of collection. Regardless of the shipping schedule, holding times begin with sample collection. For analytical parameters with short holding times (<48 hours) it is advisable to ship coolers to the laboratory using FedEx first overnight courier service.

The person responsible for sample collection will notify the laboratory of the number, type, and shipment dates for the samples. If the number, type, or date of shipment changes due to site constraints or program changes, the field leader will notify the laboratory of the changes. This notification will also occur when sample shipments are expected to arrive at the laboratory on Saturday. If prompt shipping and laboratory receipt of the samples cannot be guaranteed (i.e., Sunday arrival), the samplers will be responsible for proper storage of the samples until adequate transportation arrangements can be made.

Sample Labeling

Each sample container will be affixed with a self-sticking, waterproof, adhesive label. Each contracted laboratory will provide sample labels for every sample container. Each label shall be completed with a pen of indelible ink and contain the following information:

- Client Name: MACTEC
- Site Name: "Site Name" for the sampling event
- Client Sample ID: 828133-SD30, for example
- Date collected: (month/day/year)
- Sample Time given as military time (for example: 1400)
- Name/Initials of Collector: MACTEC Field Sampler
- Analytical method/analyte request (for example, VOCs - 8260)
- Preservative: (for example – None, HNO_3, H_2SO_4, NaOH, HCl, $Na_2S_2O_3$, or Other)

7.3 SAMPLE CUSTODY

Sample custody will be designed to assure that each sample is accounted for at all times (Refer to SOP S8 "Chain of Custody Protocol"). To maintain this level of sample monitoring, sample container labels and shipping manifests will be employed. A COC must be completed by the appropriate sampling and laboratory personnel for each sample. Each contracted laboratory will provide laboratory specific COCs. The objective of the sample custody identification and control system will be to assure that:

- samples are uniquely identified;
- samples are analyzed for requested analyses and are traceable to their records;
- samples are protected from loss, damage, or tampering;
- alteration of samples (e.g., filtration, preservation) is documented; and
- a forensic record of sample possession and transfer is established.

The COC protocol implemented by the sampling crews includes:

- Documenting procedures and amounts of reagent added (e.g., volume of methanol and rock weight extracted for methanol-extracted rock chips) or treatment of the sample (e.g., filters);
- Recording sampling locations, sample bottle identification, and specific sample acquisition measures on the appropriate forms;
- Using sample labels to document information necessary for effective sample tracking; and
- Completing COC forms to establish sample custody in the field before sample shipment.

When coolers are packed and sealed for shipping, the sampling person responsible for relinquishing the cooler to the courier will sign the COC and the cooler custody seal (see Appendix C).

The COC form includes:

- MACTEC field sample ID;
- names of the sampler(s) and the person shipping the samples;
- purchase order number, if applicable;
- name, telephone number, and fax number of the contact person from MACTEC;
- project site and sampling event name;
- signature of person responsible for shipping;
- date and time that the samples were collected;
- names of persons relinquishing and receiving the samples and the date and time received at the laboratory;
- matrix/media of the sample;
- requested analytical methods and parameters;
- laboratory hardcopy data deliverable level and EDD requirement (if present on COC form);
- the number of containers for a particular sample; and
- analysis, container type, and preservative information.

Corrections to a COC will be made by putting one line through the incorrect entry and initialing and dating it.

The COC will accompany the samples to the laboratory and a copy of the COC will be retained by the sampler. The project manager will be responsible for maintaining a copy of the COC in the project file. A completed copy of the COCs will be supplied by the fixed laboratory with the data deliverables to MACTEC.

8.0 LABORATORY SERVICES

8.1 OFF-SITE LABORATORY REQUIREMENTS

Samples for off-site analysis will be submitted to a laboratory certified under the NYSDOH ELAP.

Routine analytical services will be provided by ELAP certified analytical laboratories under contract with NYSDEC or MACTEC. Information for these laboratories, including the laboratory-specific method detection limits (MDLs) and reporting limits, is included in Appendix B. If additional laboratory information is needed based on the specific requirements of the WAs, it will be included in the FAP.

8.1.1 Laboratory Deliverables

Off-site analytical laboratory data deliverables will include a NYSDEC ASP Category B data package and Environmental Quality Information System (EQuIS™) EDD for most field data collected in support of remediation activities. For some sampling activities a lower level of laboratory reporting may be specified including Category A deliverables. Laboratory deliverables for investigation events will be specified in the project FAP. General data deliverable objectives for various services are summarized in Table 8.1.

For initial site investigations, the laboratory will report the full target compound and target analyte lists specified in the ASP, and tentatively identified compounds (TICs) will be reported for samples analyzed for VOCs and SVOCs unless otherwise specified in the FAP.

8.2 SAMPLE CONTAINER AND PRESERVATION REQUIREMENTS

Sample integrity for samples submitted to an off-site laboratory is maintained by using containers and preservation methods that are specific to the media sampled and analytical parameters. Sample containers and preservation methods specified in NYSDEC ASP are summarized in Table 8.2. Project-specific variation or addition to the sample containers and preservation methods outlined in this table will be specified in the FAP.

Preparation of Sample Containers

Sample containers will be provided by the laboratory and are pre-prepared according to USEPA protocols. QC records for the bottles used will be maintained by the laboratory.

Sample Preservation

Sample preservation for water samples will be completed in accordance with requirements described in the ASP Exhibit I (NYSDEC, 2005). Steps to maintain the in-situ characteristics required for analysis may include storage of samples at 4 degrees Celsius, pH adjustment, and chemical fixation. Specific sample and container preservation requirements are summarized in Table 8.2 for the most commonly used methods. Holding times specified in the ASP Exhibit I are based on time of sample receipt at the laboratory. Holding times specified on Table 8.2 have been modified to begin at the time of sample collection.

Sample preservation and holding times for soils are based on guidelines provided in the ASP, referenced USEPA methods, or USEPA guidance documents.

Soil samples collected for VOC analysis will be preserved in the field in accordance with USEPA Method 5035A (USEPA, 2002) unless otherwise directed by the NYSDEC PM.

9.0 DATA QUALITY ASSESSMENT

The purpose of data quality assessment is to document that data generated under the program are accurate and consistent with project objectives. The quality of data will be assessed based on the precision, accuracy, representativeness, comparability, and completeness of the data that are generated. Data quality assessment will be conducted in three phases:

Phase 1. Prior to data collection, sampling and analysis procedures are evaluated in regard to their ability to generate the appropriate, technically acceptable information required to achieve project objectives in terms of parameters, analytical methods, detection limits, and required sampling protocols.

Phase 2. During data collection, field results will be reviewed in relation to the conceptual site model to assess whether the data generated provide sufficient information to achieve project objectives. Data may be compared to historical data to evaluate the validity of field readings. After data collection, analytical data will be evaluated for precision and accuracy. In general, evaluation of data will be based on performance checks such as laboratory control samples, field and laboratory blanks, duplicate and spiked sample analyses, and review of completeness objectives.

Documentation will include field data records, field logbooks, emails, phone conversation logbooks, photos, mobile on-site laboratory records (if applicable), laboratory sample receipt logs and chain of custody records, and laboratory report deliverables.

Information included in final reports will consist of:

- number and identity of duplicate, spike, and field blank samples analyzed;
- identification of statistical techniques, if used, to test for outliers;
- use of historical data and its reference;
- identification of analytical methods; and
- data validation results.

Phase 3. Following completion of data collection activities and review of analytical results, an assessment of the adequacy of the database generated in regard to completing project objectives will be undertaken by the QAO or PM. Recommendations for improved QC will be developed, if appropriate. In the event that data gaps are identified, the QAO or PM may recommend the collection of additional data to fully support the project's findings and recommendations.

Each phase of the assessment will be conducted in conjunction with appropriate project staff.

The following sections provides a discussion of the type and extent of quality control measurements and evaluation that will be completed in conjunction with the analytical data collected at a site. Results of this evaluation will be used to provide verification for reported sample concentrations.

9.1 FIELD QUALITY CONTROL SAMPLES

A routine process of collecting field QC samples as described in the NYSDEC DER-10 (NYSDEC, 2010) will be incorporated into field programs unless otherwise directed by the NYSDEC PM. QC samples are used to evaluate analytical data as it pertains to sample representativeness and the potential of non-site related chemicals appearing in the analytical results. Depending on the program and analysis, field QC samples to be submitted to the laboratory may include:

- Trip blanks
- Field blanks
- Equipment blanks
- Rinsate blanks
- Field duplicates
- Matrix spikes

Trip Blanks. Trip blanks are utilized to assess the potential for contaminating VOC samples during sample shipment. For aqueous VOC samples, the trip blank consists of a VOC sample container filled by the laboratory with reagent water. The trip blank is shipped with VOC sample containers from the laboratory to the site, and then returned to the laboratory with each shipment of water samples for VOC analysis.

Soil samples that are collected as unpreserved samples will utilize a water trip blank. Soil samples that are preserved in the field will utilize a trip blank that is prepared by the laboratory with the preservation fluid used in the actual samples (sodium bisulfate or methanol).

Field Blank. Field blanks are used to assess the potential for contaminants of concern to enter a sample during the filling of sample containers. A field blank is collected by pouring analyte free water into a laboratory provided container in the field (typically with preservative) and shipping the blank to the laboratory with the field samples.

Rinsate Blanks. Rinsate blanks are used to evaluate if equipment which will be reused has been decontaminated sufficiently between sampling locations.

For groundwater sampling, rinsate blanks for the bailer, sampling pump, and/or tubing assembly (i.e., equipment that is not dedicated) are scheduled during monitoring well sampling at a rate of five percent of the samples collected. Target analytes (e.g., VOCs, semivolatile organic compounds, inorganics) present within the bailer, pump apparatus, or discharge tubing are assessed by collecting a sample of reagent water passed through the sampling apparatus after washing with the decontamination solution followed by at least one rinse with reagent water. If dedicated equipment is used at a site, the need for equipment blanks may be dropped from the sampling program.

Soil equipment blanks are collected during each field event at a rate of five percent of the samples collected. Target analytes present within or on the sampling apparatus where intimate contact with the sample occurs (e.g., split-spoon, trowel) are assessed by rinsing the sampling apparatus with deionized water following decontamination. Rinsate blanks are collected directly into the appropriate aqueous sample container.

Rinsate blanks may also be collected on other types of equipment, such as pore water sampling equipment or sediment sampling equipment.

Equipment Blanks. Although not routine, it may be necessary to evaluate if potential contaminants of concern at a site are present in new sampling equipment, either from the equipment itself, or from the manufacturing process. For this type of equipment blank, water that has been tested to be free of the contaminant of concern is used to pump through, or flow over, the equipment of concern and directly into sampling containers.

Field Duplicates. Following DER-10 Quality Assurance Requirements, field duplicates of soil and water samples will be submitted for analysis of project-specific parameters at a rate of five percent of the samples collected. These duplicates are intended to assess the homogeneity of the sampled media and the precision of the sampling protocol.

Matrix Spike/Matrix Spike Duplicates. In accordance with DER-10 Quality Assurance Requirements, MS/MSDs for soil and water samples will be requested for analysis at a frequency of five percent of the samples collected. To meet this requirement MACTEC will select samples for MS/MSD analyses and will provide additional sample volume to the laboratory. MS/MSD samples will be identified on COC forms.

Additional QA/QC tools, such as performance evaluation samples or split samples, may also be used if deemed appropriate on a site-specific basis and will be identified in the FAP.

9.2 VERIFICATION OF SAMPLING PROCEDURES

The following will be used to evaluate the quality of the field sampling data:

- documentation of field equipment calibration activities;
- reviewing field data to evaluate whether samples were collected in the appropriate location;
- reviewing field sample data records and chain-of-custody (COC);
- reviewing sample handling and preservation procedures;
- reviewing geologic information documented; and
- reviewing field chemistry data (pH, specific conductivity, temperature, etc.).

Sampling procedures will be evaluated by the Field Lead and/or the PM as appropriate. The results of the evaluation will be included in the investigation report.

9.3 DATA REDUCTION AT SUBCONTRACTED LABORATORY

Initial data reduction of laboratory testing data is completed by the analytical laboratory to convert instrument or measurement outputs to units of concentration appropriate for final reporting. Calculations made during initial data reduction are described in the referenced analytical methods, laboratory SOPs, and in the laboratory QA Program.

Analytical data provided by the laboratory include hard copy data packages and EDDs. Upon receipt by MACTEC, EDDs are downloaded directly to MACTEC's Technical Environmental Database (TED) by data management staff for reduction to standard data tabulations. Completed data tabulations are provided to the data validation staff along with the original data packages. During the data review process the electronic data are checked against the hardcopy data package to verify that no systematic error occurred during the production of the electronic deliverable.

9.4 DATA USABILITY AND SUMMARY REPORT (DUSR) AND DATA VALIDATION

Data generated under this contract will be reviewed by a project chemist or scientist. Three levels of review are established as options for project analytical data. These levels include a completeness review, Category

A review, or DUSR review. The level of review selected for analytical datasets will be identified in the individual WAs FAPs.

9.4.1 Completeness Review

For all analytical data collected under the NYSDEC program, a completeness review will be performed. The completeness review will confirm that samples identified in the FAP were collected by the field samplers and reported by the analytical laboratory, and that results are reported by the laboratory for all samples, analytical methods, and target analytes that were requested on COC forms. To perform the completeness review the following documents will be evaluated for comparison to determine if data gaps exist:

- FAP
- QAPP
- Chain of Custody
- Laboratory Report and EDD

Findings of the completeness review will be summarized in associated DUSR or Category A Review report described in Sections 9.4.2 and 9.4.3 or will be communicated to the MACTEC PM as applicable.

9.4.2 DUSR and Data Validation

For the majority of analytical data collected under this program, a data usability review will be completed in accordance with NYSDEC Division of Environmental Remediation guidance DER-10, Appendix 2B for Data Usability Summary Reports (NYSDEC, 2010a). During the DUSR review the results are reviewed using the laboratory hardcopy deliverables to verify that results were reported and qualified correctly by the laboratory, and to evaluate QC measurements to determine the usability of results. Data qualifiers defined in USEPA guidelines may be added to the results using professional judgment of the project chemist and general procedures specified in USEPA Region II validation guidelines. DUSR checklists are used by the MACTEC project chemist to document the DUSR checks and record notes regarding interpretation and data qualification. DUSR checklists are included in Appendix C.

A DUSR is prepared for each project sampling task by the project chemist or scientist. The MACTEC QAO, or designee, completes a final review of the DUSR before data are finalized. The DUSR includes the following information:

- Site Location and Sampling Event
- Subcontract Laboratory Name and Address
- Summary of Analytical Methods
- Data Quality Observations and Data Qualification Summary
- Table of Final Results and Qualifiers
- Completed DUSR checklists and qualification documentation

If a formal validation of data is required, the requirement will be identified in the FAP and confirmed with the NYSDEC PM. Validation of laboratory data will be performed in accordance with *National Functional Guidelines for Organic Superfund Methods Data Review* (USEPA, 2017a) and *National Functional Guidelines for Inorganic Superfund Methods Data Review* (USEPA, 2017b), as well as the appropriate USEPA Region II revisions to these protocols.

9.4.3 Category A Review

For sampling events where data use objectives can be supported by a less vigorous level of data review , a reduced level of review described as Category A will be performed. This Category A Review will focus primarily on data completeness and laboratory batch QC (blanks and LCS) and sample-specific QC (surrogates and MS/MSD), and will not include raw data verification checks. During the Category A Review the results are reviewed using the laboratory hardcopy deliverable summary forms to verify results were reported and qualified correctly by the laboratory, and to evaluate QC measurements to determine general usability of results for specific site objectives. As with DUSR reviews, additional data qualifiers may be added to the results using professional judgment of the project chemist and general procedures specified in USEPA Region II validation guidelines. Category A review checklists are used by the MACTEC project chemist to document data checks and record notes regarding interpretation and data qualification. Category A checklists are included in Appendix C.

A Category A Review is prepared for designated project sampling tasks by the project chemist or scientist. The MACTEC QAO, or designee, completes a final review of the Category A Review before data are finalized. The Category A Review report includes the following information:

- Site Location and Sampling Event
- Subcontract Laboratory Name and Address
- Summary of Analytical Methods
- Data Quality Observations and Data Qualification Summary
- Table of Final Results and Qualifiers
- Completed Category A checklist and qualification documentation

9.4.4 Data Management and NYSDEC EDD Reporting

MACTEC's TED will be used for managing analytical data generated as part of the NYSDEC program during data review and generation of investigation reports. TED contains fields to store raw laboratory results, validated laboratory results, site spatial data and geotechnical information. Federal and NYS project-specific regulatory SCGs have also been included in the database and are available to export for comparison to laboratory results.

Computerized routines in TED are used to produce temporary data spreadsheets for data review and data qualification during completion of DUSRs and validation reports. These spreadsheets are used to input final results and qualifiers into TED once data review is completed. Final cross tabulation data tables including complete results for samples and methods are produced with each DUSR directly from TED.

A variety of other data outputs are routinely created from data in TED. These include risk assessment statistical tables, laboratory split sample comparison tables, detected contaminant crosstab tables (hit tables), and comparison to applicable or relevant and appropriate requirements crosstab tables (Exceedance tables). Analytical results in TED can be used in a variety of Geographic Information System data graphics and plotting programs including computer aided design software. The following tables are often prepared to present data in site reports:

- Hits Only Cross Tabulation Tables
- Analyte Frequency and Concentration Summary Tables
- Data Comparisons to Regulatory Standards
- Analytical time-series plots

User access to TED projects is password protected. Users are assigned roles which limit their ability to modify data. The majority of users have only read capability. TED files are fully backed up on a nightly schedule, with incremental backups scheduled throughout the day. Updates and Deletes to the database are recorded and preserved for tracking, along with a date stamp and the user's initials.

TED is also used for computerized sample tracking for projects that choose to use the Tracking Module. In TED, the sample tracking programs are used to:

- provide labels and bottle information before samples are collected,
- provide automated COC and shipping information for shipping samples to the lab, and
- produce a tracking file to quickly verify that the analyses requested from the lab are returned.

NYSDEC Electronic Data Deliverable (EDD).

Final laboratory data sets (and other required associated data) will be provided to the NYSDEC in a NYSDEC EQuIS EDD format that complies with the most recent guidance at the NYSDEC EDD Submission Website (http://www.dec.ny.gov/chemical/62440.html). A computerized routine is used to convert the TED data directly into the NYSDEC EQuIS EDD format. Unless otherwise specified by the MACTEC PM, with the NYSDEC PM concurrence, laboratory data will be submitted to the NYSDEC in a NYSDEC EQuIS EDD format.

9.5 DATA USABILITY

Measurement performance criteria are based on the stated DQOs for each WA. Depending on the required data quality, the following considerations for precision, accuracy, and completeness may be evaluated. To meet these requirements, quality control criteria are provided in the standard laboratory methodologies. These criteria include the use of field duplicates and MS/MSD samples to assess precision; MS/MSDs, laboratory control samples, surrogate spikes, labeled isotope internal standards, and calibration results to assess accuracy; blank samples to determine representativeness; and field duplicates to assess comparability. The amount (percentage) of valid data obtained from validation will be used to determine completeness. The results of the data usability evaluation will be included in the site-specific report and impacts and/or limitations on the use of the data will be discussed.

9.5.1 Precision

Precision is a measure of the mutual agreement between concentrations of samples collected at the same time from the same location (e.g., duplicates). Precision is measured by performing duplicate measurements in the field or laboratory. Precision is expressed in terms of relative percent difference (RPD) using the following equation:

$$RPD = [(C1-C2)/((C1+C2)/2)] \times 100$$

Where:

C1 = The larger of the two concentrations.

C2 = The smaller of the two concentrations.

Laboratory precision will be evaluated using USEPA Region II guidelines or others as available. The acceptance criteria and frequency of measurement of precision are included for each of the media in Appendix C.

Acceptable levels of precision will vary according to the sample matrix, the specific analytical methods, and the analyte concentration relative to the MDL.

9.5.2 Accuracy

Accuracy is the degree of agreement of a measurement with an accepted reference or true value. The difference between the values is generally expressed as a percentage or ratio. Through quality control checks for accuracy, potential bias of reported sample concentrations is identified. Accuracy of field instrumentation is assured by daily initial calibration and calibration checks. The accuracy of laboratory analytical procedures is measured through a review of calibration, MS/MSD, surrogates, and laboratory control sample results.

Continuing calibration accuracy checks are assessed by comparing the true value against the reported concentration. The percent difference (%D) between the results is calculated as follows:

Accuracy may be expressed as a %D calculated by the following equation:

$$\%D = (V_t - V_m)/V_t \times 100$$

Where:

V_t = the true or real value expected.

V_m = the measured or observed value.

The degree of accuracy demonstrated for laboratory control samples, surrogates, and MS/MSD samples is expressed as a percent recovery (%R). The %R indicates the amount of known concentration of an analyte that has been detected by the associated instrumentation. The %R is calculated as follows:

$$\%R = (SSR - SR)/SA \times 100$$

Where:

SSR = the spiked sample result.

SR = the unspiked sample result.

SA = the value of the spike added.

The objective for field measurement accuracy initially is to successfully calibrate the associated instrumentation to the manufacturer's specifications and to then check the amount of deviation from the calibrated values at the end of day. The objective for accuracy of laboratory determinations is to demonstrate that the analytical instrumentation provides consistent measurements, which are within USEPA and statistically-derived method-specific accuracy criteria. Laboratory DQOs for accuracy as measured by "%Recovery" are included in Appendix C.

9.5.3 Completeness

Completeness is a measure (percentage) of the amount of valid data obtained from a measurement system relative to the amount that would be expected to be obtained under correct, normal conditions. Valid data will be defined by the successful attainment of the DQOs as specified in this QAPP.

$$\text{Completeness (A\%)} = \frac{\text{\# of valid values reported for a parameter} \times 100}{\text{\# of samples collected for analysis for that particular parameter}}$$

A% = Acceptance Percentage

The QA objective for completeness will be optimized by employing and evaluating frequent quality control checks throughout the analytical process so that sample data can be assessed for validity of results and to allow for reanalysis within the hold time when problems are indicated by the QC results.

A completeness of at least 85% is acceptable for most data. The evaluation of completeness will include an assessment of critical samples that would require resampling and/or reanalysis even if the overall goal of 85% was met.

9.5.4 Representativeness

Representativeness expresses the degree to which sample data depict existing site conditions. Sample representativeness will be assessed through an evaluation of the sample results with respect to the sampling design (locations and conceptual site model) to determine if the results are representative of the environment from which the samples were collected. Measurements will be made so that analytical results are representative of the media (e.g., soil, water, sediments) and conditions being measured, to the extent possible. Representative data are collected by establishing standardized procedures for identification of sample locations and sampling techniques, and the collection of a sufficient number of samples. Sampling protocols are designed to collect representative samples of the media. Sample handling protocols (e.g., storage, transportation, holding time, sample preservation) are selected to protect the representativeness of the collected sample during shipment to the laboratory. Proper documentation will establish that protocols have been followed and sample identification and integrity are assured.

Sample representativeness will also be assessed through an analysis of the blank results. The concentrations and frequencies of target analytes detected in blanks will provide an indication of data representativeness. USEPA Region II validation guidelines will be used to eliminate potential false positive results indicated by the blank data. The data usability assessment will describe issues concerning representativeness based on a review of these data.

9.5.5 Sensitivity

Sensitivity will be evaluated for key contaminants of concern that have reporting limits near the standard/criteria being used to evaluate the data. Reporting limits will be reviewed to ensure they are less than the corresponding standard/criteria. The FAP will address how results will be evaluated if reporting limits are greater than corresponding standard/criteria. An evaluation of the sensitivity of the data will be included in the data usability assessment.

9.5.6 Comparability

The characteristic of comparability reflects: (1) the internal consistency of measurements made at the site, (2) the expression of results in units consistent with other organizations reporting similar data, and (3) the confidence with which one data set can be compared to other similar measurements. The use of subcontract laboratories that have NYSDOH ELAP certification is a QA step designed to ensure that laboratories will produce chemical data that meet standards for testing for work within New York. Use of USEPA and other standard analytical methods used in the environmental testing industry provides another level of QA that results will be comparable to industry standards.

10.0 PROJECT REPORTING

Data generated under this contract will be included in a report to the NYSDEC; typical types of reports include the following:

- data summary report
- long term monitoring report
- inspection report
- remedial investigation report
- construction completion report
- final engineering report
- annual report
- periodic review report

Reports will be completed in accordance with NYSDEC DER-10 guidelines, where applicable. Reports will include, where appropriate, tables, figures and copies of the validation report.

10.1 QUALITY REVIEW OF STUDIES AND REPORT PREPARATION

Quality reviews are performed during the course of a project to ensure that the project deliverables meet currently accepted professional standards. The level of effort for each assignment will vary depending on type of assignment, project objectives and goals, duration, and size. Review of the project will entail periodic discussions between technical staff, Task Leaders, Site Managers, QAO, PM, and Program Manager.

To enhance the professional quality of the company's studies and reports, the PM and Program Manager will:

- require that reports refer to and are consistent in scope with the project proposal and contract; and
- require that the report be organized and written so that (1) NYSDEC understands the limitations and uncertainties associated with the report and (2) facts are distinguished from opinion, and risks and limitations are identified.

Implementation of QC for reports involves the use of a technical review routing and sign-off forms which are maintained in the project file. The PM and Program Manager provide final review and release for the deliverables.

10.2 REPORTS TO MANAGEMENT

Management personnel receive QA reports appropriate to their level of responsibility. The PM receives copies of QA documentation. QC documentation is retained within the project file (e.g., field data documentation). Section 11.0 details QA activities which are integral to the MACTEC QA Program and the reports which they generate. In some instances a final audit report for an individual project may also be prepared. The reports would include:

- periodic assessment of measurement data accuracy, precision and completeness;
- results of performance audits and/or systems audits;
- significant QA problems and recommended solutions for future projects; and
- status of solutions to problems previously identified.

Additionally, incidents requiring corrective action will be fully documented. Procedurally, the PM will prepare the reports to management. These reports will be addressed to the Task Leader, or Site Manager and QAO. The summary of findings shall be factual, concise, and complete. Required supporting information will be appended to the report.

11.0 REVIEWS, AUDITS AND RESPONSE ACTIONS

This section presents review and audit activities that may be performed as part of a project field sampling, data review, and reporting activities. Reviews and audits are completed to verify that proper procedures, documentation, and QA/QC measures are being used to provide data of acceptable quality consistent with DQOs and that subsequent calculation, interpretation and other project outputs are checked and validated. Response actions may be undertaken to correct deficiencies identified during reviews and audits. These reviews and audits are described in MACTEC SOP S27. Assessments and audits may be conducted to evaluate whether the useable project data are in conformance with project quality objectives as stated, that adequate project oversight activities are in place, or as part of corrective action measures. Audits may be scheduled or unscheduled and may be completed by MACTEC personnel or by the NYSDEC or other agencies with interest in the project.

During the development of each project FAP, the scope of projects will be evaluated to determine the need for field audits. Formal audits may be scheduled for projects with complicated sampling procedures, unusual field measurement methods, mobile laboratories, or other circumstances and should be incorporated into project planning tasks prior to initiation of field activities. The scheduling of field audits will be done in conjunction with the MACTEC QAO and PM, and the NYSDEC remediation manager.

11.1 FIELD OVERSIGHT

Field Leaders will review work practices and documentation on a daily basis. The Field Leader will oversee the field samplers and subcontractors to ensure that the work is conducted according to the site-specific FAP. If deficiencies are identified corrective actions will be implemented immediately in the field. Issues that might possibly impact the data will be documented in the field notes.

11.2 FIELD SAMPLING TECHNICAL SYSTEMS AUDIT

An on-site technical systems audit (TSA) may take place during field activities. It is beneficial to conduct these audits early in the field program so that necessary corrective action measures can be implemented, if required. The audit will consist of an evaluation of sampling techniques, field parameter measurements, record keeping, including logbooks and COCs, sample collection and handling, sample design, subcontractor oversight and health and safety.

11.3 FIXED LABORATORY TECHNICAL SYSTEMS AUDIT

Off-site Laboratory TSA are not routinely scheduled by MACTEC. In general, environmental laboratory approval is based on certification of the NYSDOH ELAP and laboratory audits will not be completed by MACTEC unless specifically requested by NYSDEC. It will be the responsibility of MACTEC to determine that laboratories are certified under ELAP and that they maintain the certification for the duration of the project.

In the event that a project-specific laboratory audit is needed, the audit will be planned with the MACTEC QAO and project chemist. A fixed laboratory TSA may consist of a review of the following: sample handling procedures, equipment condition and operation, analytical methods and procedures and overall conformance with SOPs provided in this QAPP. The audit may span a period of one or more days, so that the audit team can view various types of analytical procedures that will be used on the project. Mobile laboratories and other field testing technologies are sometimes contracted to perform real-time analysis of soil, water, soil vapor, or air samples at the site location. Guidelines for use of field-testing technologies are provided in DER-10 Appendix 2A (NYSDEC, 2010a). Field audits of the mobile laboratory are commonly included in the project scope and scheduled at the beginning of sampling events to verify that the laboratory is providing services following the defined scope, and that laboratory procedures, documentation processes, and reporting meet the prescribed objectives of the field sampling program. Additional QA steps may include the analysis of reference materials and collection of split samples analyzed at an ELAP approved off-site laboratory.

11.4 DATA VALIDATION REVIEW

A DUSR or data validation review will be completed by the MACTEC QAO or senior project chemist after completion of the data evaluation and report. Data validation reports and procedures used will be reviewed and calculations checked for completeness and accuracy. The review will also check for conformance with data validation procedures outlined in Section 9.4 of this QAPP.

11.5 PROJECT REVIEW

Project reviews are scheduled and conducted periodically by the Program Manager. The intent of project review is to assess scope and contractual compliance and overall technical quality of the contracted services.

11.6 AUDIT SCHEDULING AND PLANNING

The scheduling of QA and system audits completed by MACTEC will be determined on a project-specific basis and identified in the WA Issuance from the NYSDEC. During the project scoping process, the MACTEC PM and technical leaders, in consultation with the NYSDEC PM, will evaluate the project scope, quality goals, and execution tasks, and determine if audits are needed. If audits are included in the scope of the project, the MACTEC QAO will complete the audits and provide a formal audit report to the MACTEC PM and the NYSDEC for review. Audits are completed following MACTEC SOP S27.

11.7 ASSESSMENT FINDINGS AND CORRECTIVE ACTION RESPONSES

Deficiencies that are found as a result of the TSAs will be communicated both verbally to the responsible party upon discovery and will also be documented in a written audit report. A formal corrective action response in writing will be requested from the responsible party (e.g., field lead, laboratory manager, chemistry supervisor). The response will document the reason for the deficiency and the actions that will be put in place to correct the deficiency. Corrective action responses will be filed in the project files.

11.7.1 Immediate Corrective Action

Immediate corrective action is usually applied to spontaneous, non-recurring problems, such as an instrument malfunction. The individual who detects or suspects nonconformance to previously established criteria or protocol in equipment, instruments, data, methods, etc., will immediately notify their supervisor. The supervisor and the appropriate Task Leader, Site Manager, or PM will then investigate the extent of the problem and take the necessary corrective steps. If a large quantity of data is affected, the Task Leader must prepare a memorandum to the PM and QAO. These individuals will collectively decide how to proceed. If the problem is limited in scope, the Task Leader or Site Manager will decide on the corrective action measure, document the solution and notify the PM and the QAO in memorandum form.

11.7.2 Long-Term Corrective Action

Long-term corrective action procedures are devised and implemented to prevent the recurrence of a potentially serious problem. The QAO will be notified of the problem and will conduct an investigation to determine the severity and extent of the problem. The QAO will then file a corrective action request with the PM and project leaders.

In case of dispute between the QAO and the PM, the MACTEC Program Manager will make a final determination for the company.

Corrective actions may also be initiated as a result of other activities, including:

- performance audits;
- systems audits;
- laboratory/field comparison studies; and
- QA project audits conducted by the QAO.

The need for laboratory audits or field program audits will be determined on a project-specific basis as described in Section 10.

The QAO will be responsible for documenting notifications, recommendations, and final decisions. The PM and the QAO will be jointly responsible for notifying program staff and implementing the agreed upon course of action. The QAO will be responsible for verifying the efficacy of the implemented actions. The development and implementation of preventive and corrective actions will be timed, to the extent possible, so as not to adversely impact either project schedules or subsequent data generation/processing activities. The QAO will also be responsible for developing or identifying and implementing routine program controls to minimize the need for corrective action.

12.0 REFERENCES

40 CFR Part 136. Code of Federal Regulations, US Office of the Federal Register.

APHA, 2017. "Standard Methods for the Examination of Water and Wastewater"; American Public Health Association; American Water Works Association; Water Environment Federation; 23rd Edition; 2017.

NYSDEC, 1998. "Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations"; Technical and Operational Guidance Series 1.1.1; New York State Department of Environmental Conservation; Division of Water; June 1998, Plus 2000 and 2004 Addendum.

NYSDEC, 2002. "Draft Procedures for Collection and Preparation of Aquatic Biota for Contaminant Analysis"; New York State Department of Environmental Protection; Division of Fish, Wildlife, and Marine Resources; Bureau of Habitat; October 2002.

NYSDEC, 2005. "Analytical Services Protocol (ASP)"; New York State Department of Environmental Conservation. July 2005.

NYSDEC, 2006. "Environmental Remediation Program"; 6 NYCRR PART 375; New York State Department of Environmental Conservation; Division of Environmental Remediation; December 2006.

NYSDEC, 2010a. "Technical Guidance for Site Investigation and Remediation"; DER-10; New York State Department of Environmental Conservation; Division of Environmental Remediation; May 2010.

NYSDEC, 2010b. "Soil Cleanup Guidance Policy"; CP-51; New York State Department of Environmental Conservation, October 21, 2010.

NYCRR, 2016. "Water Quality Regulations Surface Water and Groundwater Classifications and Standards"; Title 6, Part 700-706; New York Codes, Rules, and Regulations; June 2016.

New York Codes, Rules, and Regulations (NYCRR), 2020. "Identification and Listing of Hazardous Wastes"; Title 6, Part 371: New York Codes, Rules, and Regulations. April 2020.

NYSDEC, 2019. "Quality Assurance Project Plan (QAPP) Guidelines, New York State Department of Environmental Conservation, October 2019.

NYSDEC, 2019a. "Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs"; New York State Department of Environmental Conservation, June 2019.

NYSDEC, 2019b. "Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids"; NYSDEC, October 2019.

NYSDEC, 2020. "Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs"; New York State Department of Environmental Conservation. 2020.

NYSDOH, 2006. "Guidance for Evaluating Soil Vapor Intrusion in the State of New York"; NYSDOH; October 2006, with May 2017 Update.

USEPA, 1983. "Methods for Chemical Analysis of Water and Wastes"; EPA-600/4-79-020; USEPA Office of Research and Development; March 1983.

USEPA, 2001. "EPA Requirements for Quality Assurance Project Plans"; EPA QA/R-5; EPA/240/B-01/003; USEPA Office of Environmental Information; March 2001.

USEPA, 2002. "Ground-Water Sampling Guidelines for Superfund and Resource Conservation and Recovery Act Project Managers"; USEPA 542-S-02-001; United States Environmental Protection Agency; Office of Solid Waste and Emergency Response; May 2002.

USEPA, 2015. "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods"; USEPA Publication SW-846; Third Edition; Final Updates I (1993), II (1995), IIA (1994), IIB (1995), III (1997), IIIA (1999), IIIB (2005), IV (2008), and V (2015).

TABLES

Table 8.1 - NYSDEC Data Quality Objectives and Data Review Levels

Service	DQO	Lab Deliverable	Data Review Level
Site Characterization (SC)	N&E,	Cat B	DUSR
Remedial Investigation/ Feasiblity Study (RI/FS)	N&E, Risk	Cat B	DUSR
Site Closure	remedial decisions	Cat B	DUSR
Vapor Intrusion (VI)	N&E, Risk	Cat B	DUSR
Remedial Action (RA)	remediation cleanup, Monitoring, O&M	Cat B, Cat A	None, CatA, DUSR
Remedial Design (RD)	engineering data, pre-design study	Cat B, Cat A	CatA, DUSR
Site Management	LTM, system performance, system effects monitoring	Cat B, Cat A	CatA
Site Response Activities/Interim Remedial Measures	N&E, risk, cleanup	Cat B, Cat A	None, CatA, DUSR
Waste Characterization	Hazardous Characteristics	Cat A	None
RSO (remedial system optimization)	operation support	Cat A	CatA

DQO = Data Quality Objective
N&E = Nature and Extent
Risk = Quantative Risk Assessment
O&M = Operation and Maintenance
LTM = Long Term Monitoring
Cat B = Category B defined in NYSDOH ASP
Cat A = Category A defined in NYSDOH ASP
DUSR = Data Usability Summary Report per DER-10
CatA = Reduced Review defined in QAPP

TABLE 8.2
SAMPLE CONTAINER, PRESERVATION AND HOLD TIME REQUIREMENTS

NYSDEC QUALITY ASSURANCE PROGRAM PLAN AND PROGRAM FIELD ACTIVITIES PLAN

PARAMETER	Example METHOD	MEDIUM	CONTAINER	VOLUME REQUIREMENTS	PRESERVATION	HOLDING TIMES[1]
Volatile Organics						
TCL VOCs	SW 8260	Low Soil/Sediment	VOA Vial*	Fill - no headspace*	Cool, 4°C*	7 days
	SW 8260	Low Soil/Sediment	VOA Vial - field preserved	5 g	Freeze within 48 hours	14 days
	SW 8260	Low Soil/Sediment	VOA Vial - field preserved	5 g	Cool, 4°C with sodium bisulfate	14 days
	SW 8260	High Soil/Sediment	VOA Vial - field preserved	10 g	Cool, 4°C with methanol	14 days
	SW 8260 – GW, SW, wastewater 624 – discharge/effluent 524.2 – drinking water	Groundwater/Liquid	Glass, Teflon® lined septa	(2) 40 mL	Cool, 4°C HCL to pH <2	14 days
1,4-Dioxane	SW 8270-SIM	Groundwater/Liquid	Glass, Teflon® lined cap	(2) l-L	Cool, 4°C	7 days extract/40 days analyze
Per- and Polyfluorinated Substances (PFAS)	537 Modified	Soil/Sediment	HDPE, no Teflon®	100 g	Cool, 4°C	14 days extract/28 days analysis
	537 Modified	Groundwater/Liquid	HDPE, no Teflon®	(2) 250 mL	Cool, 4°C	14 days extract/40 days analysis
Extractable Organics						
TCL SVOCs or TCL Pesticides/PCBs	SW 8270 SW 8081/SW 8082	Soil/Sediment Groundwater/Liquid	Glass, Teflon® lined lid Glass, Teflon® lined cap	100 g (2) l-L	Cool, 4°C Cool, 4°C	14 days extract/40 days analyze 7 days extract/40 days analyze
Inorganics						
TAL Inorganics (no Hg)	SW 6010	Soil/Sediment	Glass	2g	Cool, 4°C	6 months
Mercury	SW 7471		Glass	1g	Cool, 4°C	28 days
Cyanide	SW 9012		Glass	10g	Cool, 4°C	14 days
Hexavalent Chromium	SW 7196 or 7199		Glass	2g	Cool, 4°C	30 days extract/7 days analyze
TAL Inorganics (no Hg)	SW 6010 and/or 6020	Groundwater/Liquid	Glass or Polyethylene	450 mL	HNO_3 to pH<2, 4°C	6 months
Mercury	SW 7470		Glass or Polyethylene	200 mL	HNO_3 to pH<2, 4°C	28 days
Cyanide	SW 9012		Glass or Polyethylene	1 L	NaOH to pH>12, 4°C	14 days
Hexavalent Chromium	SW 7196 or 7199		Glass or Polyethylene	500 mL	Cool, 4°C	24 hrs.
TCLP	SW 1311/8260	Soil/Sediment	Glass, Teflon® lined lid	3x100g	Cool, 4°C	7 days extraction/7 days analyze
VOCs	SW 1311/8270	Soil/Sediment	Glass, Teflon® lined lid	200g	Cool, 4°C	7 days extraction/7 days

TABLE 8.2
SAMPLE CONTAINER, PRESERVATION AND HOLD TIME REQUIREMENTS

NYSDEC QUALITY ASSURANCE PROGRAM PLAN AND PROGRAM FIELD ACTIVITIES PLAN

PARAMETER	Example METHOD	MEDIUM	CONTAINER	VOLUME REQUIREMENTS	PRESERVATION	HOLDING TIMES[1]
SVOCs Mercury Inorganics (RCRA) Pesticides Herbicides	 SW 1311/7470 SW 1311/6010 SW 1311/8081 SW 1311/8151	 Soil/Sediment Soil/Sediment Soil/Sediment Soil/Sediment	 Glass, Teflon® lined lid Glass, Teflon® lined lid Glass, Teflon® lined lid Glass, Teflon® lined lid	 200g 200g 200g 200g	 Cool, 4°C Cool, 4°C Cool, 4°C Cool, 4°C	extraction/40 days analyze 7 days extraction/28 days analyze 180 days extraction/180 days analyze 7 days extraction/40 days analyze 7 days extraction/40 days analyze
Ignitability	SW 1030	Soil/Sediment	Glass, Teflon® lined lid	25g	Cool, 4°C	28 days
Reactivity	9012/9034	Soil/Sediment	Glass, Teflon® lined lid	40g	Cool, 4°C	28 days
Corrosivity	SW 1110	Soil/Sediment	Glass, Teflon® lined lid	30g	Cool, 4°C	28 days

Notes:* Only if directed by NYSDEC PM

[1] All holding times expressed in days/months are from date of sample collection; holding times expressed in hours are from date/time of collection.

°C = Celsius
g = gram
Hg = mercury
HNO_3 = nitric acid
L = liter
mL = milliliter
NaOH = sodium hydroxide
PCB = polychlorinated biphenyls
SVOC = semivolatile organic compound
TAL = Target Analyte List
TCL = Target Compound List
VOC = volatile organic compound
HDPE = high density polyethylene

APPENDIX A

MACTEC STANDARD OPERATING PROCEDURES

TABLE A-1 FIELD SAMPLING STANDARD OPERATING PROCEDURES (SOPS)

SOP #	SOP Title	Revision No.	Revision Date	Attachments	Related SOPs
S1	Drinking Water Sampling From Private and Public Supply Wells	0	4/20/2020	Water Grab Sampling Record Field Calibration Record	S3 S29
S2	Water Level Measurement and Monitoring Well Condition Evaluation Procedures	0	4/20/2020	Water Level Measurement FDR	S21
S3	Low Flow Groundwater Sampling	0	4/20/2020	Low Flow Groundwater Sampling Record Field Instrument Calibration Record Information Handout: Low Flow Groundwater Field Parameter Data	S2 S21 S29
S4	Hydrasleeve™ Groundwater Sample Collection	0	4/20/2020	Water Grab Sampling Record Field Instrument Calibration Record	S2 S21 S29
S5	Passive Diffusion Bag Groundwater Sample Collection	0	4/20/2020	Water Grab Sampling Record	S2 S21 S29
S6	Per- and Polyfluoroalkyl Substances(PFAS) Field Sampling Protocols	0	4/20/2020	Daily PFAS Protocol Checklist Record	
S7	Surface Water Sampling	0	4/20/2020	Surface Water and Sediment Sampling Record Field Instrument Calibration Record	S10 S21 S29
S8	Chain of Custody Procedures	0	4/20/2020		
S9	Pore Water Sampling	0	4/20/2020	Water Grab Sampling Record Field Instrument Calibration Record	S21 S29
S10	Sediment Sampling	0	4/20/2020	Surface Water and Sediment Sampling Record	S7 S21 S29
S11	Description and Identification of Soil Samples	0	4/20/2020	Key to Soil Descriptions and Terms	S16 S17 S18 S19
S12	Description and Identification of Rock Samples	0	4/20/2020	Field Guide for Rock Core Logging	S16 S17 S18 S19
S13	Soil Sample Collection	0	4/20/2020		S11 S14 S16 S17 S18 S19 S21 S29
S14	Field Preservation of VOC and GRO Soil Samples	0	4/20/2020	En Core® Sampling Procedures Terra Core™ Sampling Kit Fact Sheet	S11 S13 S16 S17 S18 S19 S29
S15	Methanol Extraction of Fractured Rock Sample Collection	0	4/20/2020		S12 S16 S29

Prepared by: NWV 04/14/2020
Checked by: JMF 04/24/2020

SOP #	SOP Title	Revision No.	Revision Date	Attachments	Related SOPs
S16	Drilling - Soil Boring and Rock Coring Oversight	0	4/20/2020	Utility Clearance Form Soil Boring Log Rock Coring Log Field Instrument Calibration Record	S11 S12 S20 S21 S22
S17	Direct Push Sampling	0	4/20/2020	Utility Clearance Form Soil Boring Log Field Instrument Calibration Record	S11 S20 S21 S22
S18	Sonic Drilling Oversight	0	4/20/2020	Utility Clearance Form Soil Boring Log Field Instrument Calibration Record	S11 S20 S21 S22
S19	Test Pit Excavation and Sampling Oversight	0	4/20/2020	Utility Clearance Form Test Pit Excavation Log Field Instrument Calibration Record	S11 S20 S21
S20	Heavy Equipment Decontamination Oversight	0	4/20/2020		
S21	Field Equipment Decontamination	0	4/20/2020		
S22	Monitoring Well and Microwell Installation	0	4/20/2020	Well/Piezometer Construction Record - Stickup Well/Piezometer Construction Record - Flushmount	S16 S17 S18
S23	Monitoring Well Development	0	4/20/2020	Well Development Record Field Instrument Calibration Record	S2 S3 S21
S24	Monitoring Well Decommissioning	0	4/20/2020	Well Decommissioning Record Field Instrument Calibration Record NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy	S16 S20
S25	Soil Vapor Intrusion Sampling	0	4/20/2020	Soil Vapor Intrusion Sampling Record NYSDEC Structure Sampling Questionnaire SSDS Inspection Record S25D - Field Instrument Calibration Record	S29
S26	Quality Assurance and System Audit Procedures	0	4/20/2020		

SOP # S1

MACTEC STANDARD OPERATING PROCEDURE #S1

DRINKING WATER SAMPLING FROM PRIVATE AND PUBLIC SUPPLY WELLS

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples ______________________ April 27, 2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

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DRINKING WATER SAMPLING FROM PRIVATE AND PUBLIC SUPPLY WELLS

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures by which MACTEC personnel should conduct drinking water sampling at private and public supply wells for chemical analysis. Proper procedures are necessary to assure the quality and integrity of supply water analytical results. Construction and operation of supply wells will vary; therefore, this SOP may not be applicable to all situations.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure should be documented in the field logbook and/or field data record.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 2019. Laboratory Services and Applied Science Division (LSASD) Operating Procedure: Potable Water Supply Sampling. ASBPROC-305-R4. Effective date June 11, 2019.

3.0 DEFINITIONS

Private Water Supply Well – A well that serves as a drinking water system and is not regulated.

Public Water Supply Well – A well and distribution system that is regulated by a government entity and must be sampled regularly to ensure the water is safe to drink.

Potable Water – A liquid that is suitable for drinking.

4.0 PROCEDURE

This section contains both the responsibilities and protocol for sampling private and public supply wells. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to supply well sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook.

4.2 Preparation

Office Procedures

1. Ensure that the project manager or NYSDEC has acquired permission from the property owner or residence to collect the supply well sample.
2. Contact the well owner with the proposed schedule for sampling, and coordinate with the well owner on timing; obtain information on the pumping rate and frequency during the last several weeks, if available.
3. Review pertinent information with regards to well construction, development, and sampling information on the wells to be tested, if available.
4. Assemble appropriate logbooks and field data records to complete the field assignment.

Sampling Considerations

This SOP assumes that private or public supply wells are equipped with operational pumps and plumbing to purge the mechanical systems and collect samples. If the mechanical systems for supply wells are not operational, then the sampling should be conducted using Low Flow Groundwater Sampling Procedures.

The following should be considered when choosing the location to collect a potable water sample from a private and/or public water supply well (EPA, 2019):

- Sample locations selected should be supplied with water from a service pipe connected directly to a water main in the segment of interest.

- Whenever possible, choose the tap closest to the water source, and prior to the water lines entering the residence, office, building, etc., and prior to any holding or pressurization tanks.
- The sampling tap must be protected from exterior contamination associated with being too close to a sink bottom or to the ground. Contaminated water or soil from the faucet exterior may enter the bottle during the collection procedure because it is difficult to place a bottle under a low tap without grazing the neck interior against the outside faucet surface. If the tap is too close to the ground for direct collection into the appropriate sample container, it is acceptable to use a smaller container to transfer sample to a larger container.
- When filling any sample container, care should be taken that splashing drops of water from the ground or sink do not enter the bottle or cap.
- Leaking taps that allow water to discharge from around the valve stem handle and down the outside of the faucet or taps in which water tends to run up on the outside of the lip are to be avoided as sampling locations.
- Disconnect any hoses, filters, or aerators attached to the tap before sampling. These devices can harbor a bacterial population if they are not routinely cleaned or replaced when worn or cracked.
- Taps where the water flow is not constant should be avoided because temporary fluctuation in line pressure may cause clumps of microbial growth that are lodged in a pipe section or faucet connection to break loose. A smooth flowing water stream at moderate pressure without splashing should be used. The sample should be collected without changing the water flow.

Data Form

The Water Grab Sample Field Data Record (FDR) shall be used to record sampling information and observations (**example Attached**). All entries shall be made in indelible ink.

4.3 Field Procedures

Private and public supply well samples will be collected by filling sample containers from a tap, sample port or spigot.

Private drinking water sampling:

1. Don gloves.
2. Evaluate the water supply system for the presence of treatment systems (e.g. carbon filters, sediment filters, water softeners). If a treatment system is identified select a sampling location before the treatment system.
3. If the sampling location is at a faucet evaluate if an aerator is present and remove prior to sampling.
4. Purge water at the sampling point until sufficient volume has been purged to ensure the water collected is from the well. This is generally 10 minutes of purging or until the well pump turns on.
5. Collect samples in laboratory-supplied containers.
6. Follow standard sample handling and custody procedures to contain and transport samples to the off-site laboratory.

Public Drinking Water Supply Sampling:

1. Don gloves.
2. Identify the sampling location closest to the well head and prior to treatment systems and storage tanks. Typically, this will be the location where the system owner collects regulatory compliance samples.
3. Purging the system may not be necessary if the location selected is in line with the direct delivery system and water is continuously pumped from the well. If the sampling location is not in direct line with the delivery system purge sufficient water to clear potentially stagnant water.
4. Collect samples in laboratory-supplied containers.
5. Follow standard sample handling and custody procedures to contain and transport samples to the off-site laboratory.

5.0 ATTACHMENTS

Drinking Water Grab Sampling Record

DRINKING WATER SAMPLING FIELD DATA RECORD

PROJECT NAME		Sampler Signature:	Print Name:
PROJECT NUMBER		Checked By:	Date:

Owner: ______________________________

Address: ______________________________

LOCATION ID	**SAMPLE TAP LOCATION**	**PURGE START TIME (minimum 10 min.)**	**WATER TREATMENT SYSTEM** Yes / No
SAMPLE ID	**SAMPLE DATE**	**PURGE END TIME/ SAMPLE TIME**	**Comment:**

ANALYTICAL PARAMETERS

	PARAMETER	**METHOD NUMBER**	**PRESERVATION METHOD**	**VOLUME REQUIRED**
☐				
☐				
☐				
☐				
☐				
☐				

Owner: ______________________________

Address: ______________________________

LOCATION ID	**SAMPLE TAP LOCATION**	**PURGE START TIME (minimum 10 min.)**	**WATER TREATMENT SYSTEM** Yes / No
SAMPLE ID	**SAMPLE DATE**	**PURGE END TIME/ SAMPLE TIME**	**Comment:**

ANALYTICAL PARAMETERS

	PARAMETER	**METHOD NUMBER**	**PRESERVATION METHOD**	**VOLUME REQUIRED**
☐				
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Owner: ______________________________

Address: ______________________________

LOCATION ID	**SAMPLE TAP LOCATION**	**PURGE START TIME (minimum 10 min.)**	**WATER TREATMENT SYSTEM** Yes / No
SAMPLE ID	**SAMPLE DATE**	**PURGE END TIME/ SAMPLE TIME**	**Comment:**

ANALYTICAL PARAMETERS

	PARAMETER	**METHOD NUMBER**	**PRESERVATION METHOD**	**VOLUME REQUIRED**
☐				
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MACTEC
511 Congress Street, Portland Maine 04101

SOP # S2

STANDARD OPERATIONG PROCEDURE #S2

WATER LEVEL MEASUREMENT AND MONITORING WELL CONDITION EVALUATION PROCEDURES

April 20, 2020

NYSDEC Program QAPP – D009809

Revision 0

APPROVED:

____________________________ April 27, 2020

Charles Staples, PG, Program Technical Lead Date

Review Date

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WATER LEVEL MEASUREMENT AND MONITORING WELL CONDITION EVALUATION PROCEDURES

1.0 PURPOSE

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the methods for measuring water levels in and evaluating the condition of monitoring wells during field investigations at hazardous and non-hazardous waste sites. The objective of water level measurements is to gain accurate measurements (to within 0.01 feet [ft]) of the depth of ground water for use during well installation, use in preparation of groundwater elevation contour maps, slug tests, packer tests, and pumping tests.

Deviation from this procedure in planning or in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data record.

2.0 PROCEDURE

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for determining the appropriate water level measurement procedures based on the sampling program objectives

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to water level measurement activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

2.2 Preparation

Office preparation

1. Review pertinent information with regards to well construction, development, and sampling information on the wells to be measured, if available.

2. Assemble appropriate logbooks and field data records to complete the field assignment.
3. Make copies of field data records with water level measurements and the description of monitoring well conditions from the previous sampling event, if available.

Equipment Selection and Sampling Considerations

The following list of equipment may be utilized during water level measurements. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Electronic water level indicators – graduated with an engineer's scale at 0.01 ft intervals
- Tap water or Deionized water
- Alconox®, Liquinox® or other non-phosphate concentrated laboratory grade soap
- Pump sprayer
- Pint sized squeeze bottles
- Any necessary personal protective equipment (gloves, eyewear, Tyvek® suits)
- Air monitoring instruments as required (PID or FID as specified in HASP)
- Field logbook
- Monitoring well inventory and/or water level field data records (FDRs) (site specific as needed)
- Well keys
- Previous measurement data (if available)
- Oil/water interface probe (if necessary)
- Engineer's rule
- Additional weight on tape if required

2.3 Field Procedures

Site-specific conditions may warrant the use of stringent air monitoring and potentially more significant decontamination scenarios.

- Record the condition of the well (protective casing, concrete collar, lock in place, etc.) on the FDR.
- Check that the water level tape has no obvious kinks or damage. If multiple water level meters are to be used, they should be checked for consistency by comparing readings from all meters used at one easily accessible monitoring well.
- Don appropriate PPE for the task and site conditions. Stand upwind of the well; unlock and open the well. If a vented cap is present, conduct well mouth air screening from the vent. If a non-vented well cap is present, remove the cap and screen the well mouth immediately. Record all

pertinent air monitoring results (sustained, dissipating, background, odor) on the FDR and in the field logbook.

- Identify the previous measuring point marking or notch on the riser or casing (if present). Record this location in the field logbook and on the FDR. It is important to always include the measuring point reference with the water level measurement (*e.g.* 7.15 feet below top of PVC riser [TOR]).
- Using a previously decontaminated water level indicator, turn on the meter, check the audible indicator, reel the electronic probe into the well riser (with the increments visible) slowly until the meter sounds, grasp the tape with hand, withdraw the tape and lower it again slowly until the sound is again audible. Check the depth to water on the tape and make a mental note of the depth to within 0.01 feet. Lower the probe again slowly and repeat the measurement for accuracy. If the measurement varies, repeat until a consistent measurement has been determined. It is not uncommon for a well to be under vacuum/pressure and for water in the well to rise or drop after the cap has been opened until the water reaches equilibrium with atmospheric pressure. A one-foot error is the most common measurement type during water level measurements. Be sure to read the depth correctly on the tape.
- Record the depth to water from the measuring point on the FDR. Make sure to include the measuring point reference with the water level measurement.
- Procedures utilized during water level measurements where free phase petroleum products are floating on the water table should be modified to include the use of the oil/water interface probe. The procedures during the use of this probe should be implemented similarly and by manufacturers' specifications. Using this type of probe, the thickness of the product can be determined.
- When measuring the depth to the bottom of the well, care must be taken to accurately determine the true depth to bottom as the graduated tape on a water level indicator will vary with manufacturer. At the start of the field program, using an engineer’s rule, measure from the 1-ft graduated mark on the tape to the 0-ft setpoint on the probe. For some manufactures (e.g. Heron Instruments) the 0-ft setpoint is the bottom of the probe and depth to bottom measurements can be directly recorded from the graduated tape. Pin style water level indicators (e.g. Solinst) typically have a 0-ft setpoint that is halfway up the metallic probe. For these style probes the offset from the bottom of the probe to the point of the pin must be measured and then added to depth to bottom measurements from the graduated tape.

Decontaminate the probe and tape. Refer to the **Field Equipment Decontamintion** for guidance.

3.0 ATTACHMENTS

Water Level Measurement and Monitoring Well Condition Field Data Record

SOP # S3

MACTEC STANDARD OPERATING PROCEDURE #S3

LOW FLOW GROUNDWATER SAMPLING PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27, 2020

Charles Staples, PG, Program Technical Lead — Date

Reviewed — Date

LOW FLOW GROUNDWATER SAMPLING

1.0 PURPOSE

The following steps outline the purging and sample collection activities for low-flow sampling. Data will be recorded on the Low Flow Groundwater Field Data Record (FDR). Construction of monitoring wells may vary; therefore, this SOP may not be applicable to all situations.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure should be documented in the field logbook and/or field data record.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 2017. Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from monitoring Wells (Revision 4). EQASOP-GW4. Effective date July 30, 1996, Revised September 19, 2017.

3.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sampling environmental monitoring wells. Proper procedures are necessary to ensure the quality and integrity of the samples.

3.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the sampling objectives.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook.

3.2 Preparation

Office Preparation

- Review pertinent information with regards to well construction, development, and sampling information on the wells to be tested, if available.
- Determine target depth for location of the pump intake. Target depth should be the portion of the screened interval that intersects the zone of highest K. If the zone of highest K is unknown, or if the screen is placed within homogenous material, then the target depth shall be the midpoint of the saturated screen length. Primary flow zones should be identified in wells with screen lengths longer than 10 ft.
- Assemble appropriate logbooks and field data records to complete the field assignment.
- Make copies of field data records from the last sampling event.

Equipment Selection

Sampling pumps and water quality probes may vary depending on the well diameter, groundwater constituents and depth to groundwater, but generally, sampling will consist of the following equipment:

- Pump (e.g., peristaltic, bladder, submersible, or inertial) capable of a flow rate between 50 and 500 ml/minute and appropriate power supply. The pump type will principally depend on the depth to water and well diameter. Peristaltic pumps are effective only for wells where the depth to water is less than about 25 ft. Bladder pumps and submersible pumps are most commonly used for wells with depths to water greater than 25 ft. Inertial pumps are only recommended for narrow diameter wells that cannot be sampled using a bladder or peristaltic pump.
- Water quality parameter probes and flow-through cell (e.g., YSI) for measuring pH, temperature, conductivity (and/or specific conductance), dissolved oxygen (DO) and oxidation/reduction potential (ORP) of groundwater
- Turbidity meter (e.g. Hach)
- Calibration solutions for the water quality parameter probes
- Graduated water level indicator (accurate to 0.01 ft)
- Tubing, connections and tools as appropriate
- Graduated cylinder
- Watch or stopwatch
- Purge water container (e.g. 5-gallon bucket or carboy)
- Low flow groundwater sampling record (**example Attached**)
- Personal protection equipment (PPE)
- Decontamination supplies (e.g., DI water, Liquinox® soap, paper towels)
- Sample containers and cooler (provided by the laboratory)

- Ice for sample preservation
- Clean plastic sheeting
- Paper towels.

3.3 Field Procedures

Water quality parameter measurements shall be made using instrumentation and a flow through cell. Water quality parameter instruments will be calibrated daily as per the manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**).

Sampling will be conducted using the following procedure:

1. Don appropriate PPE.
2. Measure and record the depth to water and depth to the bottom of the well. Care should be taken to minimize disturbance of the water column within the well during pre-sample measurements.
3. If a submersible pump is used, decontaminate pump prior to use (if pumps are dedicated then this applies to the initial effort only) (**Equipment Decontamination SOP Table A-1**). Attach appropriate length of dedicated tubing or mark the tubing at the appropriate point so that when the pump and tubing are lowered into the well, and the mark is at the top of the well riser, the pump will be located at the target depth within the screened interval.
4. Carefully lower the pump to the predetermined target depth. Start the pump at a purge rate low enough to achieve 0.3 ft of drawdown or less based on historical data. If sampling the well for the first time, start the pump at the lowest possible setting (or approximately 100-ml per minute) and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little (i.e., less than 0.3 ft) or no drawdown, if possible. If stabilized drawdown cannot be achieved, use the no-purge method described later in this section.
5. Monitor and record pumping rate and water levels every 3 to 5 minutes (or as appropriate) during purging. Appropriate measurement frequency may be calculated using the flow rate and the time required to purge a volume equivalent to that in the sample tubing and flow through cell. Record any adjustments to pumping rates on the FDR.
6. During purging and sampling the tubing should remain filled with water.
7. If there is visible turbidity in the discharge water, continue purging until the turbidity clears up, if possible, before connecting to the flow through cell. Connect the discharge tubing to the flow through cell. The flow through cell cannot be used for turbidity measurements. Turbidity should be measured prior to entering the flow through cell through the use of an inline tee fitting. Purging is considered complete and sampling may begin when the field parameters have stabilized, or the purge time has

exceeded 2 hours. Stabilization is considered to be achieved when three consecutive readings, taken at 3 to 5-minute intervals, are within the following limits:

- Turbidity (+/- 10% for values >10 NTUs. If turbidity is greater than 10 and does not stabilize, continue purging well for up to two hours, collect sample and document on the FDR and in field logbook. Collection of a filtered sample for metals analysis may be necessary if turbidity is greater than 50 NTUs.)
- DO (+/- 10% for values greater than 0.5 milligram per liter (mg/L). If three dissolved oxygen values are < 0.5 mg/L, then DO is considered stabilized)
- Specific conductivity (+/- 3%)
- Temperature (+/- 3°)
- pH (± 0.1 unit)
- ORP (± 10 millivolts)

8. To ensure the sample is representative of formation water, the final purge volume must be greater than the volume of the well drawdown (calculated by multiplying the height of the drop in water level by the radius of the well casing squared times pie) plus the volume of the sample tubing.
9. If there is excessive drawdown in the well such that water levels do not stabilize while pumping, the well can be sampled using the no-purge method. For this method, the well is purged until dry and the well allowed to recharge as much as possible. The sample is then collected from the recharged water.
10. To collect the analytical sample, disconnect the tubing from the flow through cell. Water samples for laboratory analyses must not be collected after water has passed through the flow through assembly. Fill sample containers directly from the tubing without alterations to the pumping rate (pumping rate may be lowered for the collection of VOC samples to avoid splashing or overfilling).
11. The volatile organic compound (VOC) fraction shall be collected first. The VOC sample container shall be filled without air space within the container. The VOC container should not be overfilled to avoid diluting the sample preservative. The vial should be 90% filled, and then topped off using water added incrementally from the container cap.
    - Samples will be labelled and handled consistent with the procedures in the QAPP and **Chain of Custody SOP (Table A-1)**.
12. Subsequent sampling efforts should duplicate the pump intake depth and final purge rate from the initial sampling event (use final pump dial setting information).
13. If using non-dedicated equipment, remove the pump from the well and decontaminate by flushing with the decontamination fluid specified in the **Equipment Decontamination SOP (Table A-1)**, or the site-specific FAP. Typically, decontamination will consist of flushing the pump with potable water and Alconox® followed by flushing with deionized water.

14. Complete remaining calculation and entries on the Low flow Groundwater FDR after sampling is completed at each well. Include any observations made during sampling such as color, odor, etc., in the field logbook and FDR.
15. Secure the well cap, compression plug, and lock.

4.0 ATTACHMENTS

Low Flow Groundwater Sampling Record

Field Instrument Calibration Record

Information Handout: Low Flow Groundwater Field Parameter Data

LOW FLOW GROUNDWATER SAMPLING RECORD

MACTEC
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PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

WELL DIAMETER (IN.) ☐ 1 ☐ 2 ☐ 4 ☐ 6 ☐ 8 ☐ OTHER ______

TUBING ID (INCHES) ☐ 1/8 ☐ 1/4 ☐ 3/8 ☐ 1/2 ☐ 5/8 ☐ OTHER ______

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ______

WELL INTEGRITY

	YES	NO	N/A
CAP	___	___	___
CASING	___	___	___
LOCKED	___	___	___
COLLAR	___	___	___

INITIAL DTW (BMP)	FT	FINAL DTW (BMP)	FT	PROT. CASING STICKUP (AGS)	FT	TOC/TOR DIFFERENCE	FT
WELL DEPTH (BMP)	FT	SCREEN INTERVAL	FT	PID AMBIENT AIR	NA PPM	REFILL TIMER SETTING	NA SEC
WATER COLUMN	FT	DRAWDOWN VOLUME (final DTW- initial DTW X well diam. squared X 0.041)	GAL	PID WELL MOUTH	NA PPM	DISCHARGE TIMER SETTING	NA SEC
CALCULATED GAL/VOL (water column X well diameter^2 X 0.041)	GAL	TOTAL VOL. PURGED (mL per minute X total minutes X 0.00026 gal/mL)	GAL	DRAWDOWN/ TOTAL PURGED		PRESSURE TO PUMP	NA PSI

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE QAPP)

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^{o}C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% and <10 ntu or 3 values <5 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS
	BEGIN PURGING									

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

	TEMP.	SP. CONDUCTANCE	DISS. O_2	pH	REDOX	TURBIDITY

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure max (ex. 1.686 = 1.69)
pH: nearest tenth (ex. 5.53 = 5.5)
DO: nearest tenth (ex. 3.51 = 3.5)
TURB: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101)
ORP: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER ______
- ☐ WATTERA
- ☐ OTHER______
- ☐ OTHER______

DECON FLUIDS USED
- ☐ ALCONOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER______

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER______
- ☐ OTHER______
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ OTHER ______
- ☐ OTHER ______
- ☐ OTHER ______

EQUIPMENT USED
- ☐ WL METER ______
- ☐ PID ______
- ☐ WQ METER ______
- ☐ TURB. METER ______
- ☐ PUMP ______
- ☐ OTHER ______
- ☐ FILTERS NO. ____ TYPE ______

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED ☐ YES ☐ NO

NUMBER OF GALLONS GENERATED ______

NO-PURGE METHOD UTILIZED ☐ YES ☐ NO

NOTES

DEVIATIONS FROM THE WORK PLAN

Sampler Signature: Print Name:

Checked By: Date:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME:		TASK NO:	DATE:
PROJECT NUMBER:		MACTEC CREW:	
PROJECT LOCATION:		SAMPLER NAME:	
WEATHER CONDITIONS (AM):		SAMPLER SIGNATURE:	
WEATHER CONDITIONS (PM):		CHECKED BY:	DATE:

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

AM CALIBRATION — Start Time ________/End Time________

POST CALIBRATION CHECK — Start Time ________/End Time________

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0		+/- 0.1 pH Units			
pH (7)	SU	7.0		+/- 0.1 pH Units	7.0		+/- 0.3 pH Units
pH (10)	SU	10.0		+/- 0.1 pH Units			
Redox	+/- mV	240		+/- 10 mV	240		+/- 10 mV
Conductivity	mS/cm	1.413		+/- 0.5 % of standard	1.413		+/- 5% of standard
DO (saturated)	%	100		+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)			+/- 0.2 mg/L			+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1		< 0.5 mg/L			
Temperature	^oC						
Baro. Press.	mmHg						

TURBIDITY METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1		<0.1		+/- 0.3 NTU of stan.
20 Standard	NTU	20		20		+/- 5% of standard
100 Standard	NTU	100		100		+/- 5% of standard
800 Standard	NTU	800		800		+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Background	ppmv	<0.1		<0.1		within 5 ppmv of BG
Span Gas	ppmv	100		100		+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Methane	%	50		50		+/- 10% of standard
O_2	%	20.9		20.9		+/- 10% of standard
H_2S	ppmv	25		25		+/- 10% of standard
CO	ppmv	50		50		+/- 10% of standard

OTHER METER

METER TYPE ____________
MODEL NO. ____________
UNIT ID NO. ____________

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced:
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45μm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other
- Other
- Other

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.

** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.

1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

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FIELD INSTRUMENT CALIBRATION RECORD

MACTEC

NYSDEC Field Programs

Information Handout: Low Flow Groundwater Field Parameter Data

March 2017, Revised April 2020

INTRODUCTION

This sheet provides information related to field data collection during low flow groundwater sampling including: temperature, pH, turbidity, conductivity, dissolved oxygen (DO), and oxidation/reduction potential (ORP). The goal of this handout is to provide a general understanding of the data being collected to assist staff with identify situations where data may not be accurate due to improper instrument calibration or instrument error.

Documents containing additional information are provided as attachments including:

- USEPA Region 1 Standard Operating Procedure Calibration of Field Instruments (Attachment 1)
- USEPA Region 1 Low Stress (Low Flow) Purging And Sampling Procedure For The Collection Of Groundwater Samples From Monitoring Wells (Attachment 2)
- instrument information pamphlets provided by Pine Environmental (Attachment 3), and
- a link to the USGS National Field Manual website.

GENERAL CONSIDERATIONS FOR FIELD EVENTS

- Review NYSDEC Program QAPP SOPs and Project Field Activities Plan (FAP)
- Record field data on appropriate Field Data Record (FDR)
- Avoid storing equipment/instruments for long periods in extreme cold or hot conditions that might occurred in parked car in the field
- Calibrate instruments in controlled environment (room temp if possible).
- Do not get turbidity meters wet. All other equipment is typically more water resistant but is not waterproof. Care should be taken to protect all equipment during rain events.
- Record field parameter results as displayed on the instrument. Significant figures and rounding will be applied later during data summary process.
- For questions regarding equipment contact the Field Operations Lead or Bruce Cunningham 207 828-3657 if equipment is obtained from Field Operations Support group in Portland (FOS).

LOW FLOW GROUNDWATER FIELD DATA

Instruments used for low flow groundwater sampling that are currently provided by the FOS group in Portland, Maine include:

- YSI 556 Multiparameter System
- HACH 2100P Turbidimeter or HACH 2100Q
- Water level indicator

Instructions on instrument calibration, maintenance and operation which are provided by Pine Environmental Services are included in Attachment 3.

Temperature

Units: Temperature should be measured in degrees Celsius (°C).

Calibration – Thermometers are not calibrated by field staff, they are checked against a NIST Thermometer annually. Record of annual calibration filed in Portland FOS with Bruce Cunningham. If the instrument readings are questionable it can be checked with ice water which should be register approximately 0 °C

Other considerations: Some field parameters are corrected based on temperature (pH, dissolved oxygen, and specific conductance). So it is important that the temperature is correct.

Typical measurements: Average groundwater temperatures in the Northeast range from approximately 5.5 °C in Maine to 11 °C in southern New York. Seasonal temperatures vary by as much as ± 10 °C in shallow wells and less in deeper wells.

pH

Units: pH is measured in pH standard units (SU) on a scale of 0-14. The pH (power of hydrogen) scale measures the concentration of hydrogen ions in solution.

Calibration – pH will be calibrated prior to mobilization to the field and daily once prior to conducting field activities and once after sampling is complete. pH will be calibrated with 2 or 3 solutions (based on project requirements) covering the expected range. Typically pH 4 and pH 7 (and pH 10 if a third solution is required) will be used. Acceptance criteria is ± 0.1 for the AM check and ± 0.3 at pH 7 for the PM check. Rinse and dry the probe between solution checks.

Maintenance and Corrective Actions: pH is measured through the glass bulb located on the end of the probe. Do not touch the glass bulb with fingers. Oily film or scratches on the bulb will interfere with the design characteristics of the glass membrane and affect pH measurements. Do not use the instrument if the bulb is broken or scratched or if the electrode body is cracked, broken or the internal electrode has been damaged. If necessary, the probe can be replaced either through FOS or the rental company.

Typical measurements: Most groundwater in the US has pH ranging from 6 to 8.5 SU and surface water ranges from 6.5 to 8.5 SU. The pH of distilled water is usually around 5.6 SU due to dissolved CO2 and the formation of carbonic acid.

Oxidation/Reduction Potential (ORP)

Units: ORP (also referred to as redox potential [Eh]) is a measure of the intensity of electron activity between two electrodes. ORP is measured in millivolts (mV).

Calibration: ORP will be calibrated prior to mobilization to the field and daily prior to conducting field activities. The instrument should be allowed to stabilize before running daily calibrations and should be adjusted for temperature according to the manufactures specifications. Our typical calibration solution has a value of 240 mV with an acceptance criteria of ±10 mV.

Maintenance and Corrective Actions: If calibration readings are not within acceptance criteria the electrodes may need to be cleaned. Cleaning instructions are provided in the YSI technical notes or contact Bruce Cunningham for assistance. Alternatively new calibration solutions may be needed.

Typical measurements: ORP will vary from site to site and within sites depending on a variety of factors including dissolved chemicals (metals and other compounds), and pH. In general, positive values indicate an oxidizing environment and negative values indicate a reducing environment.

Redox conditions can affect the presence of dissolved chemicals in water. Iron (ferrous iron) and dissolved manganese are often present in reducing conditions and hexavalent chromium (Cr6) might be found in oxidizing conditions.

Specific Conductance (conductivity)

Units: Conductivity is measured in Siemens (S) and distance. Field data records typically use millisiemens per centimeter (mS/cm), but instruments may provide data in other converted forms (10^6 µS/cm = 10^3 mS/cm = 1 S/cm). mho may also be used as a unit of measure for conductivity; this is numerically the same S.

Calibration: Conductivity will be calibrated prior to mobilization to the field and daily once prior to conducting field activities and once after sampling is completed. Daily calibration is a check against a standard of known concentration. Acceptance criteria for conductivity is ± 0.5% for the AM check and ± 5% for the post sampling check.

Maintenance and Corrective Actions: If calibration readings are not within the acceptance criteria, the electrodes may need to be cleaned. Contact Bruce Cunningham if equipment was obtained from FOS and he will provide instructions as appropriate.

Because the actual conductivity of a solution changes with temperature, conductivity measurements are automatically normalized to 25°C by the field instrument.

Typical measurements:

Distilled Water: 0.0005 mS/cm

Deionized water: 0.00001 – 0.001 mS/cm

Tap Water: 0.5 – 0.8 mS/cm

Drinking water: 0.05 – 0.5 mS/cm

Groundwater: 0.05 – 50 mS/cm

Surface Water: 0.01 – 4 mS/cm

Sea water: 50 mS/cm

Dissolved Oxygen

Units: Instrumentation will report DO values as either percent saturation or ppm (mg/L) units. Field data should be reported in mg/L.

Calibration: DO instrument calibration check will be conducted prior to mobilization to the field and daily once prior to conducting field activities and once after sampling is complete. Calibration checks are conducted using an oxygen saturated solution and DO free solution (if require for the field program).

Calibration for DO must be adjusted based on air pressure (mmHg) and temp (°C). Use Pressure and Temperature Chart to determine saturated solution concentration (Attachment 4). Air pressure readings can be obtained from **http://weather.noaa.gov/.** Barometric pressure is often in inches Hg which can be converted to mm by multiplying inches by 25.4.

Acceptance criteria:
DO saturation solution ± 2% (0.2 mg/L) AM calibration and ± 5% (0.5 mg/L) PM calibration.
Zero solution: < 5% (0.5 mg/L) both AM and PM.

Maintenance and Corrective Actions: The DO sensor should not be allowed to dry out and should be kept moist during storage. Method performance can be negatively affected by the following:

- calibration drift
- a loose, wrinkled, or damaged membrane
- air bubbles in the electrolyte solution
- loose-fitting O-rings and membranes
- damaged, dirty, or otherwise contaminated electrodes under the membrane.

If there is a problem with the membrane, follow instructions that are included with the instrument on how to repair or replace the membrane or contact Bruce Cunningham at FOS with questions.

Typical measurements: Groundwater DO can range from near saturation (approximately 14 mg/L) in locations where the water table is near the ground surface to <2 mg/L. Although low DO could be the result of many factors, it may indicate reducing groundwater conditions due to:

- proximity to wetlands
- landfills
- VOC plumes

Turbidity

Units: Turbidity is a measure of how light is scattered or absorbed and is measured in NTU (Nephelometric Turbidity Units).

Calibration: Initial instrument calibration is completed by the manufacturer or FOS. Check standards should be run daily prior to use in the field with commercial reference standards. Acceptance criteria is ± 5%. Check standard vials should be cleaned prior to use.

Maintenance and Corrective Actions: Dirty or scratched vials/cell or air bubbles can give false results. It is important to make sure the sample vial is clean. If there are visible scratches replace the sample vial.

Typical measurements: Clean drinking water has turbidity <5 NTU. Turbidity <50 NTU may not be visually noticeable.

Additional Information:

Additional documents that provide useful include:

- USEPA Region 1 Standard Operating Procedure Calibration of Field Instruments; Quality Assurance Unit, USEPA Region I, 11 Technology Drive, North Chelmsford, MA 01863. Jan 2010.
- USEPA Region 1 Low Stress (Low Flow) Purging And Sampling Procedure For The Collection Of Groundwater Samples From Monitoring Wells (Revision 4). EQASOP-GW4. Effective date July 30, 1996, Revised September 19, 2017.
- Various information provided by instrument manufacturers **http://www.fieldenvironmental.com/assets/files/Manuals/YSI%20556%20MPS%20Manual.pdf; https://www.ysi.com/parameters/dissolved-oxygen?Dissolved-Oxygen-1**
- USGS National Field Manual for the Collection of Water-Quality Data, **http://water.usgs.gov/owq/FieldManual/**

SOP # S4

MACTEC STANDARD OPERATING PROCEDURE #S4

HYDRASLEEVE™ GROUNDWATER SAMPLE COLLECTION

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________	April 27, 2020
Charles Staples, PG, Program Technical Lead	Date
Reviewed	Date
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HYDRASLEEVE™ GROUNDWATER SAMPLE COLLECTION

1.0 PURPOSE

This procedure is intended to describe the collection of representative groundwater samples using the HydraSleeve^{TM} sampler. The sampler is classified as a no-purge (passive) grab sampling device designed to collect groundwater samples directly from the screened interval of a monitoring well without having to purge the well prior to sample collection   The sampler can be used to collect representative groundwater samples for all analytes including; VOCs, SVOCs, metals, anions, dissolved gasses, total dissolved solids, radionuclides, PCBs and other compounds.

As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data record.

2.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sampling environmental monitoring wells using the HydraSleeve^{TM} sampler. Proper procedures are necessary to ensure the quality and integrity of the samples.

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook.

2.2 Preparation

Office preparation

- Review pertinent information with regards to well construction, development, and sampling information on the wells to be tested, if available. Evaluate the following well construction details
    - inside diameter of the well.
    - length and depth of the well screen.
    - water level in the well.
    - total depth of the well.
- Assemble appropriate logbooks and field data records to complete the field assignment.
- Make copies of the site location map, and field data from the previous sampling event.

Equipment Selection and Sampling Considerations

The sampling generally uses the following equipment/items:

- Graduated water level indicator (0.01-ft accuracy),
- HydraSleeve™ samplers,
- Water quality parameter probes (e.g., YSI), if using for measuring pH, temperature, conductivity (and/or specific conductance), dissolved oxygen (DO) and oxidation/reduction potential (ORP) of groundwater, and a standalone turbidity meter (e.g. Hach).
- Calibration solutions for the water quality parameter probes
- Water grab sample field data record (FDR; example attached)
- Personal protection equipment (PPE),
- Sample containers and cooler (provided by the laboratory),
- Ice for sample preservation, and
- Clean plastic sheeting.

The HydraSleeve™ sampler consists of the following basic components.

- A suspension line or tether attached to a spring clip at the top of the sampler or directly to the sampler itself.
- A long flexible, 4-mil thick lay-flat polyethylene sample sleeve, sealed at the bottom and with a self-sealing reed type polyethylene check valve at the top.
- A dedicated stainless-steel weight with clip, which is attached to the bottom of the sample sleeve.

- A discharge tube (e.g. straw) that is used to puncture the sample sleeve after it is recovered from the well so the sample can be decanted into bottles.
- At the top of the sleeve by the self-sealing check valve are two holes which provide attachment points for the spring clip or suspension/tether line. At the bottom of the sleeve are two holes which provide attachment points for the weight clip and weight.

2.3 Field Procedures

HydraSleeve™ Deployment

- Collect well measurements including depth to water and depth to bottom of well and record on the FDR.
- Assemble the sampler in accordance with the manufacturer's instructions.
- Remove sampler from its packing, unfold it and hold by its top.
- Crimp the top of the sampler by folding the hard polyethylene reinforcing strips at the holes.
- Attach the spring clip to the holes to ensure the top remains open until the sampler is retrieved.
- Attach tether line to spring clip. Alternatively, if no spring clip is used attach line to one (not both) of the holes at the top of the sampler.
- Fold the flaps with the two holes at the bottom of the sampler together and slide the weight clip through the holes.
- Attach a weight to the bottom of the weight clip to ensure that the sampler will descend to the bottom of the well.
- Measure and mark the tether line so that the weight attached to the bottom of the sampler will be positioned six inches off the bottom of the well screen.
- Once assembled, carefully lower the sampler to the desired sample position. Make sure that the sleeve is not pulled upwards at any time during installation into the well. If the sleeve is pulled upward at a rate of 0.5 feet/second, the top check valve will open, and water will enter the sleeve prematurely and a new sleeve will need to be deployed for sampling.
- Secure the sampler in place by tying off the suspension/tether line at the top of the well, preferably to a ring on the bottom of the compression plug (J-plug).
- Allow the monitoring well to equilibrate following installation of the sampler. In many cases the well will equilibrate within a few hours, however the sleeve can be left in place indefinitely.

HydraSleeve^{TM} Recovery and Sample Collection

- Access the monitoring well and secure the suspension/tether line without moving sampler.
- Measure the water level and record on the FDR, be careful not to disturb the water or the sampler.
- In one smooth motion pull the tether line upwards for three to five feet at a rate of 1 foot per second or faster. The motion will open the top check valve and allow the sampler to fill (typically requires a vertical distance of 1 to 1.5 times the length on the sleeve). When the sleeve is full the top check valve will close. You should feel the weight of the sampler on the tether line after the valve closes and the full sampler begins to displace water.
- Continue to pull the tether line until the sampler is at the top of the well.
- Decant and discard the small volume of water trapped in the sampler above the check valve by turning the sleeve upside down. This should be completed in a single motion to avoid unseating the check valve.
- Remove the discharge tube (straw) from its packing sleeve.
- Hold the sleeve at the check valve and puncture the sleeve just below the check valve with the pointed end of the discharge tube.
- Discharge water from the sleeve through the discharge tube into sample containers. The discharge rate can be controlled by either raising the bottom of the sampler or by rolling up the bottom and squeezing it like a tube of toothpaste.
- Samples will be labelled and handled consistent with the procedures in the QAPP and SOP 29.

Collection of Field Water Quality Parameters, if required, and Closure of Well.

- If collection of water quality parameters is required in the project specific FAP, after retrieving sampler, a water quality parameter meter such as a YSI 556 MPS or equivalent can be lowered into the well to measure parameters in the sampling interval. Alternatively, if the sampling interval is deeper than the length of the instrument cord, measurements can be collected by decanting the residual water in the sampler into a clean container in which the meter can be placed.

- Water quality parameter instruments will be calibrated daily as per the manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**).

- After sample collection is complete and water quality parameter readings have been recorded on the FDR then remove the water quality meter from the well and deploy a new HydraSleeve™ for the next sampling event, if required. Secure the well cap and compression plug and lock the well.

- Complete the remaining portions of the FDR after each well is sampled, including sample date and time (time of retrieval from the well), well sampling sequence, types of sample bottles used, sample identification numbers, preservatives used, parameters requested for analysis, and field observations of the sampling event.

3.0 ATTACHMENTS

Water Grab Sampling Record

Field Instrument Calibration Record

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ______

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE FAP)

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^{o}C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% and <10 ntu or 3 values <5 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure (SF) max (ex. 1.686 = 1.69)
pH: nearest tenth (ex. 5.53 = 5.5)
DO: nearest tenth (ex. 3.51 = 3.5)
TURB: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101)
ORP: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER ______
- ☐ PDB
- ☐ HYDRASLEEVE ______
- ☐ OTHER______

DECON FLUIDS USED
- ☐ ALCONOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER______

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER______
- ☐ OTHER______
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ OTHER______
- ☐ OTHER______
- ☐ OTHER______

EQUIPMENT USED
- ☐ WL METER ______
- ☐ PID ______
- ☐ WQ METER ______
- ☐ TURB. METER ______
- ☐ PUMP ______
- ☐ OTHER ______
- ☐ FILTERS NO. ____ TYPE ______

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ______

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

DEVIATIONS FROM THE WORK PLAN:

Sampler Signature: Print Name:

Checked By: Date:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ______ TASK NO: ______ DATE: ______
PROJECT NUMBER: ______ MACTEC CREW: ______
PROJECT LOCATION: ______ SAMPLER NAME: ______
WEATHER CONDITIONS (AM): ______ SAMPLER SIGNATURE: ______
WEATHER CONDITIONS (PM): ______ CHECKED BY: ______ DATE: ______

MULTI-PARAMETER WATER QUALITY METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

AM CALIBRATION Start Time ______/End Time ______
POST CALIBRATION CHECK Start Time ______/End Time ______

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	______	+/- 0.1 pH Units			
pH (7)	SU	7.0	______	+/- 0.1 pH Units	7.0	______	+/- 0.3 pH Units
pH (10)	SU	10.0	______	+/- 0.1 pH Units			
Redox	+/- mV	240	______	+/- 10 mV	240	______	+/- 10 mV
Conductivity	mS/cm	1.413	______	+/- 0.5 % of standard	1.413	______	+/- 5% of standard
DO (saturated)	%	100	______	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	______	______	+/- 0.2 mg/L	______	______	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	______	< 0.5 mg/L			
Temperature	°C		______			______	
Baro. Press.	mmHg		______			______	

TURBIDITY METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	______	<0.1	______	+/- 0.3 NTU of stan.
20 Standard	NTU	20	______	20	______	+/- 5% of standard
100 Standard	NTU	100	______	100	______	+/- 5% of standard
800 Standard	NTU	800	______	800	______	+/- 5% of standard

PHOTOIONIZATION DETECTOR
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Background	ppmv	<0.1	______	<0.1	______	within 5 ppmv of BG
Span Gas	ppmv	100	______	100	______	+/- 10% of standard

O_2-LEL 4 GAS METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Methane	%	50	______	50	______	+/- 10% of standard
O_2	%	20.9	______	20.9	______	+/- 10% of standard
H_2S	ppmv	25	______	25	______	+/- 10% of standard
CO	ppmv	50	______	50	______	+/- 10% of standard

OTHER METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.
☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ______
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45μm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ______
- Other ______
- Other ______

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S5

MACTEC STANDARD OPERATING PROCEDURE #S5

PASSIVE DIFFUSION BAG GROUNDWATER SAMPLE COLLECTION

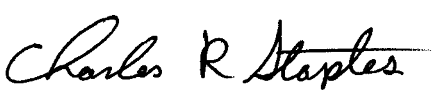
April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:



April 27, 2020

Charles Staples, PG, Program Technical Lead | Date

Reviewed | Date

PASSIVE DIFFUSION BAG GROUNDWATER SAMPLE COLLECTION

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes methodologies for deployment, recovery and quality assurance (QA) associated with the use of water-filled passive diffusion bag (PDB) samplers for obtaining volatile organic compound (VOC) data in environmental monitoring wells. This method of groundwater sample collection involves minimal disturbance of the groundwater aquifer to obtain a "representative" sample of groundwater.

This SOP addresses technical requirements and required documentation to be completed during PDB groundwater sampling and equipment calibration.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

"User's Guide for Polyethylene-based Passive Diffusion Bag Samplers to Obtain Volatile Organic Compound Concentrations in Wells, Part 1: Deployment, Recovery, Data Interpretation, and Quality Control and Assurance," Water-Resources Investigations Report 01-4060, USGS, dated 2001.

"Technical and Regulatory Guidance for Using Polyethylene Diffusion Bag Samplers to Monitor Volatile Organic Compounds in Groundwater," Interstate Technology and Regulatory Council (ITRC), dated 2004 (issued by the ITRC Diffusion Sampler Team).

EON Products, Inc., Equilbrator™ Diffusion Sampler Instructions (http://www.eonpro.com) with PDB Equipment Setup Diagram

3.0 METHOD CONSIDERATIONS

A PDB sampler works on the principle of diffusion; chemical compounds dissolved in water move from areas of high concentration outside the sampler to low concentration inside the sampler until equilibrium is reached.

The effectiveness of the use of a single PDB sampler in a well is dependent on the assumption that there is horizontal flow through the well screen and that the quality of the water is representative of the ground water in the aquifer directly adjacent to the screen. If there are vertical components of intra-borehole flow, multiple intervals of the formation contributing to flow, or varying concentrations of VOCs vertically within the screened or open interval, then deployment of multiple PDB samplers within a well may be more appropriate for sampling the well.

A typical PDB sampler consists of low-density polyethylene (LDPE) lay-flat tubing that is filled with laboratory-grade deionized (DI) water and closed at both ends. They are typically 18 to 24 inches long, with a 1.25 to 1.75 inch outside diameter (OD), and hold between 200 and 350 milliliters (ml) of water; however, they can be custom sized to fit site specific needs. Placing the samplers in a low-density polyethylene-mesh mesh will protect against abrasion in open boreholes and as a means of attachment at the prescribed depth. The bags are suspended (possibly from a locking J-plug/ well cap) in the monitoring well at the target horizon by a weighted line and allowed to equilibrate with the surrounding water. A minimum equilibration time of two weeks is recommended. The PDB samplers are retrieved from the well after the equilibration period and the enclosed water is immediately transferred to appropriate sample containers for analysis (40 ml VOC vials).

The PDB can be attached to the weighted line by a variety of methods, such as wire/cable ties through a knot or ring in non-buoyant non-stretch rope, stainless steel clamp, or direct attachment to the weight. Sufficient weight should be added to counterbalance the buoyancy of the PDB samplers. Non-buoyant non-stretch rope should be dedicated to the well to prevent carryover of contaminants. Stainless steel line could be reused if thoroughly decontaminated. All weights should be made of stainless steel and thoroughly decontaminated after each use.

The PDB method has both advantages and limitations when compared to other sampling methods.

Advantages include the following: The potential for PDB samplers to eliminate or substantially reduce the amount of purge water associated with sampling. The samplers are relatively inexpensive and easy to deploy and recover. There is no downhole equipment to be decontaminated between wells, and there is a minimum amount of field equipment required. Multiple PDB samplers, distributed vertically along the screened or open interval, may be used in conjunction with borehole flow meter testing to gain insight on the movement of contaminants into and out of the well screen or open interval or to locate the zone of highest concentration in the well. In addition, the samplers are not subject to turbidity interferences because sediment can't pass through the small pore size membrane.

Water-filled polyethylene PDB samplers are not appropriate for all compounds (e.g. MtBE, Acetone, Styrene, most semi-volatiles, most ions). The use of PDB samplers would not be appropriate if you need to collect a sample at a given point in time. There may be a problem using PDB samplers where there is low permeability, or if the well is not properly developed. If there is a vertical hydraulic gradient in the well, then the concentrations in the sampler may represent the concentrations in the water flowing vertically past the sampler rather than in the formation directly adjacent to the sampler.

One of the primary applications of PDB samplers is for long-term monitoring of VOCs in ground-water wells at well characterized sites. In addition, PDB samplers can be used to determine whether contaminant stratification is present and to locate the zone of highest concentration within a well.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sampling environmental monitoring wells using the PDB sampler. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

4.2 Preparation

- Evaluate the well construction data to determine the placement of the sampler.
- Make copies of field data record from the previous sampling event, if applicable.
- Have the vendor pre-fill the PDBs with DI water (preferably).
- The stainless-steel rings used to position the sampler at the desired depth on the tether may be attached by the vendor at the time of purchase or attached by field staff prior to deployment.

Pre-Deployment PDB Assembly Procedure

1. Sampler assemblies can either be constructed by the vendor, in the office or in the field. See Section 4.3.
2. The filled PDB samplers should be transported with a minimum of one PDB sampler designated as the pre-deployment equipment blank.

Equipment Selection and Sampling Considerations

The sampling generally uses the following equipment/items:

- Graduated water level indicator (0.01-ft accuracy),
- PDB samplers,
- Suspension line/tether, plus zip ties/rings for attaching PDBs,
- Stainless Steel weights to weight the PDB,
- Straw/tube for puncturing PDB to collect sample,
- Water grab sample field data record (FDR; example attached)
- Personal protection equipment (PPE),
- Sample containers and cooler (provided by the laboratory),
- Ice for sample preservation, and
- Clean plastic sheeting.

4.3 Field Procedures

PDB Deployment Procedure

The following deployment procedures are to be used:

1. Check well for security damage or evidence of tampering, record observations. Wells should be locked at all times when not being sampled.
2. Collect a water level measurement at the well following the **Water Level Measurement SOP** (Table A-1)
3. Before sampler deployment, measure the total well depth and compare it with the reported depth to the bottom of the well from well construction diagrams to evaluate whether sediment has accumulated in the bottom of the well.
4. Check for any obstruction in the well that would prevent PDB deployment.
5. Construct the PDB tether line. The tether line can either be constructed in the field, the office, or by the PDB vendor, with the desired PDB placement depth based on well construction details and water elevations. The tether line should be constructed such that the weight attached to the end of the tether rests on the bottom of the well with the line taut above it suspended from a locked J-plug (although the weight can be suspended if care is taken). Sufficient weight is required to be added to counterbalance the buoyancy of the PDB samplers. Calculate the distance from the bottom of the well up to the desired interval in the well where the sampler will be suspended. The

first PDB sampler should be at least two feet from the bottom of the weighted tether. For wells that are screened across the water table, PDBs should be placed at least two feet below the top of the water column to ensure that no part of the sampler will be exposed above the water table during the equilibration period. Attach rings to the tether at the desired PDB depth. Each bag requires two stainless steel rings, one at either end to properly secure the bag to the tether. If tethers are constructed by the vendor, they should be carefully checked to ensure the rings are properly placed as it is critical that the PDBs are deployed at the designated depths. If multiple PDBs are used, attach a tag to the top ring (top of the PDB sampler) identifying the sampling depth. Be sure the tags are made of the appropriate material and do not have any sharp edges that could puncture the PDB samplers or get caught up in the well.

6. Once the tether line is constructed, attach the weight to the bottom of the tether.
7. Attach the mesh or handle/ring at the top of the PDB sampler and the mesh or handle/ring at the bottom of the PDB samplers to the appropriate rings on the tether using cable ties in a way that prevents slipping of the sampler bag along the tether. Clip off excess cable tie. Care should be taken to eliminate sharp points or ends of clamps, tags, or cable ties to decrease the potential for PDB punctures or tears. Repeat as necessary for multiple samplers attached to a single tether for multiple sampling intervals and attach tether to the new j-plug/well cap.
8. Once all samplers are attached, lower the weight and weighted line down with the attached samplers into the well until the desired depth is reached. The line above the weight should be taut. The PDB samplers should now be positioned at the expected depths. A check on the depth can be done by placing a knot or mark on the line at the correct distance from the top of the upper PDB sampler to the top of the well casing and checking to make sure that the mark aligns with the lip of the casing after deployment.
9. Secure the assembly in this position with the new j-plug/well cap and secure the well.
10. Allow the system to remain undisturbed as the PDB samplers equilibrate for a minimum of two weeks.

PDB Recovery Procedure

Recovery of the PDB consists of removing the samplers from the well and immediately transferring the enclosed water to 40-milliliter sampling VOC vials for laboratory analysis.

The following PDB recovery procedures are to be used:

1. Collect a water level measurement at the well following the **Water Level Measurement SOP (Table A-1)**. Compare the current water level to the water level recorded during

deployment, and the depth of the highest PDB sampler. No part of the sampler bag should be exposed above the water table during the equilibration period.

2. When retrieving the samplers, only one sampler should be removed and processed at a time. The remaining samplers, if present, should be suspended in the well until they can be processed to isolate them from agitation, exposure to ambient weather conditions, and direct sunlight. Check the depth written on the tag attached to the top ring of the PDB sampler to ensure the correct depth is recorded on the chain of custody. If there is a lack of enough open well above the water table to hang the PDBs, samplers may be placed on and covered by clean plastic prior to processing. Gloves should be changed prior to handling each sampler.
3. Detach and remove the PDB sampler from the tether. Once retrieved, examine the surface of the PDB sampler for evidence of algae, iron or other coatings, and for tears in the membrane. Note the observations in a field logbook. If there are tears in the membrane, the sample should be rejected. If there is evidence that the PDB sampler exhibits a coating, then this should be noted, and the data results should be qualified.
4. Remove the excess liquid from the exterior of the bag to minimize the potential for cross contamination or dilution of the sample.
5. The water should be transferred from the water-filled samplers to the sample bottles immediately upon recovery. The proper collection of a sample for volatile-organic compounds requires minimal disturbance of the sample to limit volatilization and therefore a minimal loss of volatiles from the sample. The following VOC procedures should be followed:
    a. Open the vial, set cap in a protected place, and collect the sample. Using the disposable discharge "straw" or tube (provided by the vendor with the PDB), pierce the sampler near the bottom with discharge tube and allowing water to flow through the tube into the VOA vials.
    b. Do not reuse discharge tubes. If needed, the flow rate can be controlled by tilting or manipulating (e.g. folding) the sampler.
    c. Be sure the sample flow is laminar and there are no air bubbles in the sample flow.
    d. There should be a convex meniscus on the top of the vial without overtopping the vial (diluting the preservative). You can fill the vial cap and top off the vial to create the convex meniscus for VOC samples, if needed.

e. Once filled, check that the cap has not been contaminated and carefully cap the vial.
f. Place the cap directly over the top and screw down firmly. Do not over-tighten and break the cap.
g. Invert the vial and tap gently. If an air bubble appears, uncap and attempt to add a small volume of sample to achieve the convex meniscus without excessively overfilling the vial. If this has to be repeated more than twice, discard the sample and begin again with a new preserved container.
h. Immediately place the vial in the protective foam sleeve (if available) and place on ice in the sample cooler.
i. When the samples are retrieved, extreme care must be taken to ensure the vertical placement of the samplers within the well are accurately recorded on the chain of custody (in the comments section if not in the sample ID) and in the field-sampling logbook.
j. Any unused water from the PDB sampler can be discarded on the ground surface unless specified otherwise in the FAP.

6. Repeat steps 3 to 5 for each PDB sampler present in the well.
7. Upon completion of sampling at the well, attach new PDBs for each sampling interval and re-deploy for the next sampling event.
8. Samples will be labelled and handled consistent with the procedures in the QAPP and **Chain of Custody SOP (Table A-1)**.

Field data and observation should be recorded on the water grab sample field data record (**example attached**).

5.0 ATTACHMENTS

Water Grab Sampling Record

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ________

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA (AS LISTED IN THE FAP)

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^oC) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% and <10 ntu or 3 values <5 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS
FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)										**TEMP.**: nearest degree (ex. 10.1 = 10) **COND.**: 3 significant figure (SF) max (ex. 1.686 = 1.69) **pH**: nearest tenth (ex. 5.53 = 5.5) **DO**: nearest tenth (ex. 3.51 = 3.5) **TURB**: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101) **ORP**: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS		EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ S. STEEL PUMP MATERIAL	☐ WL METER ____
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PVC PUMP MATERIAL	☐ PID ____
☐ BLADDER ____	☐ POTABLE WATER	☐ LDPE TUBING	☐ GEOPROBE SCREEN	☐ WQ METER ____
☐ PDB	☐ NITRIC ACID	☐ OTHER ____	☐ OTHER ____	☐ TURB. METER ____
☐ HYDRASLEEVE ____	☐ HEXANE	☐ OTHER ____	☐ OTHER ____	☐ PUMP ____
☐ OTHER ____	☐ METHANOL		☐ OTHER ____	☐ OTHER ____
	☐ OTHER ____			☐ FILTERS NO. ____ TYPE ____

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐ NUMBER OF GALLONS GENERATED ________

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

DEVIATIONS FROM THE WORK PLAN:

Sampler Signature: Print Name:

Checked By: Date:

SOP # S6

MACTEC STANDARD OPERATING PROCEDURE #S6

PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FIELD SAMPLING PROTOCOLS

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples ______________________ April 27,2020 ______________________

Charles Staples, PG, Program Technical Lead — Date

Reviewed — Date

______________________ ______________________

______________________ ______________________

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PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) FIELD SAMPLING PROTOCOLS

1.0 PURPOSE

The purpose of this SOP is to describe the procedures/considerations when collecting soil, sediment, surface water, and groundwater samples for per- and polyfluoroalkyl substances (PFAS) characterization at a site. This SOP also describes a tiered approach that should be used to assist with field decisions. Sampling specific SOPs should also be reviewed prior to conducting field sampling activities for PFAS characterization.

This procedure applies to all MACTEC personnel and subcontractors who collect or otherwise handle samples of soil, sediment, surface water, and groundwater for analysis of PFAS. This SOP should be reviewed by all on-site personnel prior to implementation of field activities.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field log book and field forms.

Procedures and protocols in this SOP and the Program QAPP have been designed to comply with NYSDEC PFAS Sampling Guidelines (NYSDEC, 2020) (**Attached**).

2.0 REFERENCES

NYSDEC, 2020. Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Remedial Programs. January 2020.

3.0 PROCEDURES

Given the low detection limits associated with laboratory PFAS analysis, and the many potential sources of trace levels of PFAS, field personnel are advised to act on the side of caution by strictly following the subject protocols, frequently replacing nitrile gloves, and rinsing field equipment to help mitigate the potential for false detections of PFAS.

This section contains both the responsibilities and procedures involved with field sampling for analysis of PFAS.

3.1 Responsibilities

Project Manager

The project manager (PM) shall provide the Quality Assurance Program Plan (QAPP) and site-specific field activities plan (FAP) to project personnel, which shall include the sampling requirements for each investigation. The PM will detail deviations to the procedure provided in this SOP in the site-specific FAP.

Field Operations Lead

The field operations lead (FOL) shall ensure that samples are collected using procedures that are in accordance with the QAPP, site-specific FAPs, and applicable SOPs. The FOL shall also be required to make rational and justifiable decisions when deviations from these procedures are necessary because of field conditions or unforeseen issues and report the deviations to the PM.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing their tasks according to specifications outlined in the QAPP, site-specific FAPs, applicable SOPs, and other appropriate procedures. Field personnel are responsible for reporting deviations from procedures to the FOL and PM and documented in the field logbook and field data record.

3.2 Field Procedures/Considerations

The following are procedures/considerations to be made during field activities for PFAS sampling. A summary of the prohibited and acceptable items for PFAS investigation areas is included in Table 1. A checklist (**Attached)** shall be used daily prior to the commencement of fieldwork to ensure the field team is in compliance with this protocol.

Field Equipment

- **Do not use Teflon®-containing materials** (e.g., Teflon® tubing, bailers, tape, plumbing paste, or other Teflon® materials) since Teflon® contains fluorinated compounds.
- Sample containers and collected samples will be stored and shipped using dedicated coolers provided by the laboratory.
- Stainless steel, high-density polyethylene (HDPE), polypropylene, and silicone materials are acceptable for sampling. Samples should not be collected with tubing or stored in containers made of low-density polyethylene (LDPE) materials (fluorinated compounds are known to adsorb to LDPE). All sampling equipment components and sample containers should not come in contact with aluminum foil, LDPE, glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.
- MACTEC will use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. MACTEC will use ProActive SS Pumps with polyvinyl chloride (PVC) leads or Geotech SS Geosub pumps for groundwater sample collection at depths greater than 25 feet. These pumps are constructed with stainless steel and will minimize introductions of PFAS. PFAS-free bladder pumps may also be used for sampling. PVC (e.g. Whale®) pumps can be used for well development, if needed, but should not be used for sampling, or left in the wells.
- When using liners to collect soil samples during direct-push technology or during conventional drilling and sampling methodologies, acetate liners are to be used.
- Field reports will be documented on loose paper secured on masonite or aluminum clipboards (i.e. plastic clipboards, binders, or spiral hard cover notebooks are not acceptable) using a pen or pencil.
- **Post-It Notes are not allowed** on project sites.

- Use ballpoint pens. Pens will be used when documenting field activities in the field log and on field forms as well as labeling sample containers and preparing the Chain of Custody.
- **Do not use chemical (blue) ice packs** during the sampling program. This includes the use of ice packs for the storage of food and/or samples.

Field Clothing and Personal Protective Equipment

- **Do not wear water resistant, waterproof, or stain-treated clothing** during the field program. Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener. Preferably, field gear should be cotton construction and well laundered (i.e., washed a minimum of three times prior to use after purchase). New clothing may contain PFAS related treatments. **Do not use new clothing** while sampling or sample handling.
- **Do not wear clothing or boots containing Gore-Tex™** during the sampling program as it contains a PFAS membrane.
- Safety footwear will consist of steel-toed boots made with polyurethane and PVC, untreated leather boots, or well-worn leather boots. Newer leather boots may be worn if they are covered with polypropylene, polyethane, or PVC boot covers.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned prior to the following activities at each sample location:
  - Decontamination of re-usable sampling equipment.
  - Handling sample bottles or water containers.
  - Insertion of anything into the well (e.g., HDPE tubing, HydraSleeve™, bailer, etc.).
  - Insertion of silicone tubing into the peristaltic pump.
  - Sample Collection after completion of monitor well purging; and,
  - Handling of any quality assurance/quality control samples including field blanks and equipment blanks.

  In addition, gloves should be changed after the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel.

Sample Containers

- Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater, etc.). All samples should be collected in polypropylene or HDPE bottles. The screw cap will be made of polypropylene or HDPE and may be lined or unlined. However, if lined, the liner may not be made of Teflon® or other material containing PFAS.
- Container labels will be completed using pen after the caps have been placed back on each bottle.
- Glass sample containers are not to be used due to potential loss of analyte through adsorption.

Wet Weather

- Field sampling occurring during wet weather (e.g., rainfall and snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross-contamination. Teams will avoid synthetic gear that has been treated with water-repellant finishes containing PFAS. Use rain gear made from polyurethane, vinyl, and wax or rubber-coated materials.

- Teams should consider the use of a gazebo tent, which can be erected overtop of the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be handled as such; therefore, gloves should be worn when setting up and moving the tent, changed immediately afterwards and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

Equipment Decontamination

- Field sampling equipment used at each sample location, will require cleaning between uses. Alconox® and Liquinox® soap is acceptable for use since the Safety Data Sheets do not list fluoro-surfactants as an ingredient (do not use Liquinox® soap if also sampling for 1,4-dioxane). However, Decon 90 will not be used during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory certified “PFAS-free” water.
- For larger equipment (e.g., drill rig and large downhole drilling and sampling equipment), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water.

Groundwater Sampling

- At sites with dedicated sampling equipment installed in the wells that contains Teflon (e.g., tubing, pumps), this equipment should be removed from the wells and replaced with HDPE tubing and non-Teflon containing equipment, if possible. These wells will be re-developed by removing three well volumes of water, if possible, and letting the wells recover for at least 48 hours prior to sampling.
- At sites with dedicated sampling equipment installed in the wells that contain LDPE tubing, this tubing should be removed from the wells and replaced with HDPE tubing. These wells can be sampled immediately following replacement of tubing; however, attempts should be made to remove one well volume prior to sampling. For larger wells, with higher volumes of water, it may be preferable to redevelop the wells and remove one well volume with a higher volume pump. In such cases the wells should be allowed to recover for at least 48 hours prior to sampling.

Personnel Hygiene

- Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, unless the products are applied to a part of the body that will be coved by clothing. These products may contain surfactants and represent a potential source of PFAS.
- All clothing worn by sampling personnel must have been laundered multiple times.
- Many manufactured sunblock and insect repellants contain PFAS and should not be brought or used on-site. Sunblock and insect repellants that are used on-site should consist of 100% natural

ingredients, unless previously vetted by the project chemist. A list of acceptable sunscreens and insect repellents is provided in Table 1.

- For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use. When finished washing, the use of a mechanical dryer is preferred and the use of paper towel for drying is to be avoided (if possible).

Food Considerations

- No food or drink shall be brought on-site, with the exception of bottled water and hydration drinks (e.g., Gatorade® and Powerade®), which will only be allowed to be brought and consumed within the staging area.

Visitors

- Visitors to the investigation area are asked to remain outside of the exclusion zone during sampling activities.

4.0 TIERED APPROACH TO ASSIST WITH FIELD DECISIONS

In evaluating whether products contain PFAS and are suitable for use in the field, the tiered approach presented in Table 2 will be used to assist with field decisions. Any member of the field team should contact the project manager with questions.

Table 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited Items	Acceptable Items
Field Equipment	
Teflon® containing materials	High-density polyethylene (HDPE) materials
Storage of samples in containers made of LDPE materials	Acetate liners, HDPE bottles
Teflon® tubing	HDPE or silicone tubing
Waterproof field books not manufactured by Rite in the Rain	Rite in the Rain products or Loose paper (non-waterproof)
Plastic clipboards, binders, or spiral hard cover notebooks	Aluminum field clipboards or with Masonite
Sharpies®, if possible	Ballpoint pens
Post-It Notes	
Chemical (blue) ice packs	Regular ice
Excel Purity Paste TFW Multipurpose Thread Sealant Vibra-Tite Thread Sealant	Gasoils NT Non-PTFE Thread Sealant Bentonite
Equipment with Viton Components (need to be evaluated on a case by case basis, Viton contains PTFE, but may be acceptable if used in gaskets or O-rings that are sealed away and will not come into contact with sample or sampling equipment.)	

Field Clothing and PPE	
New clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed three or more times after purchase, made of synthetic or natural fibers (preferable cotton)
Clothing laundered using fabric softener	
Boots containing Gore-Tex™	Boots made with polyurethane and PVC, well-worn or untreated leather boots, leather boots with boot covers
	Reflective safety vests, Tyvek®, Cotton Clothing, synthetic under clothing, body braces
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/showering routine on the morning of sampling, unless the products are applied to body parts that will be covered by clothing.	**Sunscreens -** Alba Organics Natural Sunscreen, Yes to Cucumbers, Aubrey Organics, Jason Natural Sun Block, Kiss my face, Baby sunscreens that are "free" or "natural" **Insect Repellents -** Jason Natural Quit Bugging Me, Repel Lemon Eucalyptus Insect repellant, Herbal Armor, California Baby Natural Bug Spray, BabyGanics, Deep Woods Off **Sunscreen and insect repellant -** Avon Skin So Soft Bug Guard Plus – SPF 30 Lotion
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
Teflon®-lined caps	Lined or unlined HDPE or polypropylene caps
Rain Events	
Waterproof or resistant rain gear	Polyurethane, vinyl, wax or rubber-coated rain gear. Gazebo tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90	Alconox® and/or Liquinox® (Do not use Liquinox® if also sampling for 1,4-dioxane).
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e. Gatorade® and Powerade®) to be brought and consumed only in the staging area

Table 2. Tiered Approach

Tier and Description	Action
Tier 1: Products that *will come into direct contact* with field samples include, but are not limited to, drilling grease, sampling equipment, sample containers, and well construction materials	These products will undergo the greatest scrutiny and requires chemist's input to help evaluate the materials as a possible source of contamination[A] and as possible sampling and/or storage materials
Tier 2: Products that *will not come into direct contact* with samples, but could be *reasonably expected to contain PFAS*, such as waterproof or nonstick products	Project team/affected person can review the Safety Data Sheet (SDS)[B] and if it shows PFAS, product should not be used. If product SDS does not indicate PFAS, confirm with chemist before use

Tier 3: Products that *will not come into direct contact* with samples and are *not expected to contain PFAS*, such as ballpoint pens, zipper bags, and body braces	Project team/affected person can review SDS and if no PFAS, then appropriate to use

[A] Tier 1 products will undergo the closest scrutiny. It may be necessary to have Tier 1 products analyzed for PFAS to confirm that a specific batch or lot number does not contain PFAS. Alternate products will need to be evaluated/used if PFAS are identified in the product.

[B] SDS Check: To evaluate product SDS and/or manufacturing specs, check if the product contains anything with "fluoro" in the name or the acronyms TPE, FEP, ETFE, and/or PFA. If fluorinated compounds are not listed in the manufacturing specs and/or on the SDSs, product can be used.

5.0 ATTACHMENTS

Daily PFAS Protocol Checklist Record

NYSDEC Guidelines for Sampling and Analysis of PFAS

DAILY PFAS PROTOCOL CHECKLIST RECORD

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME	DATE
PROJECT NUMBER	START TIME
INSTALLATION	WEATHER

Field Clothing and PPE (as applicable):

- ☐ Field crew in compliance with Tables 1 and 2, SOP S6
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning
- ☐ Field crew has not applied unacceptable sunscreen or insect repellant

Field Clothing and PPE (as applicable):

- ☐ No Teflon® containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site other than Rite-in-the-Rain® Products
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-it® Notes) on-site
- ☐ Coolers filled with regular ice only. No chemical (blue) ice packs in possession

Sample Containers:

- ☐ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☐ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable):

- ☐ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of Vinyl, polyurethane, PVC, latex or rubber-coated materials only

Equipment Decontamination:

- ☐ "PFAS-free" water on-site for decontamination of sample equipment
- ☐ Alconox and Liquinox to be used as decontamination materials

Food and Drink

- ☐ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Lead shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFC sample protocols will result in the permanent removal of worker(s) from the investigation area.

Describe the noncompliance issues (include personnel not in compliance) and action/outcome of noncompliance:

Sampler Signature: Print Name:

Checked By: Date:

NEW YORK STATE OF OPPORTUNITY. | Department of Environmental Conservation

GUIDELINES FOR SAMPLING AND ANALYSIS OF PFAS

Under NYSDEC's Part 375 Remedial Programs

January 2020

www.dec.ny.gov

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ERRATA SHEET for

Guidelines for Sampling and Analysis of PFAS Under NYSDEC's Part 375 Program
Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date

Guidelines for Sampling and Analysis of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis and reporting of PFAS, DER has developed this document to summarize procedures and update previous DER technical guidance pertaining to PFAS.

Applicability

Sampling for PFAS has already been initiated at numerous sites under DER-approved work plans, in accordance with specified procedures. All future work plans should include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day or one per twenty samples, whichever is more frequent.

Data Assessment and Application to Site Cleanup

Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10.

Water Sample Results

PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt). In addition, further assessment of water may be warranted if either of the following screening levels are met:

a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or
b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L

If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase.

Sites in the site management phase should evaluate for PFAS to determine if modification to any components of the SMP is necessary (e.g., monitoring for PFAS, upgrading treatment facilities, or performing an RSO).

Testing for Imported Soil

Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the *PFAS Analyte List* (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs.

If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Analysis and Reporting

As of January 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix F) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP) does not offer certification for PFAS in matrices other than finished drinking water. However, laboratories analyzing environmental samples for PFAS (e.g., soil, sediments, and groundwater) under DER's Part 375 remedial programs need to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537.1 or ISO 25101. Laboratories should adhere to the guidelines and criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids). Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist.

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay). Commercially methods are also available for biota and air samples.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.

Please note that TOP Assay analysis of highly-contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
  - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP-approved lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an “Analytical Methods/Quality Assurance Summary Table” specifying:
  - Matrix type
  - Number or frequency of samples to be collected per matrix
  - Number of field and trip blanks per matrix
  - Analytical parameters to be measured per matrix
  - Analytical methods to be used per matrix with minimum reporting limits
  - Number and type of matrix spike and matrix spike duplicate samples to be collected
  - Number and type of duplicate samples to be collected
  - Sample preservation to be used per analytical method and sample matrix
  - Sample container volume and type to be used per analytical method and sample matrix
  - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by LC-MS/MS for PFAS using methodologies based on EPA Method 537.1
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
  - Reporting Limits should be less than or equal to:
    - Aqueous – 2 ng/L (ppt)
    - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
- Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537.1, EPA Method 533, or ISO 25101
- Include detailed sampling procedures
  - Precautions to be taken
  - Pump and equipment types
  - Decontamination procedures
  - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification. Previous results of "non-detect" for PFAS from the UCMR3 water supply testing program are acceptable as verification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., wash room sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank every day that sampling is conducted and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the latest guidelines developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8).

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

1. Project and Site Name.

2. DEC Region.

3. All personnel (and affiliation) involved in the collection.

4. Method of collection (gill net, hook and line, etc.)

5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

3. Date collected.

4. Sample location (waterway and nearest prominent identifiable landmark).

5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate "Age" column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish's tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **<u>The Bureau of Ecosystem Health will supply the bags.</u>** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **<u>The Bureau of Ecosystem Health will supply the larger bags</u>.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

    No materials containing Teflon.
    No Post-it notes.
    No ice packs; only water ice or dry ice.
    Any gloves worn must be powder free nitrile.
    No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
    No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
    Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
    Wash hands after handling any food containers or packages as these may contain PFCs. Keep pre-wrapped food containers and wrappers isolated from fish handling.
    Wear clothing washed at least six times since purchase.
    Wear clothing washed without fabric softener.
    Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with "fluor" in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name ____ DEC Region ____________

Collections made by (include all crew) ____

Sampling Method: ☐Electrofishing ☐Gill netting ☐Trap netting ☐Trawling ☐Seining ☐Angling ☐Other ____________________

Preservation Method: ☐Freezing ☐Other ____________________ Notes (SWFDB survey number): ____________________

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, ______________________________, of ____ collected the
(Print Name) (Print Business Address)

following on ____________________, 20____ from ____
(Date) (Water Body)

in the vicinity of ____
(Landmark, Village, Road, etc.)

Town of _______________________________________, in _________________________________ County.

Item(s) ____

____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on ____________________________________, 20______.

____ ___________________________
Signature Date

I, __________________________________, received the above mentioned sample(s) on the date specified and assigned identification number(s) ____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_______________________________________ ___________________
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) developed the following guidelines for laboratories analyzing environmental samples for PFAS under DER programs. If laboratories cannot adhere to the following guidelines, they should contact DER's Quality Assurance Officer, Dana Maikels, at dana.maikels@dec.ny.gov prior to analysis of samples.

Isotope Dilution

Isotope dilution techniques should be utilized for the analysis of PFAS in all media.

Extraction

For water samples, the entire sample bottle should be extracted, and the sample bottle rinsed with appropriate solvent to remove any residual PFAS.

For samples with high particulates, the samples should be handled in one of the following ways:

1. Spike the entire sample bottle with isotope dilution analytes (IDAs) prior to any sample manipulation. The sample can be passed through the SPE and if it clogs, record the volume that passed through.
2. If the sample contains too much sediment to attempt passing it through the SPE cartridge, the sample should be spiked with isotope dilution analytes, centrifuged and decanted.
3. If higher reporting limits are acceptable for the project, the sample can be diluted by taking a representative aliquot of the sample. If isotope dilution analytes will be diluted out of the sample, they can be added after the dilution. The sample should be homogenized prior to taking an aliquot.

If alternate sample extraction procedures are used, please contact the DER remedial program chemist prior to employing. Any deviations in sample preparation procedures should be clearly noted in the case narrative.

Signal to Noise Ratio

For all target analyte ions used for quantification, signal to noise ratio should be 3:1 or greater.

Blanks

There should be no detections in the method blanks above the reporting limits.

Ion Transitions

The ion transitions listed below should be used for the following PFAS:

PFOA	413 > 369
PFOS	499 > 80
PFHxS	399 > 80
PFBS	299 > 80
6:2 FTS	427 > 407
8:2 FTS	527 > 507
N-EtFOSAA	584 > 419
N-MeFOSAA	570 > 419

Branched and Linear Isomers

Standards containing both branched and linear isomers should be used when standards are commercially available. Currently, quantitative standards are available for PFHxS, PFOS, NMeFOSAA, and NEtFOSAA. As more standards become available, they should be incorporated in to the method. All isomer peaks present in the standard should be integrated and the areas summed. Samples should be integrated in the same manner as the standards.

Since a quantitative standard does not exist for branched isomers of PFOA, the instrument should be calibrated using just the linear isomer and a technical (qualitative) PFOA standard should be used to identify the retention time of the branched PFOA isomers in the sample. The total response of PFOA branched and linear isomers should be integrated in the samples and quantitated using the calibration curve of the linear standard.

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated for each target analyte and the ratio compared to standards. Lab derived criteria should be used to determine if the ratios are acceptable.

Reporting

Detections below the reporting limit should be reported and qualified with a J qualifier.

The acid form of PFAS analytes should be reported. If the salt form of the PFAS was used as a stock standard, the measured mass should be corrected to report the acid form of the analyte.

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report. Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Maikels, at dana.maikels@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 14 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of five standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%. Linear fit calibration curves should have an R^2 value greater than 0.990.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects
R^2 >0.990	J flag detects and UJ non detects
Low-level calibration check <50% or >150%	J flag detects and UJ non detects
Mid-level calibration check <70% or >130%	J flag detects and UJ non detects

Initial Calibration Verification

An initial calibration verification (ICV) standard should be from a second source (if available). The ICV should be at the same concentration as the mid-level standard of the calibration curve.

ICV recovery <70% or >130%	J flag detects and non-detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Secondary Ion Transition Monitoring

Quantifier and qualifier ions should be monitored for all target analytes (PFBA and PFPeA are exceptions). The ratio of quantifier ion response to qualifier ion response should be calculated from the standards for each target analyte. Lab derived criteria should be used to determine if the ratios are acceptable. If the ratios fall outside of the laboratory criteria, qualify results as an estimated maximum concentration.

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Branched and Linear Isomers

Observed branched isomers in the sample that do not have a qualitative or quantitative standard should be noted and the analyte should be qualified as biased low in the final data review summary report. Note: The branched isomer peak should also be present in the secondary ion transition.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

SOP # S7

MACTEC STANDARD OPERATING PROCEDURE #S7

SURFACE WATER SAMPLING

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27,2020

Charles Staples, PG, Program Technical Lead

Date

Reviewed

Date

SURFACE WATER SAMPLING

1.0 PURPOSE

The purpose of this technical procedure is to describe the methodology for collecting surface water samples for laboratory analyses and the associated water quality measurements.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data record.

2.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 1987, *Compendium of Superfund Field Operations Methods*, EPA 540/P-87/001a, OSWER 9355.0-14, September.

EPA, 1988, *EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA*, Interim Final OSWER Directive 9355.3-01, August.

De Vera, E.R., B.P. Simians, R.D. Stephens, and D.L. Storm. 1990. *Samplers and Sampling Procedures for Hazardous Waste Streams*. EPA-600/2-80-018.

Korte, N. and P. Kearl. 1984. *Procedures for the Collection and Preservation of Groundwater and Surface Water Samples and for the Installation of Monitoring Wells*. U.S. Department of Energy, Grand Junction, Colorado.

3.0 DEFINITIONS

Surface water – Includes all water on the surface of the ground directly exposed to the atmosphere, including, but not limited to, lakes, ponds, reservoirs, artificial impoundments, streams, rivers, springs, seeps, and wetlands.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with surface water sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

Surface water samples may be collected either as composite or discrete samples, as described. Actual sampling locations will be confirmed in the field prior to initiation of the sampling program. Samplers should anticipate accommodating on-site adjustment to changing field conditions. When surface water and sediment samples are collected from the same location, water samples shall be collected first. Refer to **Sediment Sampling SOP (Table A-1)** for sediment sample collection guidance.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

4.2 Preparation

Equipment Selection

For most sites, a decontaminated bottle sampler attached to a pole (e.g. polyvinyl chloride [PVC] pipe) can be used as the sampling device, or the sample container itself can serve as the sampling device.

There are several more sophisticated sampling devices that can be used to collect water at discrete depths in deep bodies of water (e.g. Van Dorn, Kemmerer). However, for most routine site investigations of shallow lakes, ponds, and streams, this equipment is not necessary.

The following equipment will typically be used during surface water sampling:

- Water Quality Meter for measuring pH, temperature, conductivity (and/or specific conductance), dissolved oxygen (DO) and oxidation/reduction potential (ORP), and a standalone turbidity meter (e.g. Hach),
- Calibration solutions for the water quality parameter probes
- Laboratory-provided sample containers,
- Self-adhesive sample bottle labels,
- High-density polyethylene (HDPE) or stainless-steel, dippers, bailers or another sampling device,
- Appropriate personal protective equipment (PPE) and other health and safety equipment specified in the Health and Safety Plan,

- Previous field notes and blank field data sheets (e.g., sample collection form and Chain of Custody),
- Pen with indelible ink,
- Plastic bags,
- Cooler with ice and,
- GPS receiver (if required).

Pre-Sample Planning

In general, surface water sample locations may include shallow or deep lakes, ponds and other types of impoundments, creeks and streams, ditches, low-lying areas, and intermittently wet drainage areas. These bodies of water may receive contaminant input from surface runoff; groundwater; or from direct discharge through a sluice, ditch, or pipe.

If current information is not available, conduct a reconnaissance of all surface water sample locations to determine accessibility to the water body, depth of water, dangerous conditions (strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.), and sampling and personal protection equipment selection criteria. Access to water bodies such as streams may be hampered by thick vegetation, and lakes and ponds that will require the use of a boat may not be accessible by road. Therefore, the logistics of getting sampling equipment and containers to and from the sites must be considered before attempting to sample.

Surface water samples should not be collected sooner that 24-hours after heavy rains because they will not be representative samples reflecting normal (i.e., baseline) conditions.

Surface water samples should be collected from downstream to upstream locations so that if sediments are disturbed it will not affect the subsequent samples. When surface water samples are collected at sediment sample locations, the surface water sample should be collected prior to the sediment sample (which will suspend the fines), no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column.

4.3 Sample Location Selection Considerations

Streams, Tributaries, and Creeks

In moving water bodies such as streams, tributaries, and creeks, sample points should be located where the water is homogeneous both horizontally and vertically. Samples should be taken far enough downstream from the source input for the discharge to be completely mixed. Locations immediately below riffle areas will be vertically mixed and narrow channel areas promote horizontal or cross-channel mixing. Sampling should take place downstream of riffle areas and narrow channel areas where low flow and minimal turbulence conditions are present. The selection of strategically located sample sites may depend on several factors, such as homogeneity, accessibility, intake points for water supplies, stream velocity, and geomorphology.

In general, a single grab sample collected at mid-depth in the center of the channel is adequate to represent the entire mixed cross-section of small streams less than 20 feet wide. If vertical profile samples are specified in the site-specific Field Activities Plan (FAP) for larger and deeper streams or creeks, these samples should be taken from mid-stream just below the surface, at mid-depth, and just above the bottom and composited. The pH, temperature, specific conductivity, and dissolved oxygen should be measured for each sample point when vertical composite samples are collected. Water depth can either be measured with a graduated staff (e.g. yardstick) at shallow depths or with one of various manual or electronic devices available for deeper depths.

Stagnant areas or pools in a stream or creek could contain different contaminant concentrations from the flowing areas, depending on the physical and chemical properties of the contaminant and the proximity of these areas to the source. A sample may be taken at mid-depth to determine if these areas represent contaminant sinks.

Lakes, Lagoons, Ponds, and Impoundments

The selection of representative sample points in standing bodies of water depends on the size, shape, and depth of the basin, and will be specified in the site-specific FAP. Samples can be collected along a vertical transect and/or horizontal grid. The site-specific work plan will designate whether a single mid-point sample, vertical profile samples, or discrete depth samples are required. In larger basins, stratification may inhibit uniform vertical mixing. In these instances, discrete depth samples may be collected at each stratification layer. In smaller basins, such as ponds, lagoons, and impoundments, the entire water column is generally uniformly mixed and one sample at the deepest point may be adequate. The deepest point is usually in the center of small ponds and other containment catch basins. For impoundments with a dam, the deepest point is generally near the base of the dam. Water depth can either be measured with a graduated staff (e.g. yardstick) at shallow depths or with one of various manual or electronic devices for deeper depths.

Wading into the water body to collect samples is not recommended in shallow lakes and ponds. Wading will disturb bottom sediments, which may contaminate the water column resulting in a false positive parameter result. Therefore, a boat is typically used to collect representative water samples in lakes, lagoons, ponds, and impoundments.

4.4 Field Procedures

Sampling Procedures

Laboratory-provided sample containers will be used to directly collect water samples if sample containers do not contain preservatives. Where required by site conditions, remote sampling into sample containers will be allowed by clamping the container onto the end of a clean extension rod. The extension rod must be made of material that does not include contaminants of interest.

Beakers or dippers (i.e. transfer containers), which may be attached to extension rods, may be used if sample containers have preservatives or remote sampling site conditions prevent sampling by direct sample container immersion. The beakers or dippers will be obtained from a scientific instrument supplier so that the material composition of such a sampling container may be documented. The selected type of transfer device, the composition of this device, and the volume of the device will be recorded on a sample field data record (FDR) (example **attached**). Alternatively, tubing may be affixed to the extension rod with a sample collected using a peristaltic pump. Bailers may be used if direct access to the sampling point can be reached. Sample transfer containers must be disposable or decontaminated prior to each use. Discrete depth sampling devices may be used when the site-specific FAP directs that specific depth intervals be sampled.

Water quality parameter measurements shall be made using instrumentation and a commercially manufactured flow through cell or direct immersion of the probes into the surface water body. Water quality parameter instruments will be calibrated daily as per the manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (example **attached**).

Equipment Decontamination

Before sampling begins, reusable sampling devices (e.g. metal bailers, beakers, dippers, etc.) shall be decontaminated. Mobile decontamination supplies may be utilized so that equipment can be decontaminated on-site. Each piece of sampling equipment shall be decontaminated before sampling operations and between sampling locations. Decontamination of field equipment will be performed in accordance with the **Equipment Decontamination SOP (Table A-1)**. Typically, decontamination will consist of scrubbing equipment with potable water and Alconox® followed by a scrub with deionized (DI) water and a final DI water rinse. The FAP should specify decontamination requirements.

General Surface Water Sampling Procedures

- Samples will be collected first from areas that are suspected of being the least contaminated to minimize the risk of sample cross-contamination. Typically, in flowing water bodies, sampling shall progress from downstream to upstream to avoid sediment disturbance affecting subsequent samples.
- Prior to sampling, the water body characteristics (e.g. size and depth) should be observed and described in the field logbook. Observations that should be noted include:
  - Estimate of surface area of water body
  - Surface water and site conditions (e.g. floating oil or debris, gassing)
  - Location of any discharge pipes, sewers, or tributaries
  - Weather observations (e.g. wind speed, is it sunny or cloudy, and approximate wave height)

- Collect X-Y coordinates of the sample location using a portable global positioning system (GPS) instrument. If a GPS is ineffective due to the terrain or tree canopy, mark the location in the field with a stake or flag and document the location in the field logbook to allow identification of location on aerial photograph, if possible.

- Don a clean pair of nitrile or equivalent gloves.
- Surface debris (i.e. sticks, leaves, vegetation) will be cleared from the sample location prior to sample collection, taking care not to disturb bottom or bank sediments.
- Measure water quality parameters (pH, dissolved oxygen, specific conductivity, and temperature) at each sample location prior to collecting a water sample. Samples for water quality parameters will be collected either through direct immersion of water quality probe or collection of water in a separate container at a like location and depth as the samples for laboratory analysis.
- Collect the sample in accordance with the appropriate method-specific procedures outlined in section 4.5 of this SOP.
- Identify, handle, and document the samples in accordance with the QAPP and the **Chain of Custody SOP (Table A-1)**.
- Document the sampling event on a Surface Water Sample FDR. Including:
    - Distance of sample collection point from right or left edge of water (include cardinal direction).
    - Water depth.
    - Sample depth interval.
    - Sample collection method (grab, discrete)

Note: Collection of surface water samples in deep-water areas may require the use of a boat. The Health and Safety Manager or Site Coordinator shall be consulted for additional health and safety requirements.

4.5 Method Specific Sample Collection Procedures

Samples Collected by Container Immersion

Surface water sample collection by container immersion will be conducted in accordance with the following procedures:

- The outside of all capped sample containers shall be triple rinsed with the surface water being sampled before filling the containers with the sample to be analyzed.
- Submerge the sample container or transfer container below the water surface with minimal surface disturbance and with the open end pointed upstream.
- If possible, the sample container or transfer container will be lowered no closer than 3 to 6 inches above the bottom sediments.
- Note: sample containers with preservatives should not be collected by the container immersion method.

Samples Collected by Dipper

Surface water sample collection with a dipper on an extension rod will be conducted in accordance with the following procedures:

- A disposable dipper or decontaminated dipper container will be used.
- Depth of water at each sampling site will be measured and the dipper will be lowered using the extension rod to the appropriate sampling location in accordance with the FAP.
    - If possible, the dipper will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The dipper will be inserted facing downstream and withdrawn very slowly and carefully to avoid agitation of the bottom sediments; and
- Transfer the sample from the dipper directly into the sample container. Minimize aeration of the sample as much as possible.

Samples Collected by Peristaltic pump

Surface water sample collection with a peristaltic pump will be conducted in accordance with the following procedures:

- Disposable tubing will be attached (e.g. zip tied) to a decontaminated extension rod.
- Depth of water at each sampling site will be measured and the tubing intake will be lowered to the appropriate sampling location in accordance with the FAP.
    - If possible, the tubing intake will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The tubing will be connected to the peristaltic pump head and pre-sample purging will begin.
    - an appropriate purge rate will be selected to avoid disturbance of the bottom sediments and to prevent volatilization of the sample
    - Purging will occur for a minimum of time to completely purge the tubing volume 5x, generally 1 minute of purging will suffice
- The sample will be collected by pumping directly into the sample container.

Samples Collected by Bailer

Surface water sample collection with a bailer will be conducted in accordance with the following procedures:

- A disposable HDPE bailer or equivalent will be used.

- Depth of water at each sampling site will be measured and the bailer will be lowered to the appropriate sampling location in accordance with the FAP.
- If possible, the bailer will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The bailer will be inserted facing downstream and withdrawn very slowly and carefully to avoid agitation of the bottom sediments; and,
- Transfer the sample from the bailer directly into the sample container. Minimize aeration of the sample as much as possible.

Samples Collected by Discrete Depth Sampling Devices

Surface water sample collection with a discrete depth sampling device will be done in accordance with the following procedure:

- A Van Dorn, Kemmerer sampler or equivalent will be used.
- Depth of water at each sampling site will be measured and the sampling device will be lowered to the appropriate sampling depth in accordance with the site-specific work plan.
- If possible, the sampling device will be lowered no closer than 3 to 6 inches above the bottom sediments.
- The sampling device will be lowered facing upstream and opened once at the desired sampling depth. The device will be withdrawn very slowly and carefully to avoid agitation of the bottom sediments.
- Transfer the sample from the device directly into the sample container. Minimize aeration of the sample as much as possible.

5.0 ATTACHMENTS

Water Grab Sampling Record

Surface Water and Sediment Sampling Record

Field Instrument Calibration Record

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

PROJECT NAME		SAMPLE LOCATION	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/NUMBER	PAGE OF

SURFACE WATER DATA

WATER DEPTH AT SAMPLE LOCATION ________ FT. DEPTH OF SAMPLE BELOW WATER SURFACE ________ FT. FLOW RATE ________ ML/MIN

WATER QUALITY PARAMETERS:

- TEMPERATURE ________ °C
- SPEC. COND. ________ mS/cm
- PH ________ pH Units
- ORP ________ mV
- TURBIDITY ________ NTUs
- DO ________ mg/L
- ☐ WINKLER METHOD
- ☐ DO PROBE

EQUIPMENT USED:

- ☐ BEAKER
- ☐ BOTTLE
- ☐ PACS BOMB
- ☐ PUMP ________
- ☐ FILTER
- No. ______ Type: ________
- ☐ FIELD DUPLICATE COLLECTED

DUP. ID ________

TYPE OF SURFACE WATER:

- ☐ STREAM
- ☐ RIVER
- ☐ LAKE
- ☐ POND
- ☐ SEEP
- ☐ ________

FIELD SKETCH SHOWN/ATTACHED

☐ YES ☐ NO

DECON FLUIDS USED

- ☐ ALL USED
- ☐ LIQUINOX/DI H_2O SOLUTION
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ 25% METHANOL/75% ASTM TYPE II H_2O
- ☐ ETHYL ALCOHOL
- ☐ ________

SAMPLING EQUIPMENT

WATER QUALITY METER MODEL NO. ________ UNIT ID NO. ________

TURBIDITY METER MODEL NO. ________ UNIT ID NO. ________

SEDIMENT SAMPLE INFORMATION

TYPE OF SAMPLE

- ☐ DISCRETE
- ☐ COMPOSITE

SAMPLE INTERVAL:

TOP ________

BOTTOM ________

COLLECTION EQUIPMENT

- ☐ HAND AUGER/CORER
- ☐ S.S. SPLIT BARREL
- ☐ ALUMINIUM PAN
- ☐ S.S. SHOVEL
- ☐ HAND SPOON/SPATULA
- ☐ S.S. BUCKET
- ☐ OTHER ________

DECON FLUIDS USED

- ☐ ALL USED
- ☐ LIQUINOX/DI H_2O SOLUTION
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ 25% METHANOL/75% ASTM TYPE II H_2O
- ☐ ETHYL ALCOHOL

QC SAMPLES

- ☐ DUPLICATE ________
- ☐ EQ BLK ________

MS/MSD:

- ☐ YES
- ☐ NO

TYPE OF MATERIAL:

- ☐ ORGANIC
- ☐ SAND
- ☐ GRAVEL
- ☐ CLAY
- ☐ FILL
- ☐ OTHER________

SAMPLE OBSERVATIONS

ODOR ________

COLOR ________

OTHER ________

PID ________

FIELD SKETCH SHOWN/ATTACHED

- ☐ YES
- ☐ NO

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							

NOTES/SKETCH

Sampler Signature: Print Name:

Checked By: Date:

Deviations from the work Plan:

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ____

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^{o}C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% or <10 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure (SF) max (ex. 1.686 = 1.69)
pH: nearest tenth (ex. 5.53 = 5.5)
DO: nearest tenth (ex. 3.51 = 3.5)
TURB: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101)
ORP: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP	DECON FLUIDS USED	TUBING/PUMP/BLADDER MATERIALS		EQUIPMENT USED
☐ PERISTALTIC	☐ ALCONOX	☐ SILICON TUBING	☐ S. STEEL PUMP MATERIAL	☐ WL METER ____
☐ SUBMERSIBLE	☐ DEIONIZED WATER	☐ HDPE TUBING	☐ PVC PUMP MATERIAL	☐ PID ____
☐ BLADDER ____	☐ POTABLE WATER	☐ LDPE TUBING	☐ GEOPROBE SCREEN	☐ WQ METER ____
☐ PDB	☐ NITRIC ACID	☐ OTHER ____	☐ OTHER ____	☐ TURB. METER ____
☐ HYDRASLEEVE ____	☐ HEXANE	☐ OTHER ____	☐ OTHER ____	☐ PUMP ____
☐ OTHER ____	☐ METHANOL		☐ OTHER ____	☐ OTHER ____
	☐ OTHER ____			☐ FILTERS NO. ____ TYPE ____

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ____

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

Sampler Signature: Print Name:

Checked By: Date:

DEVIATIONS FROM THE WORK PLAN:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ______ TASK NO: ______ DATE: ______
PROJECT NUMBER: ______ MACTEC CREW: ______
PROJECT LOCATION: ______ SAMPLER NAME: ______
WEATHER CONDITIONS (AM): ______ SAMPLER SIGNATURE: ______
WEATHER CONDITIONS (PM): ______ CHECKED BY: ______ DATE: ______

MULTI-PARAMETER WATER QUALITY METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

AM CALIBRATION Start Time ______/End Time______
POST CALIBRATION CHECK Start Time ______/End Time______

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	______	+/- 0.1 pH Units			
pH (7)	SU	7.0	______	+/- 0.1 pH Units	7.0	______	+/- 0.3 pH Units
pH (10)	SU	10.0	______	+/- 0.1 pH Units			
Redox	+/- mV	240	______	+/- 10 mV	240	______	+/- 10 mV
Conductivity	mS/cm	1.413	______	+/- 0.5 % of standard	1.413	______	+/- 5% of standard
DO (saturated)	%	100	______	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	______	______	+/- 0.2 mg/L	______	______	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	______	< 0.5 mg/L			
Temperature	°C		______			______	
Baro. Press.	mmHg		______			______	

TURBIDITY METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	______	<0.1	______	+/- 0.3 NTU of stan.
20 Standard	NTU	20	______	20	______	+/- 5% of standard
100 Standard	NTU	100	______	100	______	+/- 5% of standard
800 Standard	NTU	800	______	800	______	+/- 5% of standard

PHOTOIONIZATION DETECTOR
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

Background	ppmv	<0.1	______	<0.1	______	within 5 ppmv of BG
Span Gas	ppmv	100	______	100	______	+/- 10% of standard

O_2-LEL 4 GAS METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

Methane	%	50	______	50	______	+/- 10% of standard
O_2	%	20.9	______	20.9	______	+/- 10% of standard
H_2S	ppmv	25	______	25	______	+/- 10% of standard
CO	ppmv	50	______	50	______	+/- 10% of standard

OTHER METER
METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.
☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ______
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45μm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ______
- Other ______
- Other ______

	Cal. Standard Lot Number	**Exp. Date**
pH (4)	______	______
pH (7)	______	______
pH (10)	______	______
ORP	______	______
Conductivity	______	______
<0.1 Turb. Stan.	______	______
20 Turb. Stan.	______	______
100 Turb. Stan.	______	______
800 Turb. Stan.	______	______
PID Span Gas	______	______
O_2-LEL Span Gas	______	______
Other	______	______

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S8

MACTEC STANDARD OPERATING PROCEDURE #S8

CHAIN OF CUSTODY PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________	April 27,2020
Bradley LaForest, NRCC-EAC, Project Manager	Date

Reviewed	Date
____________________	____________________
____________________	____________________
____________________	____________________

CHAIN OF CUSTODY PROCEDURES

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the chain of custody (COC) procedures and sample handling considerations when collecting environmental samples at a site. This SOP also describes a tiered approach that should be used to assist with field decisions. This procedure applies to all MACTEC personnel and subcontractors who collect or otherwise handle samples of environmental samples and should be reviewed by all on-site personnel prior to implementation of field activities.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in planning or in the execution of planned activities must be approved by the project manager.

2.0 REFERENCES

American Society for Testing and Materials. 1996. Standard Guide for Sampling Chain-of-Custody Procedures. D 4840-95.

3.0 DEFINITIONS

COC Record – legal documentation of custody of sample materials and instructions for analytical laboratory.

Custody – physical possession or control. A sample is under custody if it is in possession or under control so as to prevent tampering or alteration of its characteristics.

Sample Label – a record attached to samples to ensure legal documentation of traceability.

4.0 PROCEDURES

Field data sheets and COC records must be completed by the appropriate sampling personnel for each sample. The objectives of the MACTEC COC program are to ensure:

- Samples are uniquely identified.
- samples are collected for all scheduled analyses.
- the correct samples are analyzed for requested analyses and are traceable to their records.
- descriptions of important sample characteristics and field observations are recorded.
- samples are protected from loss and/or are identified if damaged.
- alteration of samples (e.g., filtration, preservation) is documented.
- a forensic record of sample integrity is established.

- sample security is maintained; and
- relevant field information is recorded including location, sample number, date and time, identification of field samples, and individuals collecting the samples.

Field data records (FDRs), sample labels and COC forms are used to document identification and handling of samples from the time of collection through the completion of chemical analysis. In some projects, analytical data may be used in litigation. Accountability of the history of a sample must be available to demonstrate that the data are a true representation of the environment. The COC record is used as evidence in legal proceedings to demonstrate that a sample was not tampered with or altered in any way that may bias the analytical accuracy of the laboratory results. It is extremely important that COC records be complete, accurate and consistent.

4.1 Responsibilities

Project Manager

The project manager (PM) shall provide the Quality Assurance Program Plan (QAPP) and is responsible for the overall compliance with this SOP.

Field Operations Lead

The field operations lead (FOL) shall ensure that the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the shipper or laboratory (i.e., on-site or off-site).

Field Personnel

Field personnel (sample collectors) shall ensure the samples are correctly collected, labeled, tracked by chain-of-custody, and stored until they are delivered directly to the FOL or laboratory (i.e. on-site or off-site). The sample collector shall maintain custody of the samples until they are relinquished to the FOL or laboratory. The sample collector shall be responsible for informing the FOL of sampling conditions and if any of the samples are potentially hazardous. Appropriate comments should be made on the COC form to inform the laboratory of potentially hazardous samples which will provide a more efficient testing method.

4.2 COC Protocol Consideration

The COC protocol followed by the sampling personnel involves the following steps:

- recording sampling locations, sample bottle identification, and specific sample collection procedures on the appropriate field data records.
- using pre-prepared sample labels that contain all information necessary for effective sample tracking; and
- completing standard COC forms to establish analytical sample custody in the field before sample shipment.

Sample Custody

Sample custody procedures are designed to ensure that sample integrity is maintained from collection to final disposition. A critical aspect of sound sample collection and analysis protocols is the maintenance of strict COC procedures as described in this SOP. COC procedures include tracking and documentation during sample collection, shipment, and laboratory processing. A sample is considered to be in an individual's custody if it is (1) in the physical possession of the responsible party; (2) in view of the responsible party after being in their possession (3) secured to prevent tampering; or (4) placed in a designated, secure area that is controlled and restricted by the responsible party.

Custody will be documented throughout all sampling activities on the COC record for each day of sampling. This record will accompany the samples from the site to the laboratory. FOLs or other designated personnel are required to sign, date, and note on the record the time when relinquishing samples from their custody. Any discrepancies will be noted at this time. Samples will be shipped to subcontract laboratories via overnight air courier (e.g. FedEx or other approved shipping carrier). Shipping tracking numbers will be used as custody documentation during this time and will be retained as part of the permanent sample custody documentation. In some cases, samples may be hand delivered to the laboratory; hand delivery will be noted on the COC form. The subcontractor laboratory is responsible for sample custody once samples are received.

Sample Labels

Each sample container will be affixed with a self-sticking, waterproof, adhesive label. Each contracted laboratory will provide sample labels for every sample container. Each label shall be completed with a pen of indelible ink and contain the following information:

- Client Name: MACTEC
- Site Name: “Site Name” for the sampling event
- Client Sample ID: 828133-SD30, for example
- Date collected: (month/day/year)
- Sample Time given as military time (for example: 1400)
- Name/Initials of Collector: MACTEC Field Sampler
- Analytical method/analyte request (for example, VOCs - 8260)
- Preservative: (for example – None, HNO3, H2SO4, NaOH, HCl, Na2S2O3, or Other)

COC Record

COC forms will be used to document the integrity of all samples to maintain a record of sample collection, transfer of samples between personnel, shipment of samples, and receipt of samples at the laboratory, COC forms will be filled out for each sample/analysis at each sampling location. The COC forms shall include the following information:

- Project name and project number if applicable.
- Project PM contact information.
- Name and address of laboratory to receive the samples.

- COC control number.
- Sample type, sample method.
- Location ID, sample ID.
- Sample collection date and time.
- Matrix code.
- Analyses requested.
- Field QC for matrix spike (MS)/matrix spike duplicate (MSD), if applicable.
- Container type, size and number.
- Preservatives used.
- Data deliverable type.
- Field sampling personnel names and initials.
- Turn-around-time for laboratory analysis; and,
- Comments to the laboratory, if applicable.

The FOL will perform the following duties:

- Receive the samples from the sample collector(s).
- Check sample labels against the FDRs or other sample collection documentation.
- Complete the COC entry for each sample.
- Sign and enter the date and time relinquished to the shipper; and,
- Prepare the samples for shipment from the field to the laboratory.

The FOL will sign the "Sampled By" and "Relinquished By" fields on the COC record, marking the date and time custody is transferred to the shipping agency or other authorized person (e.g. courier or laboratory).

Any corrections to the COC form entries will be made by a single-line strike mark through the incorrect item, and then entering the correct entry adjacent to the strikeout item. Corrections will be initialed and dated by the person making the change.

The original COC will be sealed in a plastic bag and taped to inside lid of the shipping container (e.g. sample cooler). A copy of the COC will be sent to the PM as a scanned image or picture if equipment is unavailable for scanning. Any hard copies (e.g. carbonless copy paper duplicate records) will be retained by the FOL and placed in the project files upon completion of the field program.

Overnight Sample Storage

In some cases, samples that cannot be shipped immediately to a laboratory must be temporarily stored on ice in a secured location or in a MACTEC controlled sample refrigerator until arrangements can be made for delivery. A temperature blank must accompany samples.

SOP # S9

MACTEC STANDARD OPERATING PROCEDURE #S9

PORE WATER SAMPLING

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

______________________________ April 27,2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

________________ ________________

________________ ________________

________________ ________________

PORE WATER SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of pore water samples for chemical analysis.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documnted in the field logbook and/or field data record.

2.0 REFERENCES

Maine Department of Environmental Protection (ME DEP), 2009, Protocol for Groundwater/Surface Water Interface Sampling Using a Pore Water Sampler, RWM- DR-023, April.

3.0 PROCEDURE

This section contains both the responsibilities and procedures involved with pore water sampling. Proper pore water sampling procedures are necessary to ensure the quality and integrity of the samples.

3.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting them in the field logbook and on the field data records.

3.2 Preparation

Equipment Selection and Sampling Considerations

The following three types of samplers are typically used for pore water sampling:

Push Point Sampler – A push point pore water sampler is comprised of a strengthening rod and the pore water sampler itself, both made of stainless steel. The pore water sampler is a hollow tube slotted at its tip to allow pore water to percolate through. The strengthening rod slides into the pore water sampler, and while in place, adds strength and minimizes water from entering the pore water sampler during installation of the device.

Pore Water Observation Device (POD) – A POD pore water sampler constructed of two nested PVC slotted screens, an inner and an outer, with silicon tubing attached to the inner screen for sample collection. The inner screen is constructed of a section of 1-inch diameter slotted screen. The outside screen is constructed of a section of 2-inch diameter slotted screen. The annular space between the two nested screens is filled with filter sand. The samplers are approximately 3 inches long with length of silicon tubing inserted through the caps on the outer and inner screen from which the sample is drawn.

Drive Point Piezometer – A drive point piezometer is a 6-inch long stainless-steel pipe with holes in it that are screened to allow pore water to flow into the sampler. The top of the sampler has a ¾ inch NPT coupling on top for attaching pipe to drive the sampler into the substrate using a slide hammer. Inside the coupling is a barbed fitting used to attach silicon tubing to draw out the sample. Drive-point piezometers typically are used for single point installation only.

Push point samplers are temporary points whereby they are inserted in the sediment, sampled, and then removed. PODs and drive point piezometers are permanent (i.e., dedicated) sample points that are typically installed at a sample location and left in place, which is more conducive to collection of pore water over multiple sampling events.

If non-dedicated sampling equipment is to be used and the contaminant histories of the sample locations are known, it is advisable to establish a sampling order starting with the least contaminated area and progressing to the most contaminated last.

The following equipment will typically be used during pore water sampling:

- Pore water sampler (i.e., push point sampler, POD, or drive point piezometer)
- Water Quality Meter for measuring dissolved oxygen (DO)
- Calibration solutions for the DO probe
- Peristaltic pump and power supply (12-volt battery),
- Laboratory-provided sample containers,
- Self-adhesive sample bottle labels,
- ¼-inch outside High-density polyethylene (HDPE) and ¼-inch inside diameter silicon tubing,

- Rubber boots or hip waiters (as appropriate),
- Appropriate personal protective equipment (PPE),
- Previous field notes and blank field data sheets (e.g., sample collection form and Chain of Custody),
- Pen with indelible ink,
- Cooler with ice and,
- GPS receiver (if required).

Inspect the sampling bottles (obtained from the analytical laboratory prior to the sampling event) to be used to ensure that they are appropriate for the samples being collected, are undamaged, and have had the appropriate types and volumes of preservatives added. The types of sample containers to be used and sample preservation requirements will be provided in the Site-Specific FAP.

3.3 Field Procedures

Pore Water Purging and Sampling with a Peristaltic Pump

The standard procedure for pore water purging and sampling using a peristaltic pump will be conducted as described below.

Push Point Sampler, Drive Point Piezometer and POD Sampling

1. Inspect the equipment to ensure that it is in good working order.
2. If using water quality instrumentation, it should be calibrated per the instrument manufacturers' specifications. Calibration results will be recorded on the appropriate form (**example attached**)
3. Install the sampling point using one of the following methods:
    a. Using a push point sampler, carefully insert it into river/streambed to the desired depth (do not remove strengthening rod until instrument has been securely placed in sediment). Remove the strengthening rod from the push point sampler and connect the pore water sampler to the peristaltic pump using appropriate tubing (i.e., silicon and HDPE).
    b. Using a drive point piezometer, the piezometer is attached to a 4 – foot length of steel pipe (threaded on one end with a ¾ npt thread) and a slide hammer is used to install the piezometer to the desired depth. Prior to attaching the steel pipe, a length of silicon tubing is attached to the barb fitting at the top of the piezometer. The tubing should be long enough to account for the depth of water and depth the sampler is installed, so the tubing is above the level of the water at the sample locations.
    c. Using at POD sampler, a small hole is excavated in the sediment and the sampler installed and backfilled with native sediment. The pore water sampler should be inserted deep

enough to ensure the sample collected will contain only groundwater and no surface water (between 8 to 12 inches). Sampling tubing will need to be attached to the barbed fitting on the POD prior to backfilling activities.

4. The peristaltic pump is connected to the tubing attached to the sampler.
5. Turn pump on and purge water for several minutes until purge water is relatively clear. Pumping rate should be low enough to ensure that surface water is not drawn down into the sample. Once the water appears clear the dissolved oxygen should be measured from the pore water and in the surface water. The difference between the surface water and pore water should be evaluated as a measure of potential surface water infiltration. Ideally the DO in pore water is less than 2 mg/l and surface water are generally greater than 5 mg/l. The greater the difference between the readings the more likely the sample is representative of pore water.
6. If the formation intercepted by the screen is not transmissive enough for sample collection, gently advance and/or pull back the sampler in an attempt to find a more transmissive zone. If the formation does not allow adequate transmission of water, it may require a change in sampling location. This change should be made at the discretion of the field personnel and should be documented in field notes.
7. Neither the tubing nor the pore water sampler should be reused at subsequent sampling locations without appropriate decontamination. Do not put the strengthening rod back in the pore water sampler once sample has been collected, as sediment in the sampler must be flushed out first and properly decontaminated.
8. If pore water sampling is to be collected for multiple sampling events at the same location, use of permanent pore water samplers should be considered. The sampling point should be marked in a permanent manner. Additionally, all points should be located/identified with a global positioning system (GPS).
9. Document each sample on a water grab sampling record (**example attached**).
10. Appropriately seal, store, handle, and ship samples in accordance with the **Chain of Custody SOP (Table A-1)**, the QAPP and site specific FAP.

4.0 ATTACHMENTS

Water Grab Sampling Record

Field Instrument Calibration Record

GRAB SAMPLING RECORD - WATER

MACTEC

511 Congress Street
Suite 200
Portland, Maine 04101

PROJECT NAME		LOCATION ID	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/INSTALLATION	PAGE OF

SAMPLE TYPE: ☐ GROUNDWATER ☐ SURFACE WATER ☐ STORM WATER ☐ DRINKING WATER ☐ PORE WATER ☐ OTHER: ____________

FIELD PARAMETERS WITH PROGRAM STABILIZATION CRITERIA

TIME	DTW (FT)	PURGE RATE (mL/min)	TEMP. (^{o}C) ±3%	SP. CONDUCTANCE (mS/cm) ±3%	DISS. O_2 (mg/L) ±10% or 3 values <0.5 mg/L	pH (units) ±0.1	REDOX (mv) ±10 mv	TURBIDITY (ntu) ±10% or <10 ntu	PUMP INTAKE DEPTH (ft)	COMMENTS

FINAL STABILIZED FIELD PARAMETERS (rounded to appropriate significant figures)

TEMP.: nearest degree (ex. 10.1 = 10)
COND.: 3 significant figure (SF) max (ex. 1.686 = 1.69)
pH: nearest tenth (ex. 5.53 = 5.5)
DO: nearest tenth (ex. 3.51 = 3.5)
TURB: 3 SF max, nearest tenth (6.19 = 6.2, 101 = 101)
ORP: 2 SF (44.1 = 44, 191 = 190)

EQUIPMENT DOCUMENTATION

TYPE OF PUMP
- ☐ PERISTALTIC
- ☐ SUBMERSIBLE
- ☐ BLADDER ____________
- ☐ PDB
- ☐ HYDRASLEEVE ____________
- ☐ OTHER ____________

DECON FLUIDS USED
- ☐ ALCONOX
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ METHANOL
- ☐ OTHER ____________

TUBING/PUMP/BLADDER MATERIALS
- ☐ SILICON TUBING
- ☐ HDPE TUBING
- ☐ LDPE TUBING
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ S. STEEL PUMP MATERIAL
- ☐ PVC PUMP MATERIAL
- ☐ GEOPROBE SCREEN
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ OTHER ____________

EQUIPMENT USED
- ☐ WL METER ____________
- ☐ PID ____________
- ☐ WQ METER ____________
- ☐ TURB. METER ____________
- ☐ PUMP ____________
- ☐ OTHER ____________
- ☐ FILTERS NO. ____ TYPE ____________

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	ANALYTE LIST	FIELD FILTERED	PRESERVATION METHOD	VOLUME REQUIRED	QC COLLECTED
☐							
☐							
☐							
☐							
☐							
☐							
☐							

PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES ☐ NO ☐

NUMBER OF GALLONS GENERATED ____________

NO-PURGE METHOD UTILIZED YES ☐ NO ☐

NOTES:

DEVIATIONS FROM THE WORK PLAN:

Sampler Signature: Print Name:

Checked By: Date:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ______ TASK NO: ______ DATE: ______
PROJECT NUMBER: ______ MACTEC CREW: ______
PROJECT LOCATION: ______ SAMPLER NAME: ______
WEATHER CONDITIONS (AM): ______ SAMPLER SIGNATURE: ______
WEATHER CONDITIONS (PM): ______ CHECKED BY: ______ DATE: ______

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

AM CALIBRATION — **Start Time** ______ **/End Time** ______

POST CALIBRATION CHECK — **Start Time** ______ **/End Time** ______

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	______	+/- 0.1 pH Units			
pH (7)	SU	7.0	______	+/- 0.1 pH Units	7.0	______	+/- 0.3 pH Units
pH (10)	SU	10.0	______	+/- 0.1 pH Units			
Redox	+/- mV	240	______	+/- 10 mV	240	______	+/- 10 mV
Conductivity	mS/cm	1.413	______	+/- 0.5 % of standard	1.413	______	+/- 5% of standard
DO (saturated)	%	100	______	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	______	______	+/- 0.2 mg/L	______	______	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	______	< 0.5 mg/L			
Temperature	°C		______			______	
Baro. Press.	mmHg		______			______	

TURBIDITY METER		Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
METER TYPE ______							
MODEL NO. ______							
UNIT ID NO. ______	<0.1 Standard	NTU	<0.1	______	<0.1	______	+/- 0.3 NTU of stan.
	20 Standard	NTU	20	______	20	______	+/- 5% of standard
	100 Standard	NTU	100	______	100	______	+/- 5% of standard
	800 Standard	NTU	800	______	800	______	+/- 5% of standard
PHOTOIONIZATION DETECTOR							
METER TYPE ______	Background	ppmv	<0.1	______	<0.1	______	within 5 ppmv of BG
MODEL NO. ______							
UNIT ID NO. ______	Span Gas	ppmv	100	______	100	______	+/- 10% of standard
O_2-LEL 4 GAS METER							
METER TYPE ______	Methane	%	50	______	50	______	+/- 10% of standard
MODEL NO. ______	O_2	%	20.9	______	20.9	______	+/- 10% of standard
UNIT ID NO. ______	H_2S	ppmv	25	______	25	______	+/- 10% of standard
	CO	ppmv	50	______	50	______	+/- 10% of standard
OTHER METER							
METER TYPE ______	______	______	______	______	______	______	See Notes Below for Additional Information
MODEL NO. ______	______	______	______	______	______	______	
UNIT ID NO. ______	______	______	______	______	______	______	
______	______	______	______	______	______	______	

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ______
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45μm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ______
- Other ______
- Other ______

	Cal. Standard Lot Number	**Exp. Date**
pH (4)	______	______
pH (7)	______	______
pH (10)	______	______
ORP	______	______
Conductivity	______	______
<0.1 Turb. Stan.	______	______
20 Turb. Stan.	______	______
100 Turb. Stan.	______	______
800 Turb. Stan.	______	______
PID Span Gas	______	______
O_2-LEL Span Gas	______	______
Other	______	______

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S10

MACTEC STANDARD OPERATING PROCEDURE #S10

SEDIMENT SAMPLING PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27,2020

Charles Staples, PG, Program Technical Lead | Date

Reviewed | Date

SEDIMENT SAMPLING PROCEDURE

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines and procedures for use by field personnel in the collection and documentation of sediment samples for chemical and physical analysis. This SOP does not include the procedures and equipment selection for sediment sampling for biological analysis, which is very specific to the aquatic environment and type of analysis (toxicological and bioaccumulation tests, benthic community analysis, etc.), This SOP is only applicable to bedload sediment sampling and does not include suspended load sampling.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 1995, *Standard Guide for Core Sampling Submerged, Unconsolidated Sediments*, ASTM D 4823-95, reapproved 2019.

EPA, 2001, *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual,* Office of Water, EPA 823-B-01-002.

EPA, 2020, *Sediment Sampling,* Region 4 Laboratory Services and Applied Science Division (LSASD), Operating Procedure, Number LSASDPROC-200-R4, February.

3.0 DEFINITIONS

Sediment – Sediment is generally considered as unconsolidated mineral and organic deposits found underwater, such as on the bottom of rivers, streams, creeks, ponds, lakes, lagoons, and estuaries or deposited by a water body. Broadly speaking, sediment is "eroded material which lies below surface water the majority of the time where the surface water is capable of providing for an aquatic biota habitat."

Disturbed Sediment Sample – A sediment sample where the in situ physical structure and fabric has been disturbed as the direct result of sample collection. Disturbed sediment samples can be collected using hand augers, spoons, or scoops.

Undisturbed Sediment Sample – A sediment sample who's in situ physical structure and fabric has not been disturbed as the result of sample collection. Undisturbed sediment samples can be collected using the core samplers.

Grab Samples – A disturbed sediment sample that is collected by using such devices as the sample container (e.g., wide-mouth jar), or a stainless-steel spoon, scoop, or hand auger, and is representative of the current conditions at the location sampled.

Composite Samples – Composite samples are comprised from at least two grab samples that are thoroughly mixed in a decontaminated bowl to be representative of an area, transect, or vertical section. The result typically is considered an average concentration of the area or column of sediment sampled.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with sediment sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or field data record.

4.2 Preparation

Equipment Selection and Sampling Objective Considerations

Several devices are available for the collection of sediment samples, the proper selection of which is dependent on:

1. the sampling objectives,
2. whether the sediment is above or below water,
3. the sediment thickness
4. the depth of water above the sediment,
5. the accessibility and conditions of the sampling locations, and
6. the analytical requirements.

Therefore, it is prudent to conduct a site visit to the sampling locations before the development of the work plan. Two types of sediment sampling devices will typically be used: core samplers and grab samplers. Most of these devices are constructed of stainless steel, and some core samplers allow a disposable sleeve to be inserted into the core barrel to retain the sample. The sleeve should be made of high-density polyethylene (HDPE) or acetate. Teflon or low-density polyethylene (LDPE) should not be used.

Core Samplers

The collection of submerged sediment samples and most sediment deposits above water (both grab and composite samples) may be conducted with a core sampler. The advantage of a core sampler over a grab sampler is that discrete and minimally disturbed samples can be collected with no loss of the finer grained material as the sample is raised to the surface (ASTM, 2019). The simplest core sampler is a hand-driven, hollow, stainless steel or polycarbonate core barrel, with a beveled edge on the head assembly at the leading end and a check valve or flapper valve at the opposite end to keep the sample in the barrel by partial vacuum (end-filling type). The trailing end has a T-handle to push and/or twist the core barrel into the soft sediment. Core barrels are typically 1- to 2-inches in diameter and are available in 2- and 4-foot lengths. For deeper submerged sediments (> 2 feet), usually collected from a boat, handle extensions can be added to the top of the hand core sampler.

A sample sleeve, or core liner can be inserted into some core samplers to obtain discrete samples that are handled and shipped in the sleeve. Upon extrusion from the core barrel, cores can be subsampled or homogenized. One disadvantage to core samplers is that the volume of sediment retrieved in one core barrel may be insufficient if full suites of analyses are needed, thus requiring multiple cores to be collected at each location.

Grab Samplers

Grab samplers will disturb the sediment during collection, which may be a limiting factor for some sampling parameters and objectives. If sampling dry to moist surficial sediments is the sampling objective, then a sample can be collected by using grab samplers such as stainless-steel hand augers, spoons, or scoops, or the sample containers themselves. If sampling shallow submerged sediment (< 6 inches deep), then the sample container may be used as the preferred collection device to minimize loss of fines upon raising the sample to the surface. The lid of the sample container may be used to cover the mouth of the sample container before raising it to the surface.

For deeper submerged sediments (> 2 feet), usually collected from a boat, a Ponar grab sampler or equivalent is an option for surficial deposits. This type of sampler has a jaw-type mechanism that is tripped from above in order to close the jaws and collect the sample. The dredge is lowered slowly through the water to the sediment with the jaws in the open position. As the dredge is retrieved, the jaws close and the isolated sediment is brought to the surface. The disadvantage to using these grab samplers is that a pebble or stick can often prevent the jaws from shutting completely, and the sample will be washed or lost upon raising the sampler to the surface. If sample collection is not successful using a grab sampler, then use of a core sampler may be required.

Additional Sampling Equipment

In addition to the chosen sampling devices described above, sediment sampling will generally consist of the following equipment:

- Personal protection equipment (PPE)
- Rubber boots or waders
- Stainless steel bowls, spoons, spatulas, if compositing or homogenizing samples
- Decontamination supplies (e.g., DI water, Liquinox® soap, paper towels)
- Documentation material (pens, logbook, Field Data Records (FDR) [**example attached**]
- Sample containers and cooler (provided by the laboratory)
- Ice for sample preservation
- Clean plastic sheeting
- Paper towels

Field Sample Planning

If current site information is not available, conduct a reconnaissance of all sediment sampling locations to determine:

- accessibility of the water body,
- depth of water,
- potentially dangerous conditions (strong currents, boggy bottoms, log jams or beaver dams, waterfalls, steep banks, thick vegetation, etc.),
- sediment accumulation points to flag for sampling (e.g. pools, convex side [outer side] of meanders, mid-channel islands, downstream side of boulders, deltas, etc.), and
- sampling and personal protection equipment selection criteria.

Access to water bodies such as streams may be hampered by thick vegetation, and lakes and ponds that will require the use of a boat may not be accessible by road. Therefore, the logistics of getting the sampling equipment and containers to and from the sites must be considered before attempting to sample.

The timing of sediment sampling relative to stream flow is critical, even when fluctuation in stream flow is not a variable of concern in the project objectives. Avoid sampling during high water or flood conditions, not only for safety reasons, but also because most sediment deposits will be submerged under deeper water, will be eroding due to turbulent flow, and will be migrating and/or in suspension. If the same locations are being sampled on a periodic basis (e.g., quarterly, semi-annually, yearly), it is critical to sample under the same flow conditions (e.g., base flow) each time.

Plan to collect sediment (and co-located surface water) samples along a water body in the upstream direction, starting from the most downstream sampling location. This procedure will ensure that any mobilized contaminants or fine particles from sampling activities, which will migrate downstream, do not affect the representativeness of the subsequent samples. This procedure must be followed even in lakes or ponds that are stream fed.

Select biased locations where sediment occurs. Transects may have to be diagonal to stream flow instead of perpendicular to include point bars on opposite sides. For establishing a grid or transects in a lake, placing buoys at the nodes/sampling locations works well. At small ponds, transects can be marked by stretching a cord or cable between stakes on opposing shores, using turnbuckles to provide tautness and flagging tape to mark sampling locations.

If accessing and reaching the sampling locations is difficult, taking a portable global positioning system (GPS) instrument to obtain X-Y coordinates during sampling is recommended, to avoid repeating trips. Such difficult locations will be costly to land survey. If a GPS is ineffective due to the terrain or tree canopy, marking the locations on a topographic map or aerial photograph at the time of sampling is the next best alternative.

When surface water samples are collected at sediment sampling locations, collect the surface water prior to the sediment sample (which will suspend the fines), no more than 1 foot above the sediment, unless samples are to be collected in a stratified water column as specified in the site-specific work plans. See Surface Water Sampling SOP (SOPs listed in Table A-1) for further details on surface water sampling methodology.

When selecting a boat to access sampling locations on lakes, ponds, or rivers, make sure the hull design will not disturb the bottom and is stable enough to haul loaded samplers to the surface (flat vs V-shaped). Jon boats or small pontoons work well in most situations. Care must be given to avoid disturbing the bottom near the sampling locations with oars or a motor's propeller. If necessary, use two anchors to anchor both ends of the boat to prevent rotation during sampling.

Prior to sampling, decontaminate non-disposable sample equipment according to the Field Equipment Decontamination SOP (SOPs listed in Table A-1) and procedures outlined in the site-specific FAP.

4.3 Field Procedures

1. Review carefully the Site Health and Safety Plan (HASP) and appropriate Activity Hazards Analysis (AHA).
2. Don appropriate personal protection equipment (PPE), such as tall rubber boots or waders and personal floatation devices, as specified in the site-specific FAP, prior to entering the water. A walking stick or trekking pole is often needed when wading in unclear water, to probe the bottom for sure footing and depth of water.
3. Due to uneven terrain, water hazards (currents, holes, ice, drowning, etc.), hazardous biota (snakes, spiders, stinging nettles, etc.), remoteness, and the hauling of equipment, gear, and sample

containers, always sediment sample as a team of at least two personnel, with one team member as a site health and safety officer.

4. Approach submerged sampling locations from downstream and collect the sample facing upstream. Wading disturbs the sediment bottom and the suspended fine-grained material migrates downstream.
5. Never wade in water deeper than 2 feet, and generally no deeper than the top of the knee. Instability increases in deeper water, especially in a current, and it becomes more difficult to sample. If the water is not clear (unable to see the bottom), proceed with extreme caution, probing the bottom ahead with a walking stick for depth and unevenness. One of the team members should stay on or close to shore to hand equipment and supplies back and forth. If deemed necessary, the sampler may need to don a seat harness and be on a safety rope that is controlled by the other team member.
6. When using a hand coring device, slowly push the corer into the sediment until there is a noticeable resistance (usually indicating the channel or basin floor), or until the top of the core barrel is at the sediment surface.
7. For sediment sampling using a boat, gently lower all grab and core samplers to the bottom so as not to create a bow wave and disturb the fine sediment on the bottom. After the sample is collected at a given location, measure the depth of water with a weighted fiberglass tape and record this information on the sample FDR (**example attached**). These data are also useful for profiling the bottom of the water body (e.g., lake or pond).
8. Retrieve the sampling device slowly through the water to avoid washout by creating turbulent flow. Immediately extrude (for core samplers) or directly transfer (for grab samplers) the sample to a stainless-steel bowl and check to see that sediment recovery is acceptable (no visible signs of sediment loss or washing). If sediment recovery is unacceptable or the volume is insufficient, collect another sample close to, but upstream of, the previous attempt.
9. Unless collecting a sample for volatile organic compound (VOC) analysis, thoroughly homogenize the collected sediment sample in a mixing bowl (due to the stratified nature of sediment deposits), whether from a grab or core sampler, after removing excess water (being careful not to lose the fines in the process), rocks, sticks, leaves, and other organic debris. Then transfer the sediment into the sample containers using a stainless-steel spoon or spatula. Fill the sample container such that little to no headspace exists.
    a. Samples for VOCs should be collected without homogenization directly from the sampler or immediately after transfer to the stainless-steel bowl.

10. Collect X-Y coordinates of the sample location using a portable GPS instrument. If a GPS is ineffective due to the terrain or tree canopy, mark the location in the field with a stake or flag and indicate the sample location on the site map.
11. Appropriately label and number the sample containers. The label will be filled out with a pen containing indelible ink and will contain, at a minimum, the following information:
    a. Project number
    b. Location ID
    c. Sample number
    d. Sample location
    e. Sample depth
    f. Sample type
    g. Date and time of collection
    h. Parameters for analysis
    i. Sampler's initials
12. Document the sampling event on a sediment sample collection FDR (**example attached**). Note any pertinent field observations, conditions, or problems on the FDR and in the field book.
13. Any encountered problems (access issues, flooding by beaver dams, etc.) or unusual conditions should also be immediately brought to the attention of the FOL and PM.
14. Appropriately preserve, handle, package, and ship the samples in accordance with the chain of custody SOP (See SOP Table A-1), the QAPP, and the site-specific FAP.

5.0 ATTACHMENTS

Surface Water and Sediment Sampling Record

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

PROJECT NAME		SAMPLE LOCATION	DATE
PROJECT NUMBER		START TIME	END TIME
SAMPLE ID	SAMPLE TIME	SITE NAME/NUMBER	PAGE OF

SURFACE WATER DATA

WATER DEPTH AT SAMPLE LOCATION ________ FT. DEPTH OF SAMPLE BELOW WATER SURFACE ________ FT. FLOW RATE ________ ML/MIN

WATER QUALITY PARAMETERS:

- TEMPERATURE ________ °C
- SPEC. COND. ________ mS/cm
- PH ________ pH Units
- ORP ________ mV
- TURBIDITY ________ NTUs
- DO ________ mg/L
- ☐ WINKLER METHOD
- ☐ DO PROBE

EQUIPMENT USED:

- ☐ BEAKER
- ☐ BOTTLE
- ☐ PACS BOMB
- ☐ PUMP ________
- ☐ FILTER
- No. ______ Type: ______
- ☐ FIELD DUPLICATE COLLECTED
- DUP. ID ________

TYPE OF SURFACE WATER:

- ☐ STREAM
- ☐ RIVER
- ☐ LAKE
- ☐ POND
- ☐ SEEP
- ☐ ________

FIELD SKETCH SHOWN/ATTACHED

☐ YES ☐ NO

DECON FLUIDS USED

- ☐ ALL USED
- ☐ LIQUINOX/DI H_2O SOLUTION
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ 25% METHANOL/75% ASTM TYPE II H_2O
- ☐ ETHYL ALCOHOL
- ☐ ________

SAMPLING EQUIPMENT

WATER QUALITY METER MODEL NO. ________ UNIT ID NO. ________

TURBIDITY METER MODEL NO. ________ UNIT ID NO. ________

SEDIMENT SAMPLE INFORMATION

TYPE OF SAMPLE

- ☐ DISCRETE
- ☐ COMPOSITE

SAMPLE INTERVAL:

TOP ________

BOTTOM ________

COLLECTION EQUIPMENT

- ☐ HAND AUGER/CORER
- ☐ S.S. SPLIT BARREL
- ☐ ALUMINIUM PAN
- ☐ S.S. SHOVEL
- ☐ HAND SPOON/SPATULA
- ☐ S.S. BUCKET
- ☐ OTHER ________

DECON FLUIDS USED

- ☐ ALL USED
- ☐ LIQUINOX/DI H_2O SOLUTION
- ☐ DEIONIZED WATER
- ☐ POTABLE WATER
- ☐ NITRIC ACID
- ☐ HEXANE
- ☐ 25% METHANOL/75% ASTM TYPE II H_2O
- ☐ ETHYL ALCOHOL

QC SAMPLES

- ☐ DUPLICATE ________
- ☐ EQ BLK ________

MS/MSD:

- ☐ YES
- ☐ NO

TYPE OF MATERIAL:

- ☐ ORGANIC
- ☐ SAND
- ☐ GRAVEL
- ☐ CLAY
- ☐ FILL
- ☐ OTHER________

SAMPLE OBSERVATIONS

ODOR ________

COLOR ________

OTHER ________

PID ________

FIELD SKETCH SHOWN/ATTACHED

- ☐ YES
- ☐ NO

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							

NOTES/SKETCH

Sampler Signature: Print Name:

Checked By: Date:

SURFACE WATER AND SEDIMENT SAMPLING RECORD

SOP # S11

MACTEC STANDARD OPERATING PROCEDURE #S11

DESCRIPTION AND IDENTIFICATION OF SOIL SAMPLES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27,2020

Charles Staples, PG, Program Technical Lead | Date

Reviewed | Date

DESCRIPTION AND IDENTIFICATION OF SOIL SAMPLES

1.0 PURPOSE

This Standard Operating Procedure (SOP) is to be used for field descriptions of soil observed in natural exposures, in exploratory excavations, and in test boring samples. Field descriptions are typically based on macroscopic visual observations (i.e., with no magnification).

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2014. Standard Terminology Relating to Soil, Rock, and Contained Fluids; ASTM D653-14.

ASTM, 2017. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); ASTM D2487-17e1.

ASTM, 2017. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure); ASTM D2488-17e1, Philadelphia, PA.

3.0 PROCEDURE

Soil will be classified in accordance with the Unified Soil Classification System (ASTM D2488). A summary of this system is attached. For environmental investigations, the hydrogeologic characteristics of the soil are generally more important than its mechanical properties. Soil descriptions should include the following minimum information (where applicable and obtainable) and logged in the following order (with examples):

1) **Name** (SAND, silty GRAVEL, etc. including portions- little, trace, some, etc.)
2) **Gradation** (well-graded, poorly graded, uniform, etc.) or **Plasticity** (non-plastic, slightly plastic, etc.)
3) **Consistency/Density** (if available from SPT blow counts)
4) **Moisture** (dry, damp, moist, wet, saturated)
5) **Color** (Mensell color chart if available)
6) **Structure** (layering, fractures, cracks, etc.)
7) **Geologic Origin** (e.g., till, lake deposit, loess) and/or formal or local name (e.g., Magothy Formation, Gardiners Clay, Lloyd Sand Member). Formal and local names should only be used based on professional judgement and knowledge of the local geology.
8) **Unified Soil Classification Symbol (USCS)**. Refer to **Attachment**.

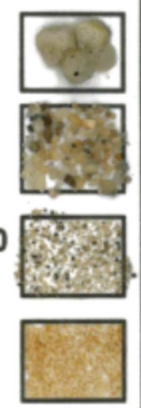
Additional details on some of the descriptors are included below.

Name

Based principally on gradation (e.g. grain size) characteristics. Grain sizes encountered during environmental investigations include:

Unified Soil Classification System (USCS)

	MILLIMETERS	INCHES	SIEVE SIZES
BOULDERS	> 300	> 11.8	-
COBBLES	75 - 300	2.9 - 11.8	-
GRAVEL:			
COARSE	75 - 19	2.9 - .75	-
FINE	19 - 4.8	.75 - .19	3/4" - No. 4
SAND:			
COARSE	4.8 - 2.0	.19 - .08	No. 4 - No. 10
MEDIUM	2.0 - .43	.08 - .02	No. 10 - No. 40
FINE	.43 - .08	.02 - .003	No. 40 - No. 200
FINES:			
SILTS	< .08	< .003	< No. 200
CLAYS	< .08	< .003	< No. 200



The predominant (>50%) grain size should be written in capital letters (e.g. SAND, SILT, GRAVEL).

Include rough percentages for the secondary, tertiary, etc. grain sizes (particles >3 inches [cobbles], coarse/fine gravel, coarse/medium/fine sand, and fines) or qualitative particle size descriptions. Qualitative descriptions are most used and provide further definition by using specific terms to describe major and minor soil constituents as follows:

- Name = major component (e.g. SAND)
- Name modifier (added as a prefix) = 35 to 50% of soil fraction (e.g. clayey, silty, sandy, gravelly)
- With some = 20 to 35% of soil fraction (e.g. some clay)
- With little = 10 to 20% of soil fraction (e.g. little clay)
- With trace = 1 to 10% of soil fraction (e.g. trace silt)

Gradation

Coarse vs Fine gained soils

Coarse- and fine-grained soils are described differently in the USCS, and although based on specific grain measurements, field crew can approximate grain size based visual observations and comparison to USCS figure included above. Coarse grained soils (sands and gravels) are defined as soils in which greater than 50% of the soil fraction is retained on a #200 sieve. Fine grained soils (silts and clays) are defined as soils in which greater than 50% of the soil fraction will pass through a #200 sieve.

Coarse grained soils are further broken down as having little or no fines (<12% passing the #200 sieve) or appreciable amounts of fines (>12% passing the #200 sieve). For coarse-grained soils that are contain little or no fines, the overall gradation is characterized as follows:

- **Well graded** soils are soils whose coarse fraction has a wide and continuous gradation of grain sizes
- The coarse fraction of **poorly graded** soils has a limited range of grain sizes.
- The coarse fraction of **uniform** soils is essentially equigranular.

For fine-grained soils state whether the fines are predominantly **silt** or **clay**. The field classification of fine-grained soil relies on the qualitative determination of plasticity and cohesiveness characteristics (refer to Attachment S11A and see below). The determination is complex and may not be necessary for soil descriptions for most environmental investigations.

Consistency

Describe the consistency of the soil. For soil samples obtained using the Standard Penetration Test (split spoon sampling with a standard hammer – See SOP S16 for details), the terminology to be used is as follows:

COARSE-GRAINED SOILS		FINE-GRAINED SOILS	
CONSISTENCY	**BLOWS/FOOT**[1]	**CONSISTENCY**	**BLOWS/FOOT**[1]
Very loose	0 to 4	Very soft	0 to 2
Loose	5 to 10	Soft	2 to 4
Medium dense	11 to 30	Firm	4 to 8
Dense	31 to 50	Stiff	8 to 15
Very Dense	> 50	Very stiff	15 to 30
		Hard	> 30

[1] Blows per foot (Standard Penetration Resistance) = number of blows required to drive a 2-inch OD by 1-3/8-inch ID split-spoon sampler with 140-pound hammer falling 30 inches, after initial penetration of 6 inches.

For non-standard penetration test sampling, consistency (density) values should not be recorded for coarse grained soils. Fine grained soils may be qualitively measured and descriped using the thumb and thumbnail procedures indcated on Attatchment S11A.

Examples of Soil Descriptions

The following are examples of soil descriptions. It is recommended that descriptive information be recorded in the order NAME, GRADATION/PLASTICITY, CONSISTENCY, MOISTURE CONTENT, COLOR, STRUCTURE, GEOLOGIC ORIGIN or NAME, UNIFIED SOIL CLASSIFICATION SYSTEM SYMBOL.

- SAND, well graded, 5-10% sub rounded gravel to 0.5-inch max diameter., < 5% fines, medium dense, moist, yellowish brown, possible root holes (SW).
- Silty CLAY, slightly to moderately plastic, trace fine sand, stiff, wet, yellowish-green, massive, Beaufort Formation (CL).
- Clayey SAND, medium to fine, some clay, medium dense, damp, light gray (SC).
- Silty SAND, widely graded, 20-25% sub rounded gravel, 15-20% silt, 10-15% rounded boulders and cobbles, dense, saturated, olive gray, boulder till (SM).
- Gravelly SAND, poorly graded, mostly sub angular coarse sand, some sub angular gravel to 0.6-inch max diameter, < 5% fines, dense, moist, reddish brown, alluvium (SP).
- SILT, non-plastic, trace fine sand, very loose, saturated, light gray, micaceous, Lacustrine (ML).
- SAND, uniform, fine, < 5% fines, loose, dry, light brown (SP).
- Silty CLAY, slightly to moderately plastic, firm, medium gray, grades downward within varve to sandy silt, non-plastic, little fine sand, light gray, varves 0.3 - 0.4-inch-thick, varved clay (CL to ML).

- Clayey SAND, coarse to fine, mostly medium to fine, some clay, very dense, dark greenish gray, micaceous, infrequent marine shells (SC).

4.0 ATTACHMENTS

Key to Soil Descriptions and Terms

KEY TO SOIL DESCRIPTIONS AND TERMS

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE-GRAINED SOILS (>50% RETAINED on the No. 200 sieve)	GRAVELS (>50% of coarse fraction RETAINED on the No. 4 sieve)	CLEAN GRAVELS (<5% fines)	GW	Well-graded gravels or gravel-sand mixtures; trace or no fines.
			GP	Poorly-graded gravels or gravel-sand mixtures; trace or no fines.
		GRAVEL WITH FINES (>12% fines)	GM	Silty gravels or gravel-sand-silt mixtures.
			GC	Clayey gravels or gravel-sand-clay mixtures.
	SANDS (50% or more of coarse fraction PASSES the No. 4 sieve size)	CLEAN SANDS (<5% fines)	SW	Well-graded sands or sand-gravel mixtures; trace or no fines.
			SP	Poorly-graded sands or sand-gravel mixtures; trace or no fines.
		SAND WITH FINES (>12% fines)	SM	Silty sands or sand-gravel-silt mixtures.
			SC	Clayey sands or sand-gravel-clay mixtures.
FINE-GRAINED SOILS (50% or more PASSES the No. 200 sieve)	SILTS AND CLAYS (liquid limit <50)		ML	Inorganic silts or rock flour, non-plastic or very slightly plastic. PI <4 or plots below "A" line.
			CL	Inorganic lean clays. Low to medium plasticity. PI >7 and plots on or above "A" line.
			OL	Organic silts, clays and silty clays. Low to medium plasticity.
	SILTS AND CLAYS (liquid limit ≥50)		MH	Inorganic elastic silt. PI line plots on or above "A" line.
			CH	Inorganic fat clay. High plasticity. PI line plots on or above "A" line.
			OH	Organic silts and clays. High plasticity.
	HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils. Decomposed vegetable tissue. Fibrous to amorphous texture.

TERMS DESCRIBING SOILS (excludes particles > 3", organics, debris, etc.)	TERMS DESCRIBING MATERIALS i.e. particles > 3", organics, debris, etc.)
Trace: 0 - 10%	Occasional: Particles present, but < 10%
Little: 10% - 25%	Some: 10% to 25%
Some: 25% - 45%	Frequent: >25%

TERMS DESCRIBING MOISTURE	TERMS DESCRIBING STRUCTURE
Dry: Absence of moisture; dusty	Layer: > 3" thick
Moist: Damp, but no visible water	Seam: 1/16" to 3" thick
Wet: Visible/free water	Parting: < 1/16" thick

CORRELATION OF STANDARD PENETRATION TEST (SPT) WITH RELATIVE DENSITY AND CONSISTENCY

GRAVEL, SAND & SILT (NON-PLASTIC)

Relative Density	N-Value (blows per foot)
Very loose	0 - 4
Loose	5 - 10
Compact	11 - 30
Dense	31 - 50
Very Dense	> 50

SILT (PLASTIC) & CLAY

Consistency	SPT N-Value	Su (psf)	Field Guidelines
Very Soft	0 - 2	0 - 250	Fist easily penetrates
Soft	3 - 4	250 - 500	Thumb easily penetrates
Medium Stiff	5 - 8	500 - 1000	Thumb penetrates with moderate effort.
Firm	9 - 15	1000 - 2000	Indented by thumb with great effort
Very Stiff	16 - 30	2000 - 4000	Indented by thumbnail
Hard	>30	over 4000	Indented by thumbnail with difficulty

ROCK QUALITY DESIGNATION (RQD)

RQD = sum of the lengths of intact pieces of core* >100mm (0.3ft.) / length of core advance

*Minimum NQ rock core (1.88 in. OD of core)

Quality Description	RQD
Very Poor	<25%
Poor	26% - 50%
Fair	51% - 75%
Good	76% - 90%
Excellent	>90%

Desired Soil Observations: (in this order)

Name (SAND, silty SAND, CLAY, etc., including portions - trace, little, etc)
Gradation/Plasticity (well-graded, poorly graded, uniform)/(non-plastic, slightly plastic, etc.)
Density/Consistency (if available from SPT blow counts, or observable for consisency)
Moisture (dry, damp, moist, wet, saturated)
Color (Mensell color chart if available)
Structure (layering, fractures, cracks, etc.)
Geologic Origin (e.g., till, lake deposit, loess) - formal name if known (e.g., Gardiners Clay)
Unified Soil Classification Symbol (USCS - above)
Odor, PID data, Torvane or pocket penetrometer data, etc.

Example Descriptions:

Silty CLAY, slightly to moderately plastic, trace fine sand, stiff, wet, yellowish-green, massive, Beaufort Formation (CL).

SAND, poorly graded, fine, trace silt, trace rounded gravel, loose, wet, light brown, ALLUVIUM, SP

- occasional partings of fine sand; 1-inch seam of olive brown silt at 8' bgs; Torvane = 0.55 tsf

Desired Rock Observations: (in this order)

Color (i.e. olive brown, gray, reddish brown)
Texture (aphanitic, fine-grained, etc.)
Lithology (igneous, sedimentary, metamorphic, etc.)
Hardness (very hard, hard, mod. hard, etc.)
Weathering (fresh, very slight, slight, moderate, mod. severe, severe, etc.)
Geologic discontinuities/jointing:
-dip (horiz - 0°-5°, low angle - 5°-35°, mod. dipping - 35°-55°, steep - 55°-85°, vertical - 85°-90°)
-spacing (very close - <5 cm, close - 5-30 cm, mod.close 30-100 cm, wide - 1-3 m, very wide >3 m)
-tightness (tight, open or healed)
-infilling (grain size, color, etc.)
Interpreted Formation (Waterville, Ellsworth, Cape Elizabeth, etc.)
RQD and Rock Mass Description (very poor, poor, fair, etc.)
Recovery

Sample Container Labeling Requirements (if retained): Site, Boring ID, Sample Number, Sample Depth, Sample Recovery, Blow Counts, Personnel Initials.

MACTEC

511 Congress Street, Portland, Maine

SOP # S12

MACTEC STANDARD OPERATING PROCEDURE #S12

FIELD DESCRIPTION OF ROCK SAMPLES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples ______________________ April 27,2020

Charles Staples, PG, Program Technical Lead — Date

Reviewed — Date

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1.0 PURPOSE

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This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International, 2014. Standard Terminology Relating to Soil, Rock, and Contained Fluids; ASTM D653-14.

Bates, R.L., and J. A. Jackson, 1980. Glossary of Geology; Second Edition; American Geological Institute; Falls Church, VA.

Core Logging Committee, South Africa Section, AEG, 1978. "A Guide to Core Logging for Rock Engineering"; Bulletin of the Association of Engineering Geologists, Vol. XV, No. 3, pp. 295-329.

Deere, D.U., 1963. "Technical Description of Rock Cores for Engineering Purposes," Rock Mechanics and Engineering Geology, Vol. 1, pp. 16-22.

Travis, R.B., 1955. "Classification of Rocks"; Quarterly of the Colorado School of Mines, Vol. 50, No. 1, pp. 1-98.

3.0 PROCEDURE

Descriptions of rock focus on physical properties that may affect the movement of groundwater and water-borne contaminants (including the presence, orientation, openness, mineralization, and degree of weathering of natural fractures).

Rock cores will be retrieved and logged in accordance with the methodology and steps outlined in the rock coring section of **the Soil Boring and Rock Coring Oversight SOP** (See SOP Table A-1 for number)**.** Rock core measurements will be recorded on the field data record included with the Soil Boring and Rock Coring Oversight SOP. Core logging reference materials and diagrams are provided as an **Attachment** to this SOP.

Describe the Core Recovery

The core recovery is the length of rock core recovered from a core run. Recovery is measured in feet and is commonly converted to a percentage. Care should be taken when placing the rock core in the box to reorient fractures and pieces of core to represent the original orientation and length of the core. The core length should be measured along the centerline.

When core recovery is less that 100% of the core run, the non-recovered section should be interpreted to be at the end of the run unless there is indication within the rock core to suggest otherwise (e.g. weathered zones, rolled fractured zones, drops in the core rods during the run).

Recoveries greater than 100% may occur when pieces of the previous run may be retrieved during the next run. This recovery should be noted on the FDR, however adjustments to the previous interval should not be made in the field.

Describe the Rock Quality Designation

Rock Quality Designation (RQD) is a modified core recovery percentage in which all intact pieces of core 4-inches or longer are summed and divided by the length of the core run (not core recovery). RQD is a measurement of "good" rock recovered from the interval of a borehole. Rocks that are highly weathered, soft, fractured, and jointed typically yield lower RQD values. As these features typically represent transmissive zones for groundwater flow, RQD values can provide a reasonable approximation of interpreting potential groundwater flow zones within bedrock which may be used for monitoring well design.

Measuring the intact core pieces for calculating RQD should be measured along the centerline of the rock core to avoid penalizing RQD by biasing against pieces of core that are impacted by very high angle fractures nearly parallel to the rock core direction. Mechanical breaks caused during the drilling process should be fitted together and counted as a continuous piece of core for the purposes of calculating RQD. Drilling breaks usually have rough fresh faces and are parallel to bedding or jointing in the rock. When in doubt, about a break it should be considered as natural in order to be conservative in the calculation of RQD.

The rock core should be assessed for soundness (hardness). Rocks that have been weakened through weathering or hydrothermal alteration, may include discolored or bleached grains, heavy staining, pitting, or weak cementation. These conditions should be noted when completing the rock description and the RQD % should be assigned an asterisk (RQD*) in that it includes pieces of rock that meet fracturing requirements for calculation but lack soundness.

Example of centerline measurement for calculating RQD:

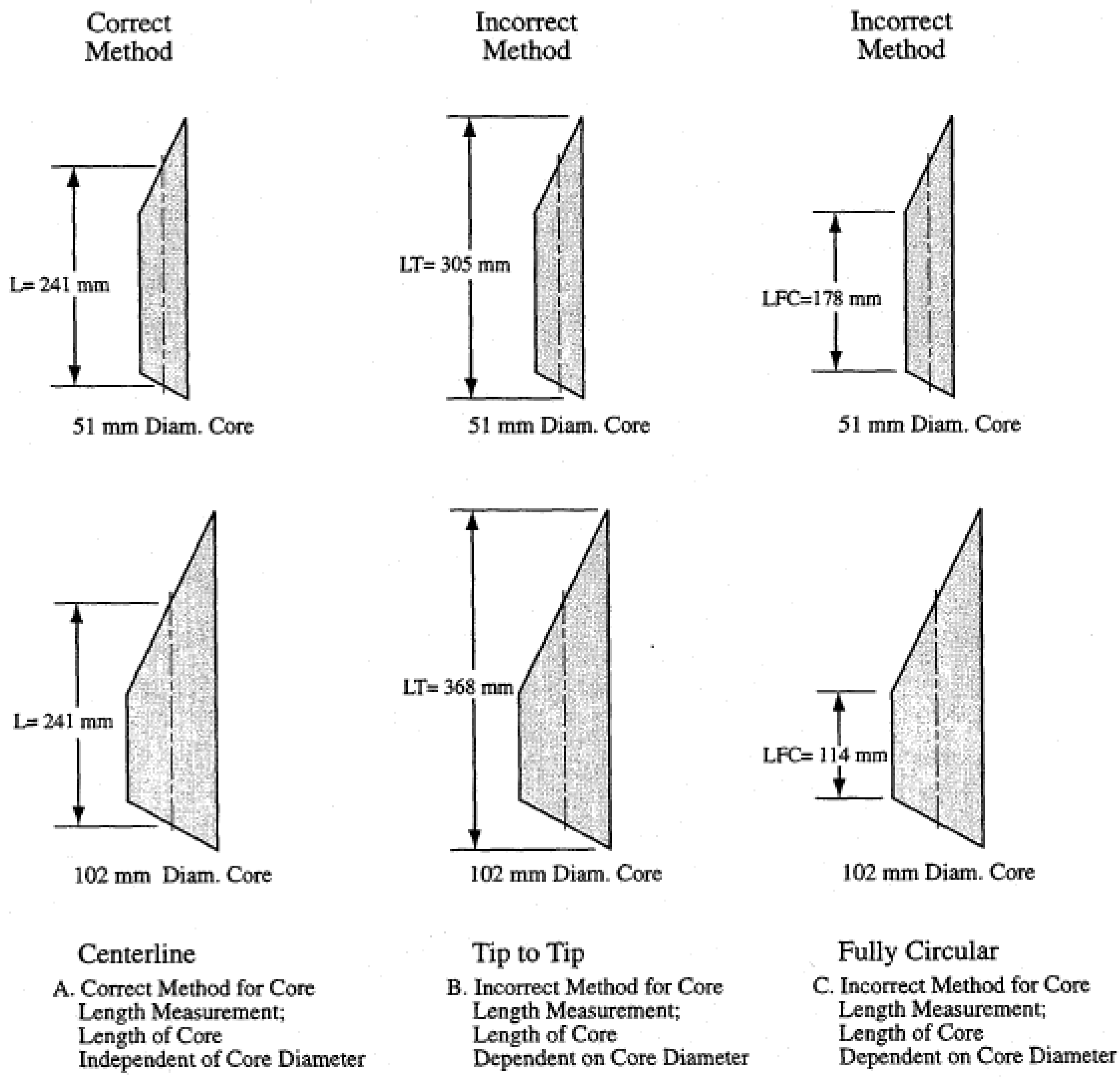


Figure 3-21. Length Measurement of Core RQD Determination.

Upon completing the summation of all core pieces 4-in or greater in length, divided that value by the length of the core run to calculate the RQD %. This value should be written on the core log FDR and on the inside lid of the rock core box. A description of the rock quality should also be included on the FDR. Terms to be used of rock quality are based on the RQD % and are:

0-25%	Very Poor
26-50%	Poor
51-75%	Fair
76-90%	Good
91-100%	Excellent

Rock Descriptions

Minimum requirements for rock descriptions are presented below.

- **Rock type.** Prior to mobilizing regional bedrock geology maps should be reviewed for potential bedrock that may be encountered during rock coring activities. Testing materials should be on hand if field determination is required between visually similar rock types (e.g. hydrochloric acid to differentiate between limestone [effervesces/fizzes] and dolomite [no effect]).
- **Color**. Rock color varies significantly depending on factors such as the lighting conditions, the wetness of the rock surface, and whether the observed surface is fresh or weathered. Field geologists should apply consistent color determination throughout the field program.
- **Texture.** Texture describes the composition of the rock. Texture typically refers to grain/crystal size in sedimentary/igneous rocks and degrees of metamorphism in metamorphic rocks.
- Principal constituent **minerals** (where discernable).
- **Weathering**. Weathering characteristics (e.g. clay lenses, pitting, mineral precipitation) may be important and should be described in reasonable detail. Descriptions should include the degree of weathering and the specific parent and daughter minerals involved.
- **Fracturing**. Fracturing (breaks) in the rock may be important and should be described in reasonable detail of the types and depths at which they were observed. Descriptions should include overall fracture density (e.g. unfractured, moderately fractured). Care should be made to note fracture depths as below ground surface and the type of fracture that was observed (e.g. mechanical break from coring, joint, fracture zone). Field data records can be created with separate columns for fracture depths to create simpler descriptions. Refer to the project specific FAP for such forms.
- Formal name (if known) of the rock **formation** (or group, series, member, or other unit designation).

Examples of Rock Descriptions

The following are examples of carbonate rock descriptions. It is recommended that descriptive information be recorded in the order ROCK TYPE, COLOR, MINERALS, TEXTURE, WEATHERING, FORMATION NAME.

- LIMESTONE, pale orange, finely crystalline, thinly bedded, weakly cemented with $CaCO_3$, moderate to good porosity, fossiliferous, slightly fractured, fracture with clay seam at 78.2 ft bgs, Suwanee Limestone.
- LIMESTONE, very pale orange, slightly dolomitic, chalky matrix, poor porosity, microfossiliferous, Suwanee Limestone.

- MARBLE, very strong, white to buff with dark green veins, nonfoliated, slightly fractured (all mechanical breaks), Inwood Marble.

4.0 ATTACHMENTS

Field Guide for Rock Core Logging

FIELD GUIDE FOR ROCK CORE LOGGING AND FRACTURE ANALYSIS®

midwest GEOSCIENCES group
www.midwestgeo.com

STEP 1

LABEL FRACTURES AND MARK CORE

- Place a strike mark perpendicularly across all fractures judged to be "natural"
- Place a two-color parallel strike mark along the entire core to indicate correct end up
- Photograph core with color chart and scale (be consistent with either dry or wet core)

STEP 2

CALCULATE CORE RECOVERY & ROCK QUALITY DESIGNATION

RUN LENGTH (in inches) 0 10 20 30 40 50 60 60"

NX CORE (2.16" dia.)

TOTAL RECOVERY 7 1 1 2 3 1 3 4 1 3 3 12 8 2 1 5 8 60"

SOLID RECOVERY 6 1 2 3 4 1 3 9 6 3 4 42"

MODIFIED RECOVERY 6 4 9 6 4 29"

* Drilling Break Illustrated

TOTAL CORE RECOVERY: SUM TOTAL OF PIECES (INCLUDING NON-INTACT CORE) / CORE RUN (Ex: 60"/ 60" = 100%)

SOLID CORE RECOVERY: SUM TOTAL OF PIECES (EXCLUDING NON-INTACT CORE) / CORE RUN (Ex: 42"/ 60" = 70%)

MODIFIED CORE RECOVERY: SUM TOTAL OF CORE PIECES (MIN.) 4 INCHES IN LENGTH / CORE RUN (Ex: 29"/ 60" = 48%, RQD is (Poor)

ROCK QUALITY DESIGNATION: 0-25: **VERY POOR** ● 26-50: **POOR** ● 51-75: **FAIR** ● 76-90: **GOOD** ● 91-100: **EXCELLENT**

STEP 3

DESCRIBE CORE SAMPLE

FORMATION NAME

USE FORMAL STRATIGRAPHIC NAME AND NOMENCLATURE WHEN POSSIBLE;
IF NOT POSSIBLE, ASSIGN SITE-SPECIFIC UNIT NAME ACCORDING TO SITE STRATIGRAPHIC POSITION

ROCK TYPE

DOCUMENT ROCK LITHOLOGY: LIST OF COMMON ROCK NAMES ARE SHOWN ON REVERSE

FIELD STRENGTH

- CRUMBLED BY HAND, SCRATCHED EASILY WITH THUMBNAIL ► **VERY WEAK**
- BROKEN BY HAND INTO PIECES, PEELED BY POCKET KNIFE ► **WEAK**
- BROKEN WITH DIFFICULTY IN TWO HANDS, EASILY SCRATCHED WITH KNIFE ► **MODERATE**
- SCRATCHED WITH KNIFE, INDENTATION MADE BY FIRM BLOW WITH ROCK HAMMER ► **STRONG**
- CHIPPED BY FIRM BLOW WITH ROCK HAMMER ► **VERY STRONG**

COLOR

USE STANDARD MUNSELL COLOR DESIGNATIONS

IS MATRIX FRESH? Note wet or dry sample
- YES → **MATRIX COLOR** List dominant color first
- NO → IS DISCOLORATION DUE TO OXIDATION?
  - YES → **OXIDIZED COLOR** Note distribution & occurence
  - NO → **SECONDARY COLOR(S)** Note distribution, position, & occurence

TEXTURE

SEDIMENTARY ROCK
- CRYSTALS ARE INDISTINGUISHABLE for (bio)chemical rocks ► **MICROCRYSTALLINE**
- CONSTITUENTS ARE INDISTINGUISHABLE for detrital rocks ► **APHANITIC**
- 0.06 mm to 0.25 mm ► **FINE-GRAINED**
- 0.25 mm to 0.5 mm ► **MEDIUM-GRAINED**
- 0.5 mm to 2.0 mm ► **COARSE-GRAINED**

FOSSILIZED ► **FOSSILIFEROUS**

Note Degree of Cementation and Grading When Applicable

METAMORPHIC ROCK
- GRAINS ARE INDISTINGUISHABLE, MAY BE CLEAVABLE BUT CAN BE OBLIQUE TO BEDDING, DULL ► **SLATY**
- GRAINS ARE INDISTINGUISHABLE, PARALLELISM IS SILKY, OR CRENULATED ► **PHYLLITIC**
- GRAINS ARE PLATY OR ENLONGATED AND PARALLEL ► **SCHISTOSE**
- CRUDELY FOLIATED WITH SUBPARALLEL AND UNEVENLY DISTRIBUTED GRAINS ► **GNEISSIC**
- NO VISIBLE PREFERRED ORIENTATION OF GRAINS ► **NONFOLIATED**

IGNEOUS ROCK
- CONTAINS MEGACRYSTS
  - COMPATIBLE IN COMPOSITION ► **PORPHYRITIC**
  - FOREIGN IN COMPOSITION ► **XENOCRYSTIC**
- CONSTITUENTS ARE INDISTINGUISHABLE ► **APHANITIC**
- CONSTITUENTS ARE DISTINGUISHABLE ► **PHANERITIC**

STRUCTURE

- UNIFORM ► **MASSIVE**
- BEDDING, FOLIATION, OR BANDS from 1 to 10ft [300mm to 3m] ► **THICKLY BEDDED** or **FOLIATED** or **BANDED**
- BEDDING, FOLIATION, OR BANDS from .3 to 1ft [100 to 300mm] ► **MEDIUM BEDDED** or **FOLIATED** or **BANDED**
- BEDDING, FOLIATION, OR BANDS from .1 to .03ft [10 to 100mm] ► **THINLY BEDDED** or **FOLIATED** or **BANDED**
- LAMINATIONS, FOLIATION, OR BANDS less than 0.03ft [<10mm] ► **LAMINATED** or **INTENSELY FOLIATED** or **INTENSELY BANDED**

DECOMPOSITION

- NO DECOMPOSITION OR DISCOLORATION APPARENT ► **FRESH**
- MOSTLY FRESH BUT DISCOLORATION NEAR FRACTURES ► **SLIGHTLY DECOMPOSED**
- MOSTLY DISCOLORED, EASILY BROKEN BY HAMMER ► **MODERATELY DECOMPOSED**
- COMPLETELY DISCOLORED, EASILY BROKEN BY HAND ► **HIGHLY DECOMPOSED**
- CAN BE CRUMBLED BY HAND (and in near-surface position) ► **RESIDUAL SOIL** (note pedogenic development)

DISINTEGRATION

- NO MINERALIZATION OR DISSOLUTION (to either rock or cementation) ► **COMPETENT**
- TRACE MINERALIZATION OR DISSOLUTION ► **SLIGHTLY DISINTEGRATED**
- SOME MINERALIZATION OR DISSOLUTION ► **MODERATELY DISINTEGRATED**
- HIGHLY MINERALIZED OR DISSOLVED ► **INTENSELY DISINTEGRATED**

For Voids: Characterize using Terms on Reverse

FRACTURE DENSITY

- NO OBSERVED FRACTURES ► **UNFRACTURED**
- CORE RECOVERED MOSTLY IN LENGTHS GREATER THAN 1 FOOT ► **SLIGHTLY FRACTURED**
- CORE RECOVERED MOSTLY IN LENGTHS FROM 0.33 TO 1 FOOT ► **MODERATELY FRACTURED**
- CORE LENGTHS AVERAGE FROM 0.1 TO 0.33 FOOT ► **INTENSELY FRACTURED**
- CORE RECOVERED MOSTLY AS NON-INTACT (NI) FRAGMENTS ► **VERY INTENSELY FRACTURED**

Characterize Fractures Using Chart on Reverse

STRATIGRAPHIC CONTACT

- CONTACT WHEN BEDS OR UNITS ARE IN FORMATION OR DEPOSITIONAL SEQUENCE ► **CONFORMABLE**
- CONTACT WHEN BEDS OR UNITS ARE NOT IN FORMATION OR DEPOSITIONAL SEQUENCE ► **UNCONFORMABLE** (note transition interval)

FRACTURE CHARACTERIZATION GUIDE

midwest GEOSCIENCES group
www.midwestgeo.com

DEPTH

DISTANCE BELOW GROUND SURFACE (always note measured units)

TYPE

STRUCTURAL BREAK WHERE LITTLE OR NO DIFFERENTIAL MOVEMENT HAS OCCURRED	► JOINT
STRUCTURAL BREAK WHERE DIFFERENTIAL MOVEMENT HAS OCCURRED	► SHEAR
DIVISION PLANE THAT SEPARATES SUCCESSIVE LAYERS OR BEDS	► BEDDING PLANE JOINT
TIGHT, OFTEN DISCONTINUOUS PLANE, MAY BE SEPARATED BY HAND ALONG PLANE	► MICROJOINT
NUMEROUS INTERSECTING JOINTS	► FRACTURE ZONE
WIDTH OF FRACTURE ZONE INDICATING NUMEROUS JOINTS, SHEARS OR FAULT	► SHEAR ZONE
BREAK DUE TO DRILLING, BLASTING, OR HANDLING	► MECHANICAL BREAK

DIP ANGLE

DEGREES FROM HORIZONTAL

APERTURE

>200mm	► WIDE
60-200mm	► MODERATELY WIDE
20-60mm	► MODERATELY NARROW
6-20mm	► NARROW
2-6mm	► VERY NARROW
>0-2mm	► EXTREMELY NARROW
NO VISIBLE SEPARATION	► TIGHT

FOR VOIDS:

PINHOLE OPENINGS	► PIT (pitted)
SMALL OPENING UP TO 4 INCHES	► VUG (vuggy)
OPENING LARGER THAN 4 INCHES	► CAVITY
CELL-LIKE FORM OF VUGS AND PITS	► HONEYCOMBED
OPENINGS FORMED BY TRAPPED GAS	► VESICLE (vesicular)

HEALING

ALL PARTS BONDED, COMPLETELY HEALED OR RE-CEMENTED	► TOTALLY HEALED
>50% FRACTURED/SHEARED DISCONTINUITIES HEALED, RE-CEMENTED, OR FILLED	► MODERATELY HEALED
<50% FRACTURED/SHEARED DISCONTINUITIES HEALED, RE-CEMENTED, OR FILLED	► PARTLY HEALED
NO FRACTURES OR SHEARS ARE HEALED, RE-CEMENTED, OR FILLED	► NOT HEALED

INFILLING

NO APPARENT INFILLING OR COATING	► CLEAN
OXIDATION OR SECONDARY STAINING ALONG FRACTURE FACE	► SURFACE OXIDATION or STAINING
DECOMPOSITION OR DISINTEGRATION ALONG FRACTURE	► DECOMPOSED or DISINTEGRATED ROCK
SEDIMENT THAT IS NON PLASTIC	► NON-COHESIVE SEDIMENT
SEDIMENT THAT YIELDS PLASTICITY	► COHESIVE SEDIMENT
SECONDARY MINERALIZATION	► MINERALIZATION (Ex: Quartz, Calcite, Manganeze, Kaolin)
OTHER	► OTHER (Note observation)

UNEVENESS

LARGE OR ANGULAR ASPERITIES	► ROUGH
NO ASPERITIES	► SMOOTH
POLISHED OR STRIATED	► SLICKENSIDED

WITH NEAR NORMAL STEPS OR RIDGES	► STEPPED
WITH WAVY SURFACE	► UNDULATING
WITH EVEN SURFACE	► PLANAR

MOISTURE CONDITIONS

WATER FLOW DOES NOT APPEAR POSSIBLE ALONG FRACTURE	► RESTRICTED
FRACTURE IS DRY, BUT WATER FLOW APPEARS POSSIBLE	► DRY
FRACTURE IS DRY, BUT SHOWS STAINING OR LEACHING	► DRY WITH STAINING or LEACHING
FRACTURE FILLING (WHERE PRESENT) IS DAMP, BUT NO APPARENT WATER FLOW	► DAMP
FRACTURE FILLING IS WET (OR STAINED), WITH APPARENT MINOR SEEPAGE	► WET WITH MINOR SEEPAGE
FRACTURE FILLING IS WASHED AND WET, WITH APPARENT CONTINUOUS SEEPAGE	► WET WITH CONTINUOUS SEEPAGE

LIST OF COMMON ROCK NAMES

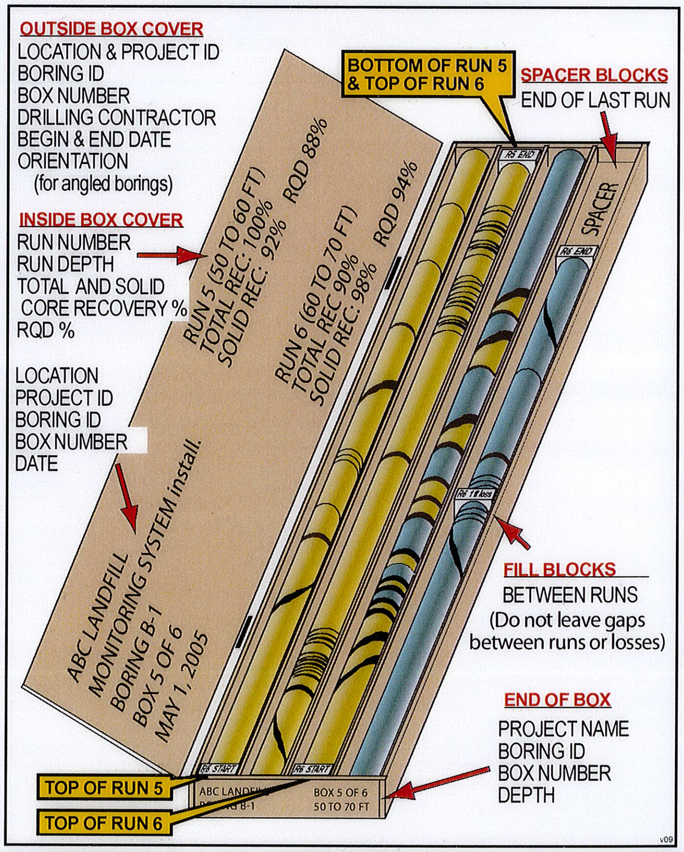
METAMORPHIC ROCKS	NON-FOLIATED	FAULT BRECCIA, QUARTZITE, MARBLE, HORNFELS	
	FOLIATED	AMPHIBOLITE, GNEISS; SCHIST, SLATE	MYLONITE / PHYLLITE

			COARSE-GRAINED / MEDIUM-GRAINED / FINE-GRAINED	
IGNEOUS ROCKS	QUARTZ RICH	PEGMATITE	GRANITE, APLITE	RHYOLITE
			DIORITE, GRANODIORITE	RHYODACITE, DACITE
	SOME QUARTZ		QUARTZ MONZONITE, QUARTZ SYENITE	QUARTZ LACITE, QUARTZ TRACHYTE, TRACHYANDESITE, ANDESITE
	QUARTZ POOR		GABBRO	BASALT, PERIDOTITE
			LAMPROPHYYRE	

PYROCLASTIC ROCKS	PYROCLASTIC BRECCIA	LAPILLI TUFF	COARSE ASH TUFF	FINE ASH TUFF

SEDIMENTARY ROCKS	Chemical & Biochemical Rocks	LIMESTONE, DOLOMITE, AND EVAPORITES			CHERT
	Detrital Rocks	SEDIMENTARY BRECCIA / CONGLOMERATE	SANDSTONE	SILTSTONE	SHALE, COAL

CORE BOX LABELING



SOP # S13

MACTEC STANDARD OPERATING PROCEDURE #S13

SOIL SAMPLE COLLECTION PROCEDURE

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27,2020

Charles Staples, PG, Program Technical Lead — Date

Reviewed — Date

SOIL SAMPLE COLLECTION PROCEDURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the methods used for obtaining surface and subsurface soil samples for physical, geotechnical, or chemical analysis. Collection of soil samples for laboratory analysis for volatile organic compounds may require specially prepared containers, syringes, or Encore samplers. This SOP also describes the procedures for using the various types of sampling equipment, which include shovels, trowels, and hand-augers.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2018. Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils, Method D1586-18.

ASTM, 2017a. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System), Method D2487-17e1.

ASTM, 2017b. Standard Practice for Thick Walled, Ring-Lined, Split Barrel, Drive Sampling of Soils, Method D-3550-17.

ASTM, 2015. Standard Practice for Thin-Walled Tube Sampling of Fine-Grained Soils for Geotechnical Purposes, Method D1587-15.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043. Revised 4/16/2004.

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020.

Hewitt, Alan D., et al. 2007. Protocols for Collection of Surface Soil Samples at Military Training and Testing Ranges for the Characterization of Energetic Munitions Constituents. U.S. Army Corps of Engineers. ERDC/CRREL TR-07-10..

3.0 DEFINTITIONS

Borehole - Any hole drilled or hydraulically driven into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing monitoring wells.

Core Sampler – A metal tube (probe rod), generally 4- to 5-feet long by 2.25- to 3.25-inch OD, typically utilized along with drive rods and a polyvinyl chloride (PVC) or acetate or equivalent liner that is used to collect soil cores utilizing a direct-push rig.

Composite Samples – Composite samples are comprised from at least two grab samples that are thoroughly mixed in a decontaminated bowl to be representative of an area, transect, or vertical section. The result typically is considered an average concentration of the depth interval sampled.

Shelby Tube Sampler – A thin-walled metal tube used to recover relatively undisturbed samples. These tubes are available in various sizes, ranging from 2 to 5 inches in outside diameter and 18 to 54 inches in length. A stationary piston device is included in the sampler to reduce sampling disturbance and increase sample recovery.

Split-Spoon Sampler – A steel tube, split in half lengthwise, with the halves held together by threaded collars at either end of the tube.

Grab Samples – A soil sample that is collected from a specific discrete interval by using such devices as stainless-steel spoon, scoop, sampling device (e.g. syringe, EnCore samplers), or sample container (e.g., wide-mouth jar).

4.0 PROCEDURES

This section contains both the responsibilities and procedures involved with soil sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting them in field data records (FDRs) and/or the field logbook.

4.2 Preparation

Equipment Selection and Sampling Objective Considerations

Specific sampling equipment and methodology will be dictated by the characteristics of the soil to be sampled, field conditions, the type of soil samples required by the project, and the analytical procedures to be employed.

Surface Soils

Soil samples obtained from the near surface (0-2 ft bgs) may be collected using a shovel, trowel, bucket auger, or stainless-steel spoon and bowl. The type of analysis required (e.g., grain-size distribution, physical, chemical) will require specific soil amounts or the use of specialized sampling equipment. Sampling locations or sampling design will be identified in the site specific Field Activities Plan (FAP).

A hand-auger can be used to extract shallow soil samples from depths as deep as three to four feet below the surface. Representative samples are collected directly from the bucket auger after withdrawal from the ground, or in soft soils from a tube sampler attached to the end of auger rods.

Subsurface Soils

Soil samples collected from greater than 2 ft bgs, typically require speciailized equipment such as a drill rig or excavator, depending on site conditions.

Equipment used to collect surface or subsurface soil samples may include, but is not limited to, the following items:

Sample devices and processing materials:

- Stainless steel spoons/trowels.
- Stainless steel hand auger.
- Stainless steel split spoon, split barrel, or continuous sampler.
- Stainless steel bowls/pans.
- Aluminum foil/pans.
- Metal/plastic scraper
- Sample jars and labels.
- Plastic sheeting.
- Appropriate decontamination equipment (e.g. stainless-steel deionized water spraying devices).
- Appropriate personnel protective equipment and safety equipment as specified in the Health and Safety Plan.

Sample handling materials:

- Sample cooler with bagged ice.
- Bubble wrap.
- Paper towels.
- Tape.
- Ziplock freezer bags

Sample description/Record keeping materials:

- Field logbook and boring log.
- Pens with waterproof ink.
- Field data records (FDRs; **examples attached**)
- Chain-of-Custody forms.
- Munsell Soil Color charts.
- Grain size charts; and
- Hand lens.

4.3 Field Procedures

Decontamination

Each piece of sampling equipment shall be decontaminated before initiation of sampling operations and between each sample location and interval. Decontamination procedures will be described in the project work plan but typically consist of a wash and scrub with potable water, brushes and Alconox®/Liquinox® soap followed by a DI water rinse. Refer to the **Field Equipment Decontamination SOP** for guidance. Spent decontamination fluids will be containerized properly, labeled, and appropriately disposed of as addressed in the FAP.

Sample Collection – Surface soils

Upon reaching the sampling location specified in the FAP. Prepare the sampling location by removing all surface materials that are not to be included in the sample (i.e., rocks, twigs, and leaves). Sod (grass and roots) should be remove using a shovel and placed to one side prior to sampling. Record pre-existing surface conditions on the Surface Soil FDR (**examples attached**).

Advance the sampler (shovel, trowel, hand auger, or tube sampler) to the required sample depth. Obtain a sufficient quantity of soil for the desired chemical or physical analyses. If volatile organic compound (VOC) or volatile petroleum hydrocarbon (GRO) samples are scheduled, they should be collected immediately based on the requirements and containers provided by the analytical laboratory. See the **Field Preservation of VOC and GRO Soil Samples SOP** for specific procedures for collection and field preservation of VOC Soil Samples. These samples should be collected directly from the sampler or from the excavated area.

The remaining soil should then be composited in a stainless-steel bowl for all other analytical parameters. Select the appropriate sample container and place the sample in the container. Describe the soil in accordance with Unified Soil Classification System (USCS) soil classification system (Refer to the **Description and Identification of Soil Samples SOP**).

Upon completion of collection of the surface soil sample, backfill the location using the excavated soils and replace sod if required.

Record all observations on the appropriate FDR (surface soil or soil boring; **example attached**) and field logbook. Mark and label sample location with flagging or a pin flag and survey the point using GPS or collect measurements from three identifiable points and record measurements and a diagram in the field logbook or field data record.

Sample Collection – Subsurface soils

Subsurface soils are typically collected during a drilling program and are collected from sample tooling as specified in the FAP. Upon reaching the required sample depth utilizing one of the drilling methods outlined in the FAP and appropriate drilling method SOP (**See SOP Table A-1 for appropriate SOP**), retrieve the sample tooling and prepare for sample collection. Alternatively samples may be collected from a test pit excavation (**Test Pit Oversight SOP**).

Complete core splitting and logging as described in the **Drilling - Soil Boring and Rock Coring Oversight SOP**. Describe the soil in accordance with USCS soil classification system (Refer to the **Description and Identification of Soil Samples SOP**).

If VOC or GRO samples are scheduled, they should be collected immediately after field screening based on the requirements and containers provided by the analytical laboratory. See the **Field Preservation of VOC and GRO Soil Samples SOP** for specific procedures for collection and field preservation of VOC Soil Samples. These samples should be collected directly from the sampler.

The remaining soil should then be composited in a stainless-steel bowl for all other analytical parameters. Select the appropriate sample container and place the sample in the container. If sufficient soil was not obtained for all analysis, additional borehole attempts at the same sample depth may be required.

Repeat this sampling procedure at the intervals specified in the project FAP until the bottom of the borehole is reached and/or last sample collected.

Record all observations on the appropriate FDR (**example attached**) and field logbook. Mark and label sample location with flagging or a pin flag and survey the point using GPS or collect measurements from three identifiable points and record measurements and a diagram in the field logbook or field data record.

Sample Handling

Upon collecting the required amount of soil, cap and label the sample container. Care should be taken to clean the sample container threads using paper towels prior to capping. The outside of the container should also be cleaned.

Clear tape should be used to wrap around the completed label to preserve legibility and prevent loss of the label during handling in wet conditions. Do not tape labels for samples collected for VOC or GRO analysis (See the **Field Preservation of VOC and GRO Soil Samples SOP**).

Place samples into a cooler with ice and begin specified storage and preservation procedures.

Samples will be labelled, handled, and transported in accordance with **Chain of Custody Procedures SOP**, the QAPP, and site-specific FAP.

5.0 ATTACHMENTS

Surface Soil Sampling Field Data Record

Soil Boring Field Data Record

Test Pit Field Data Record

SURFACE WATER AND SEDIMENT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

PROJECT NAME		**SAMPLE LOCATION**	**DATE**
PROJECT NUMBER		**START TIME**	**END TIME**
SAMPLE ID	**SAMPLE TIME**	**SITE NAME/NUMBER**	**PAGE** OF

SURFACE WATER DATA

WATER DEPTH AT SAMPLE LOCATION ________ FT. DEPTH OF SAMPLE BELOW WATER SURFACE ________ FT. FLOW RATE ________ ML/MIN

WATER QUALITY PARAMETERS:

TEMPERATURE ________ °C
SPEC. COND. ________ mS/cm
PH ________ pH Units
ORP ________ mV
TURBIDITY ________ NTUs
DO ________ mg/L
☐ WINKLER METHOD
☐ DO PROBE

EQUIPMENT USED:

☐ BEAKER
☐ BOTTLE
☐ PACS BOMB
☐ PUMP ________
☐ FILTER
No. ________ Type: ________
☐ FIELD DUPLICATE COLLECTED
DUP. ID ________

TYPE OF SURFACE WATER:

☐ STREAM
☐ RIVER
☐ LAKE
☐ POND
☐ SEEP
☐ ________

FIELD SKETCH SHOWN/ATTACHED

☐ YES ☐ NO

DECON FLUIDS USED

☐ ALL USED
☐ LIQUINOX/DI H_2O SOLUTION
☐ DEIONIZED WATER
☐ POTABLE WATER
☐ NITRIC ACID
☐ HEXANE
☐ 25% METHANOL/75% ASTM TYPE II H_2O
☐ ETHYL ALCOHOL
☐ ________

SAMPLING EQUIPMENT

WATER QUALITY METER MODEL NO. ________ UNIT ID NO. ________
TURBIDITY METER MODEL NO. ________ UNIT ID NO. ________

SEDIMENT SAMPLE INFORMATION

TYPE OF SAMPLE

☐ DISCRETE
☐ COMPOSITE

SAMPLE INTERVAL:

TOP ________
BOTTOM ________

COLLECTION EQUIPMENT

☐ HAND AUGER/CORER
☐ S.S. SPLIT BARREL
☐ ALUMINIUM PAN
☐ S.S. SHOVEL
☐ HAND SPOON/SPATULA
☐ S.S. BUCKET
☐ OTHER ________

DECON FLUIDS USED

☐ ALL USED
☐ LIQUINOX/DI H_2O SOLUTION
☐ DEIONIZED WATER
☐ POTABLE WATER
☐ NITRIC ACID
☐ HEXANE
☐ 25% METHANOL/75% ASTM TYPE II H_2O
☐ ETHYL ALCOHOL

QC SAMPLES

☐ DUPLICATE ________
☐ EQ BLK ________

MS/MSD:
☐ YES
☐ NO

TYPE OF MATERIAL:

☐ ORGANIC
☐ SAND
☐ GRAVEL
☐ CLAY
☐ FILL
☐ OTHER________

SAMPLE OBSERVATIONS

ODOR ________
COLOR ________
OTHER ________
PID ________

FIELD SKETCH SHOWN/ATTACHED

☐ YES
☐ NO

ANALYTICAL PARAMETERS

	PARAMETER	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED	QC COLLECTED	SAMPLE BOTTLE ID NUMBERS
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							
☐							

NOTES/SKETCH

Sampler Signature:	Print Name:	Deviations from the work Plan:
Checked By:	Date:	

SOIL BORING LOG

MACTEC

511 Congress Street, Portland Maine 04101

Project Name:		Boring ID:
Project Location:		Page No.
Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

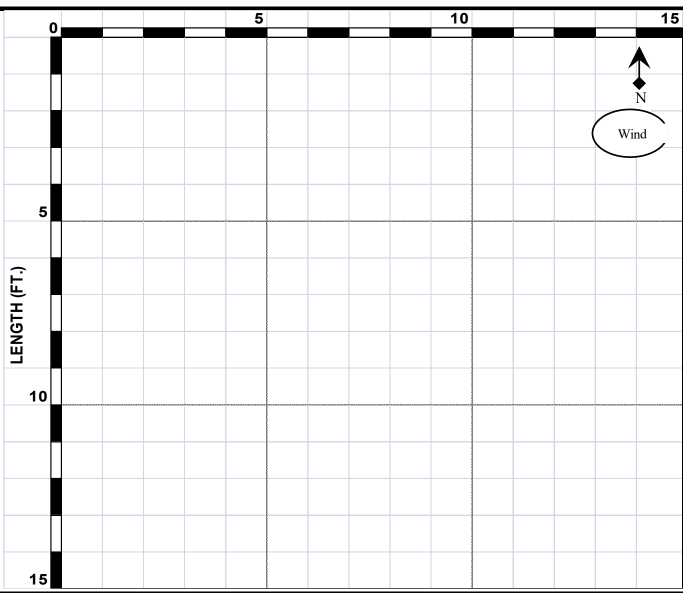
NOTES:

TEST PIT RECORD

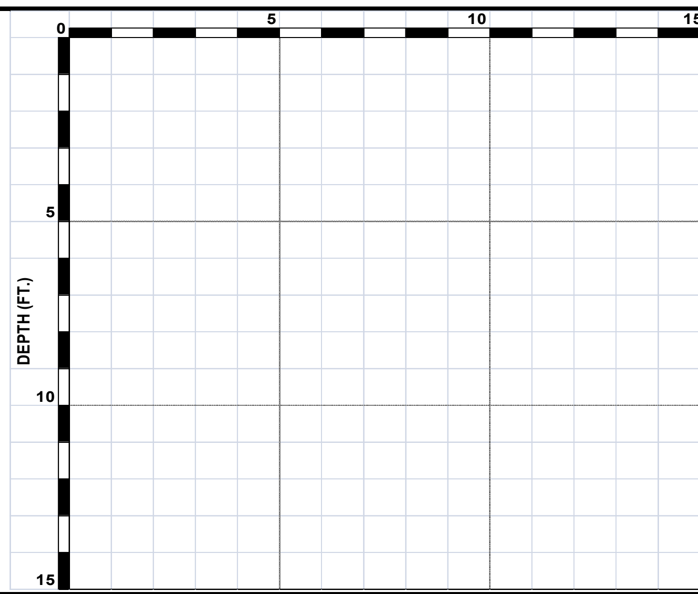
MACTEC 511 Congress Street, Portland Maine 04101	Project Name:		Test Pit ID:
	Project Location:		Page No. 1
	Project No.:	Client: NYSDEC	of: 1
Test Pit Location:	Monitoring Equipment:		**Location Sketch**
Weather:	Photographs (Y/N):	Protection Level:	N
Surface Conditions:	Length of Exc:	Width of Exc:	Wind
Subcontractor:	Date Started:	Date Completed:	
Operator:	Logged By:	Checked By:	
Equipment:	Refusal Depth:	Total Depth:	
Reference Elevation:	Water Level:	Time:	

Sample Information			Monitoring						
Depth (ft. bgs)	Sample No. & Type	Pocket Pen/ Torvane (Kg/cm^2)	PID Field Scan	PID Headspace	Lab Tests Performed	Lab Sample ID	Sample Description and Classification	USCS Group Symbol	Remarks

PLAN VIEW



CROSS-SECTIONAL VIEW



NOTES:

TEST PIT RECORD

SOP # S14

MACTEC STANDARD OPERATING PROCEDURE #S14

FIELD PRESERVATION OF VOA AND GRO SOIL SAMPLES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

April 27,2020

Bradley LaForest, NRCC-EAC, Project Manager | Date

Reviewed | Date

FIELD PRESERVATION OF VOA AND GRO SOIL SAMPLES

1.0 PURPOSE

This purpose of this Standard Operating Procedure (SOP) is to outline the steps associated with field preservation of soil samples for volatile organic analysis (VOA) in accordance with U.S. Environmental Protection Agency (USEPA) Method 5035 (USEPA, 1996). Specific steps and details are described for the primary tasks of sample container preparation, soil sample collection, sample container management and documentation.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

New Hampshire Department of Environmental Services (NHDES), "Recommended Analytical Methods for Evaluating Petroleum Contaminated Sites"; revised January 2008.

U.S. Environmental Protection Agency (USEPA), December 1996. "Test Methods for Evaluating Solid Waste"; Laboratory Manual Physical/Chemical Methods; Office of Solid Waste and Emergency Response; Washington, DC; SW-846; November 1986; Revision 4.

3.0 DEFINITIONS

En Core® Sampler – sampling device made of an inert composite polymer, designed to collect, store, and deliver soil in a sealed-headspace free state.

GRO – gasoline range organics include volatile petroleum hydrocarbons purged from a sample in the laboratory using an inert gas.

Terra Core™ Sampler – a syringe like coring device that is pushed into soils and then extruded into pre-preserved vials.

4.0 PROCEDURE

This section contains both the responsibilities and procedures involved with soil sampling for volatile organic compounds (VOCs) and GRO. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and for documenting deviations in the filed logbook and/or field data record.

4.2 Preparation

Equipment Selection and Sampling Objective Considerations

Sample containers used for the collection of off-site VOAs and GRO samples will be prepared in advance at the off-site analytical laboratory. Container preparation by the off-site laboratory will include attaching labels, adding preservation fluid, weighing sample containers, and recording all information necessary to document container preparation and to calculate sample weight and target analyte concentrations during subsequent sample analyses.

Upon receipt from the lab, the sample containers should be inspected to verify that the following have been included:

- 40 milliliter (ml) glass VOA vial with Teflon lined silicone septa lids filled with preservatives by the laboratory and pre-weighed with a water-resistant sample label.
    - Check the amount of preservative in the VOA vials. These volumes are important for determining the sample volume required in section 4.3.
        - 5mL = 2.1-2.5 mm (0.08-0.1 in) of liquid
        - 10mL = 4.2-5 mm (0.16-0.2 in) of liquid
- Sample syringe (20 mL plastic sampling syringe with end cut off) or Terra Core™ T-samplers or

En Core® samplers with a T-handle sampling device.

- A separate sample vial or container for percent moisture determination in association with each soil sample.

Containers will be stored in a dedicated area away from samples of sources of contamination (e.g. gas cans, marking paint, bug spray). A standard sample set will include three preserved VOA vials for each sample location (1 methanol, 2 deionized water) and a percent moisture container.

4.3 Field Procedures

Soil will be preserved in de-ionized water (low VOC concentration analyses) and methanol (high VOC concentration analyses) at the time of sample collection. Soils will be obtained directly from sampling devices (e.g., hand augers, split spoons, Geoprobe cores) using plastic syringe type samplers to reduce exposure of the samples to air.

For VOA, approximately 5 grams of soil is required for each analysis for low level and high-level concentration VOA vials. A good rule of thumb is that for VOA preservative volume to soil sample volume should be 1:1 (5mL preservative to 5g soil).

A soil mass of 10 grams will be added to vials for GRO analysis. For GRO analysis soil volumes should be at a 2:1 ratio to the preservative (10g to 5 mL).

Upon collection soils for VOA and GRO analysis will be immediately transferred to a vial containing a pre-measured amount of preservation fluid.

- For low concentration VOCs, two vials will be collected at each location. Vials must be shipped to the laboratory each day or frozen within 48 hours of collection. When freezing water preserved samples, vials should rest on their side to prevent glass from cracking during freezing.
- En Core ® samplers must be shipped to the laboratory each day or preserved (i.e., frozen) within 48 hours of collection.
- For VOA and GRO, one high concentration methanol vial will be collected at each location.
- For locations selected for quality assurance/quality control (QA/QC) procedures, the number of vials will be doubled or tripled for the required sample counts.
- One additional unpreserved vial of soil will be collected for percent solids analysis.

Sample Collection

Sample collection will be performed with a disposable plastic syringe (20 mL open end syringe or Terra Core™ T-handle) or En Core® sampler.

Personnel will make note of preservation fluid levels on the sample containers to ensure no significant loss had occurred. If loss of the preservative occurs during sampling, discard the sample and re-collect in a new container. The specific steps and details for soil sample collection are outlined below:

1. If samples are collected using split spoons, a direct push sampler or sonic sampler, samples will be collected from the soil core immediately upon opening the sampling device. Perform core splitting activities as described in the drilling SOPS (see Table A-1 for specific methodologies). Complete field screening using the photoionization detector (PID) for the sample surface. VOA and GRO samples are typically collected from the interval of highest PID response. For surficial soils or test pits, samples will be collected directly from the sampling location substrate (see Table A-1 for soil sampling SOPs).
2. For En Core® and Terra Core™ samplers, prepare the sampler as per the manufacturer's instructions (instructions attached). For open ended syringes move the plunger back to the 5 mL mark.
3. Push/advance the sampler into the center of the sample core/location filling the soil sampler to the target volume (5 grams). For the syringe, pull the plunger back slightly to apply suction on the soil sample which will help it to remain in the syringe during removal. Remove the sample and wipe excess soil from the outside of the sampler.
4. If the proper volume of soil is not present in the sampler, repeat the procedure until the proper volume of soil has been collected. If necessary, use a stainless-steel spatula to fill the syringe with the needed soil volume. If rocks are present in the sample it may be necessary to extrude the sample from the sleeve, select a portion of the core sample that is void of large rocks, and then advance the sampling syringe. If possible, the sample volume should consist of sand, silt or clay with very few rocks or pebbles.
5. Remove a sample container from the cooler. Carefully extrude the soil sample from the syringe or T-sampler into the sample container. This task should be done slowly and carefully to ensure that the preservation fluid does not splash from the sample container**.**
    a. Note: En Core® samples do not require to be extruded from the sampler. The sampler is capped as per the manufacturer's instructions.
6. Repeat as necessary to fill the required number of sample vials. A sample for moisture determination will be collected for all soils in the lab provided unpreserved container. The samples will be collected using the same sample syringe and coring technique used for the actual field sample.
7. Syringes should be discarded immediately after extruding sample from syringe; <u>do not reuse</u>. If split samples are collected, care must be taken to make the samples equally representative (i.e., collected from the same part of the soil core).

8. Replace container cap as soon as possible.
9. With permanent waterproof ink fill out the sample container label with the following information: date, time, location, depth of sample, sample ID code, sample type (i.e., regular, duplicate, matrix spike, matrix spike duplicate) and sampler initials. **Do not tape over the sample container label as this would add weight to the lab pre-weighed vial.**
10. Make sure the sample container lid is screwed down tightly. If necessary, wipe excess soil from the mouth of the container to get an air-tight seal. Place the sample container back into the zip lock bag. Place the container and bag into the cooler taking care that the sample container remains upright. Keep samples on ice until they are submitted to the sample manager.
11. Transport sample containers in cooler with bagged ice. Keep sample containers in individual zip lock bags.
12. Follow Chain of Custody Procedures.
13. Complete the appropriate Field Data Record (FDR) and proceed with sample handling procedures as outlined in the FAP. Vials will be transported to the laboratory for analysis using procedures specified in the Quality Assurance Project Plan (QAPP).

5.0 ATTACHMENTS

En Core® Sampling Procedures

Terra Core™ Sampling Kit Fact Sheet

QEC Quality Environmental Containers

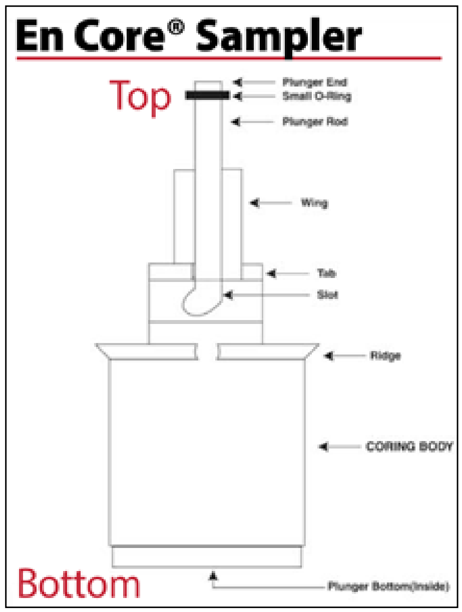
607 Industrial Park Road
P.O. Box 1160 • Beaver, WV 25813
Ph. 800-255-3950 • Fx. 304-255-3901
qecusa.com

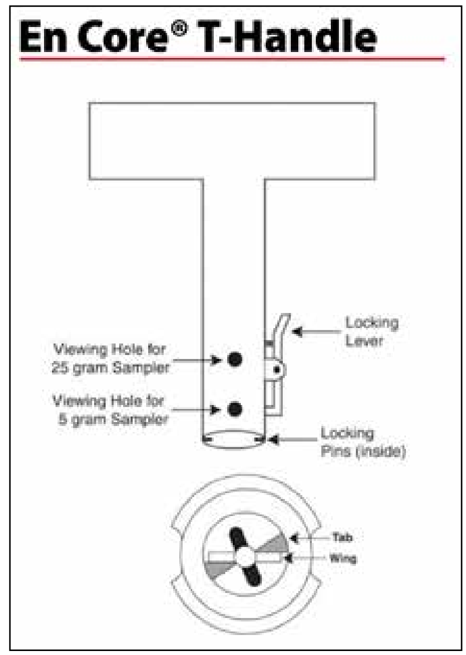
Sampling Procedures

Using En Core® Disposable Sampler and T-Handle

Note:

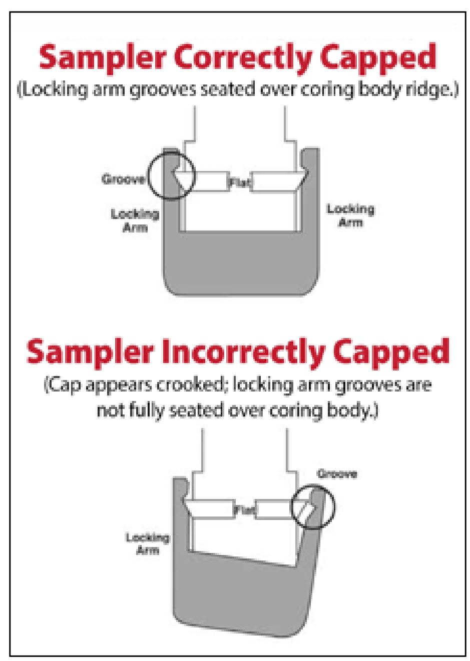
1. En Core® Sampler is a single-use device. ***It cannot be cleaned or reused.***
2. En Core® Sampler is designed to store soil. Do not use to store solvent or free product!
3. En Core® Sampler must be used with En Core® T-handle and En Core® Extrusion tool exclusively (all items sold separately).





Soil Sampling Procedures:

1. Hold coring **body** and **push plunger** down until **small o-ring** rests against tabs.
2. Depress **locking lever** on En Core® T-handle. Place coring body, **plunger end first**, into open end of T-handle, *aligning the (2)* ***slots*** *on the coring body with the (2)* ***locking pins*** *on the T-handle*. Twist coring body clockwise to lock pins in slots. Check to ensure Sampler is locked in place. Sampler is ready to use.
3. Turn T-handle with T up and coring body down. This positions plunger bottom flush with bottom of coring body (ensure that plunger bottom is in position). Using T-handle, push Sampler into soil until coring body is completely full. When full, small o-ring will appear centered in T-handle **viewing hole**. Remove Sampler from soil. Wipe excess soil from coring body exterior.
4. Cap coring body while still on T-handle. *Push* **cap** over **flat** area of **ridge** *and twist* to lock **cap** into place. **CAP MUST BE SEATED TO SEAL SAMPLER** (see diagram).
5. Remove the capped Sampler by depressing locking lever on T-handle while twisting and pulling Sampler from T-handle.
6. Lock plunger by rotating extended plunger rod fully counter-clockwise until wings rest firmly against tabs (see plunger diagram).
7. Fill in sample description on En Core® Sampler bag.
8. Return En Core® Sampler to zipper bag. Seal bag and put on ice.



Quality Environmental Containers, Inc. is an authorized reseller for the En Core® Sampler and other products from En Novative Technologies, Inc. For product information, please contact QEC's marketing department at 1-800-255-3950, or email info@qecusa.com.

Extrusion Tool Procedures ►

QEC Quality Environmental Containers
607 Industrial Park Road
P.O. Box 1160 • Beaver, WV 25813
Ph. 800-255-3950 • Fx. 304-255-3901
qecusa.com

Extrusion Procedures

Using En Core® Extrusion Tool

Caution: Always use the Extrusion Tool to extrude soil from the En Core® Sampler. If the Extrusion Tool is not used, the Sampler may fragment, causing injury.

1. To attach the En Core Sampler to the En Core Extrusion Tool: Depress **locking lever** on Extrusion tool and place Sampler, plunger end first, into open end of Extrusion Tool, aligning slots on coring body with pins in Extrusion Tool. Turn coring body clockwise until it locks into place. Release locking lever.

2. Rotate and gently push Extrusion Tool plunger knob clockwise until plunger slides over wings of coring body. When properly positioned, plunger knob will not rotate further.

3. Hold Extrusion Tool with capped sampler pointed upward so soil does not fall out when cap is removed. Remove cap from Sampler by rotating cap until locking arms are aligned with the flat area of ridge and pull cap off. To release soil core push down on plunger knob of Extrusion Tool. Remove and properly dispose of Sampler.

Warranty and Disclaimers

IMPORTANT; FAILURE TO USE THE EN CORE SAMPLER IN COMPLIANCE WITH THE WRITTEN INTRODUCTIONS PROVIDED HEREIN VOIDS ALL EXPRESS AND IMPLIED WARRANTIES, INCLUDING WARRANTY OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR USE.

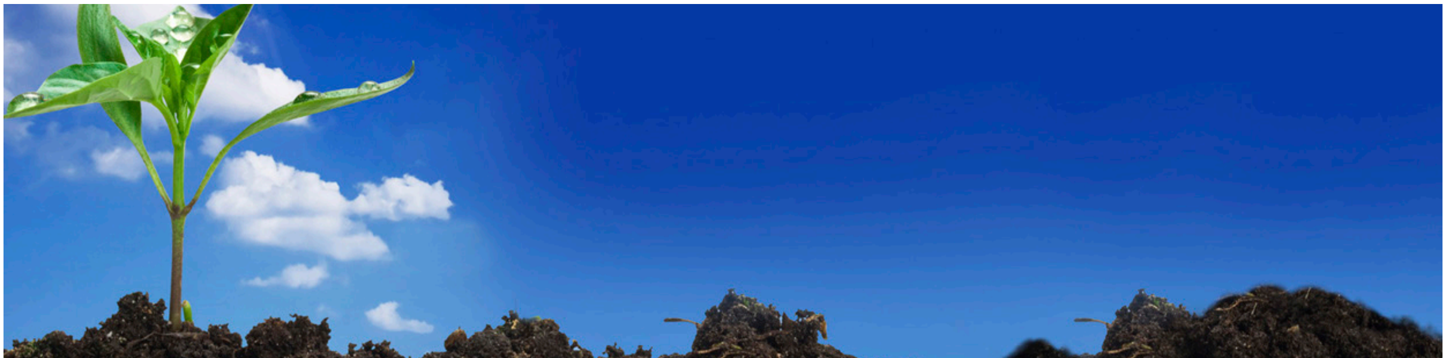
PRINCIPLE OF USE: The En ore Sampler Cartridge System is a volumetric sampling system designed to collect, store and deliver a soil sample. The En Core Sampler comes in two sizes for sample volumes of approximately 25 or 5 grams.. There are four components: the cartridge with a movable plunger; a cap with two locking arms; a T-handle (purchased separately); and an Extrusion Tool (purchased separately). NOTE: the En Core Sampler is designed to store soil. It is not designed to store solvent or free product.

The soil is stored in a sealed headspace-free state. The seals are achieved by three special Viton® o-rings, two located on the plunger and one on the cap of the sampler. At no time and under no condition should these o-rings be removed or disturbed.

QUALITY CONTROL: The cartridge is sealed in an airtight package to prevent contamination prior to use. Due to the stringent quality control requirements associated with the use of this system, the disposable cartridge is designed to be used only once.

WARRANTY: En Novative Technologies warrants that the En Core Sampler shall perform consistent with the research conducted under En Novative Technologies' approval, within 30 days from the date of delivery, provided that the customer gives En Novative Technologies prompt notice of any defect or failure to perform and satisfactory proof thereof. THIS WARRANTY DOES NOT APPLY TO THE FOLLOWING, AS SOLELY DETERMINED BY EN NOVATIVE TECHNOLOGIES: (a) Damage caused by accident, abuse, mishandling or dropping; (b) Samplers that have been opened, taken apart or mishandled; (c) Samplers not used in accordance with the directions; and (d) Damages exceeding the cost of the Sampler. Seller warrants that all En Core Samplers shall be free from defects in title. THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, WHETHER ORAL, WRITTEN, EXPRESSED, IMPLIED OR STATUTORY, INCLUDING ANY INFORMATION PROVIDED BY SALES REPRESENTATIVES OR IN MARKETING LITERATURE. IMPLIED WARRANTIES OF FITNESS AND MERCHANTABILITY SHALL NOT APPLY. En Novative Technologies' warranty obligations and customer's remedies, except as to title, are solely and exclusively as stated herein.

LIMITATION OF LIABILITY: IN NO EVENT SHALL EN NOVATIVE TECHNOLOGIES, INC. AND/OR QUALITY ENVIRONMENTAL CONTAINERS, INC. BE LIABLE FOR ANTICIPATED PROFITS, INCIDENTAL, SPECIAL OR CONSEQUENTIAL DAMAGES, INCLUDING BUT NOT LIMITED TO, DAMAGES FOR LOSS OF REVENUE, DOWN TIME, REMEDIATION ACTIVITIES, REMOBILIZATION OR RESAMPLING, COST OF CAPITAL, SERVICE INTERRUPTION OR FAILURE OF SUPPLY, LIABILITY OF CUSTOMER TO A THIRD PARTY, OR FOR LABOR, OVERHEAD, TRANSPORTATION, SUBSTITUTE SUPPLY SOURCES, OR ANY OTHER EXPENSE, DAMAGE OR LOSS, INCLUDING PERSONAL INJURY OR PROPERTY DAMAGE. En Novative Technologies' and/or Quality Environmental Containers' liability on any claim of any kind shall be replacement of the En Core Sampler or refund of the purchase price. En Novative Technologies and/or Quality Environmental Containers shall not be liable for penalties of any description whatsoever. In the event the En Core Sampler will be utilized by customer on behalf of a third party, such third party shall not occupy the position of a third party beneficiary of the obligation or warranty provided by En Novative Technologies, and no such third party shall have the right to enforce same. All claims must be brought within one (1) year, regardless of their nature.



Terra Core™ Sampling Kit

5035A Soil Sampling for VOCs, BTEX/MTBE, GRO 8015 & TPH-TX 1005

EPA SW-846 Sampling Method 5035A reduces the amount of disturbance when collecting solid/soil samples for the analysis of Volatile Organic Compounds (VOCs) by 8260, BTEX/MTBE by 8021, GRO 8015, and TPH-TX 1005. A Terra Core™ sampling kit is provided for each sample being collected, and allows for a 5 gram sample aliquot for VOCs or BTEX/MTBE or GRO and a 10 gram sample aliquot for TPH-TX 1005 (collect and extrude twice) to be collected and immediately extruded into a pre-weighed, pre-preserved 40 mL VOA vial.

Terra Core™ Sample Containers

VOCs 8260 or BTEX/MTBE 8021 or GRO 8015:

- 1 - Terra Core™ sampler that collects a 5 gram aliquot
- 1 - Methanol-preserved 40 mL VOA vial for high level analysis
- 2 - Neat 40 mL VOA vials containing stir bars for undiluted/low-level analysis
- 1 - 60 gram sample jar for percent moisture analysis or screening

TPH-TX 1005:

- 2 - Neat 40 mL VOA vials (without stir bars)

SERVICE

- On-time data delivery and rapid TAT
- Experienced staff with expertise
- Available after-hours and weekends

VALUE

- Instant access to data with Webtrieve™ and Webtrieve™ Mobile App
- Custom bottle kits with pre-printed labels and COCs

RELIABILITY

- Technical experts that can answer your most difficult questions
- A real focus on quality and process control with a rigorous QA/QC program

Get Connected!

Check out our helpful video about this service on our YouTube Channel!

Scan the QR Code with your smartphone or search for "ALS Environmental" on YouTube.

Continued on reverse side...

10450 Stancliff Road • Suite 210 • Houston, TX 77099
+1 281 530 5656
www.alsglobal.com

Connect with us!

... continued from reverse side

Collecting a Sample Using the Terra Core™ Kit

Step 1: With the plunger seated in the handle, push the Terra Core™ sampler into freshly exposed soil until the sample chamber is filled. A filled chamber will deliver approximately 5 grams of soil.

Step 2: Wipe all soil or debris from the outside of the Terra Core™ sampler. The soil plug should be flush with the mouth of the sampler. Remove any excess soil that extends beyond the mouth of the sampler.

Step 3: Rotate the plunger that was seated in the handle top 90° until it is aligned with the slots in the body. Place the mouth of the sampler into the 40 mL VOA vials listed in these instructions and extrude the sample by pushing the plunger down. Quickly place the lid back on the 40 mL VOA vial.

Note: When capping the 40 mL VOA vial, be sure to remove any soil or debris from the top and/or threads of the vial.

Step 4: Collect sample for the 60 gram jar using the bulk soil collection technique.

Holding Times:

Samples collected via 5035A must be submitted to the laboratory as soon as possible and frozen within 48 hours of collection.

Special Labeling Instructions:

Each Terra Core™ sampling kit is a foam container that includes the bottles listed in these instructions. Each bottle is pre-weighed and pre-labeled, and it is imperative that the weight is legible upon receipt at the laboratory. In addition, please complete each pre-labeled vial. DO NOT affix an additional label to the vials as it will alter the tared weight. A large label will be affixed to the outside of the ziplock bag that has a space for your Sample ID. Please complete this portion of the label.

QA/QC Requirements:

For each sampling event (or every 20 samples), please collect triple volume (three Terra Core™ Sampling Kits) for one sample location. This is needed for internal laboratory QA/QC (MS/MSD).

Special TPH-TX 1005 Sampling Instructions:

If you are collecting soil samples for Total Petroleum Hydrocarbons (TPH-TX 1005) using Method 5035A, you will receive two pre-weighed neat 40 mL VOA vials (without stir bars) contained in the Terra Core™ sampling kit (or enclosed in a separate bubble bag if no other 5035 parameters are requested). During sample collection, please collect 10 grams of sample (or extrude twice) and place into the vials.

Contact us now for more information!

10450 Stancliff Road • Suite 210 • Houston, TX 77099
+1 281 530 5656

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SOP # S15

MACTEC STANDARD OPERATING PROCEDURE #S15

METHANOL EXTRACTION OF FRACTURED ROCK SAMPLE COLLECTION

April 22, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples ______________________ April 27,2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

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METHANOL EXTRACTION OF FRACTURED ROCK SAMPLE COLLECTION

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes a sample preparation procedure for the collection of fractured bedrock core samples for analysis of VOCs. Rock core samples will be extracted in the field in methanol and an aliquot of methanol will be submitted to the laboratory for analysis. The SOP is applicable to environmental bedrock groundwater investigations.

As professional guidance for specific activities, this procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data record.

2.0 DEFINITIONS

Hydraulically Active Fractures – A fracture within the bedrock through which groundwater may flow. In bedrock core samples an active fracture will appear as a break in the rock core with some evidence of weathering, alteration, or deposition along the face of the fracture.

3.0 PROCEDURE

This section contains both the responsibilities and procedures involved with rock chip sample collection from fracture zones within rock core samples in conjunction with rock core drilling techniques.

3.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook.

3.2 Preparation

Office preparation

- Review pertinent information with regards to rock coring and sampling information on the boring to be tested, as well as the type of rock in the area to be drilled.
- Assemble appropriate logbooks and field data records to complete the field assignment.
- Make copies of the site location map, and field data from the previous sampling event.

Equipment Selection and Sampling Considerations

The sampling generally uses the following equipment/items:

- pre-weighed 8 or 12 ounce (oz) clear wide mouth glass jars (or appropriate size to accommodate core).
- 40 mL amber vials with caps/sample labels/tape
- purge and trap grade methanol (request from laboratory pre-measured with 25 ml methanol in each 40 ml vial)
- syringes and pipettes
- balance
- Notebook/field book/rock core logs (**example attached)**
- rock hammer and cold chisel
- stainless steel bowl
- personal protection equipment (PPE)
- sample containers (40 ml vials above) and cooler (provided by the laboratory)
- Cooler, ice, paper towels

3.3 Field Procedures

- In preparation of sample collection, remove cap from 8 or 12 oz. soil jar, place jar on scale and tare (i.e., weight should show 0 oz.).
- Following extraction, the rock core samples retrieved from a borehole are examined for the presence of natural hydraulically active fractures and scanned with a photoionization detector. The face of a selected fracture is chipped away using a rock hammer, chisel, or rock saw, depending on the nature of the cored bedrock fracture material, and placed in a stainless-steel bowl. Depending on the fragment sizes, the chips can be further crushed with the hammer or other decontaminated stainless-steel tools (e.g., pliers/wire cutters) to small chips/fragments and finer powder. The same method is appropriate for sampling rock matrix in proximity to fracture surfaces.
- Remove cap from tared jar and add approximately 50 grams of the chipped rock to the jar. Document the weight of rock chips/fragments added in the field logbook and FDR.

- Add 50 milliliters (mL) of purge and trap grade methanol into the sample jar. If the lab provided vials with 25 ml methanol each, add two vials. If starting with a larger container of methanol, use a pipet to measure 50 ml (the methanol should cover the rock chips). Add the cap to the sample jar. The methanol volume will be recorded in the field notebook. Label the sample jar. Slowly swirl/agitate the jar with rock chips and methanol for one to two minutes and then set aside.
- The rock chips will be allowed to "bathe" in the methanol for 24 to 48 hours, agitating one or two more times in the process (jar should be allowed to sit undisturbed for the last 12 hours to allow fines to settle).
- After the jars have sat for the required time, a disposable pipette will be used to collect an aliquot of methanol from the wide mouth sample jar. Transfer the methanol to a 40 mL amber vial and cap. Two vials may be filled but avoid adding in fines if possible (the laboratory only needs a small amount but is equipped to easily dispose the extra methanol volume).
- Record the appropriate sample identification information on the sample label and attach the label to the vial(s). Submit the sample to the laboratory for VOC analysis by USEPA Method 8260 following the **Chain of Custody Procedures SOP**. On the Chain of Custody, make sure to note the actual weight of the rock and the actual amount of methanol used in the extraction.

With the information provided on the Chain of Custody, the laboratory will be able to provide a mass of contaminant per mass of rock as they would a methanol preserved soil sample (i.e. in micrograms per kilogram).

If additional information is needed, the following information can be provided to the laboratory:

Sample collection data along with the analytical results from the laboratory will be used to determine total mass of target compounds present in the fracture zone. Detection levels will be approximately 2.5 micrograms (µg)/core sample for target VOCs reported at the laboratory. The following calculation will be used to determine total mass of a detected target compound:

Mass of Compound (µg) = (A * B * C)/D

A = Concentration of Aqueous Analysis in µg/L
B = Purge and trap purge volume in L
C = Volume of methanol used during sample collection in mL
D = Volume of methanol extract used during analysis in mL

Detection limit example:

2.5 µg = (1 µg/L * 0.005 L * 50 mL)/0.1 mL

The mass of compound will then be divided by the mass of rock originally placed in the methanol.

Example of final result:

Assume laboratory reports final mass of 10 micrograms of analyte (example trichloroethene): 10 µg divided by 50 grams (0.05 kilogram [kg]) rock = 10 µg/0.05 kg = 200 µg/kg

4.0 ATTACHMENTS

Rock Core Log

ROCK CORING LOG

MACTEC

511 Congress Street, Portland Maine 04101

	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Top of Rock:	Total Depth:	Casing Type:
Weather:	Casing Depth:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	
Driller:	Date Started:	Date Completed:	Core Barrel Type:
Rig Type/Model:	Logged By:	Checked By:	Core Size:
Reference Elevation:	Water Level:	Time:	Core Length:

Drilling Information				Sample Quality				Sample Description and Classification	Lithologic Type	Remarks
Depth (feet bgs)	Run Number	Run Length (ft) / Recovery (ft)	Penetration Rate (ft/min)	RQD (%)	Fracture Depth (feet)	Fracture Type	Fracture Angle			

NOTES:

SOP # S16

MACTEC STANDARD OPERATING PROCEDURE #S16

DRILLING - SOIL BORING AND ROCK CORING OVERSIGHT

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________	April 27, 2020
Jean Firth, PG, Program Manager	Date

Reviewed	Date
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DRILLING - SOIL BORING AND ROCK CORING OVERSIGHT

1.0 PURPOSE

This Standard Operating Procedure (SOP) was prepared to direct field personnel in the methods for advancing soil and rock borings to characterize subsurface conditions during site hydrogeological and geotechnical investigations. The objective of soil and rock boreholes is to provide samples for description and characterization of subsurface conditions, and obtain samples for geotechnical and/or chemical analyses, often prior to installation of a monitoring well. This objective requires the use of consistent procedures for documenting observations and collecting samples.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2018. Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils, Method D1586-18

ASTM, 2017. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); ASTM D2487-17e1.

ASTM, 2014. Standard Practice for Rock Core Drilling and Sampling of Rock for Site Exploration, Method D2113-14, ASTM International, West Conshohocken, PA.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020.

3.0 SOIL BORING METHODS

Test borings can be advanced by a variety of drilling methods. The quality of the information obtained from the various boring methods varies with the character of the subsurface geologic conditions, and careful consideration should be given in selecting the desired method. It may be necessary to employ more than one boring method to advance a particular borehole. The drilling techniques used on any particular project will be selected by the project manager and/or project geologist.

Commonly employed soil test boring techniques are described in the following subsections:

Auger Borings

This method involves advancing helical solid-flight or hollow-stemmed augers. This is a fast method for advancing the borehole, without the use of drilling fluid, and particularly effective for boring through partially saturated or unsaturated material above the groundwater table. Conventional sampling procedures are employed (e.g., split-spoon sampling). Some disturbance of the natural soil is caused by the advancing augers. Auger borings are primarily used for environmental investigations because they are cost effective and do not involve the introduction of drilling fluids and muds to the subsurface environment which may adversely impact samples for chemical analyses.

Auger borings are difficult to advance below the groundwater table in some types of granular soils because the soils can liquefy and move up inside the auger stem and/or collapse against the auger flights and cause excessive friction which may exceed the power of the drill rig to spin the augers. This condition is commonly referred to as "running sands" or "blowing sands" in the drilling industry. Running sands can be counteracted with limited success by maintaining a constant hydraulic head in hollow-stemmed augers during the sampling operations. However, the constant head technique is not very effective when drilling more than approximately ten feet below the water table in granular soils.

Hollow-stemmed augers are advanced hydraulically into the overburden to the required sampling depth. The auger acts as a casing during the advancement of the borehole. Augers are usually in five-foot sections. Some disturbances of the sampling zone may be created during the augering operation.

Soil sampling may either be conducted continuously from the ground surface or at predetermined specific depths. The site specific FAP will outline the soil sampling methodology. For discrete sample locations, a removable center plug is installed during advancement of the augers to prevent buildup of soil within the augers. This allows passage of the sampling equipment (typically a split-spoon sampler or Shelby tube) to the required depth of sample collection. A typical center plug utilized by drillers is a roller bit connected to an inner set of drilling rods.

Solid stem augers are not recommended for environmental investigations because soil samples cannot be obtained from discrete depth intervals. Soil samples from solid stem auger borings are typically collected from the surface of the auger flights as the cuttings are brought to the ground surface.

Cased Borings

This drilling method advances threaded steel casing to support the borehole as it is advanced. The casing can be driven or rotated to a given depth and soil within the casing removed using drilling fluid (e.g., water, drilling mud) or air. Split spoon samples can be retrieved from undisturbed soils below the bottom of the casing.

The borehole is advance by constant blows of a drive hammer (typically 300 pounds, falling over a distance of 24 inches) upon a drive head, which is attached to the casing. The casing can also be spun and pushed to the desired depth. The casing is driven/spun in five-foot increments, with representative soil samples being obtained on a continuous basis or at the completion of each five-foot drive (depending upon the project objectives outlined in the FAP).

After the casing is seated at the required depth, the borehole must be cleaned-out prior to obtaining a soil sample. The two most commonly used methods for clearing cased borings in environmental drilling are as follows are the drive and wash or rotary drilling methods.

Drive and Wash Drilling Method - Drive and wash methods are most commonly used in soils which do not contain large cobbles and boulders, or cemented horizons. The technique uses a chopping bit that is driven by a rotating drill rods to break up the material in the casing. The loosened material (cuttings) is removed from the casing by injecting drilling water or drilling mud down through the drill rods to openings in the cutting head and which then rises to the surface of the casing to settle in a wash tub adjacent to the borehole.

Rotary Technique – This method is a variation of the wash boring technique, utilizing a rotary drill bit, rather than a chopping bit. This is the method generally preferred for exploratory test borings in the geo-technical consulting industry. This method is commonly used in environmental investigations when test borings are expected to encounter dense tills and coarse granular deposits (such as gravels) or are expected to terminate at depths exceeding thirty feet below the ground surface.

The use of these materials and this method is not preferred in environmental investigations since the introduction of drilling fluids can alter the chemical composition of the groundwater adjacent to the borehole, and may have an adverse effect on groundwater quality analyses on groundwater samples from monitoring wells installed in the completed borehole. If it is necessary to use this technique to advance a borehole, the field geologist should determine the source and quality of the drilling water to be used in the boring process. The field geologist should not authorize the use of on-site or nearby groundwater or surface water bodies as the source of the drilling water, unless the proposed source has been sampled and analyzed for the full suite of contaminants considered likely to be present in the groundwater beneath the site.

In all cases where drilling water or drilling mud are used to advance a borehole, the field geologist should consider obtaining a sample of the drilling fluid for potential analysis, at the discretion of the project manager and quality assurance/quality control (QA/QC) officer.

Drilling Mud - Drilling mud may be prepared from commercially available products. Employing mud in a boring makes identification of the cuttings more difficult and hinders groundwater level observations. The use of drilling mud is typically avoided when conducting environmental investigations. The use of drilling mud can reduce the permeability of the walls of the borehole, and therefore, lead to erroneous water level measurements. Additionally, the use of drilling mud introduces foreign material to the subsurface environment, which is not completely removed upon completion of the boring. The results of chemical analyses conducted on soil samples from boreholes advanced with drilling mud may not be representative of the natural (undisturbed) formation. Water samples obtained from wells installed in these boreholes may contain contaminants or parameters, which were not originally present in the groundwater prior to the use of the drilling mud.

The basic mud mixture employed in the drilling industry is bentonite and fresh water (approximately 6 percent bentonite by weight: 50 pounds of bentonite per 100 gallons of water). Attapulgite clay is commonly used and will mix with salt water to prevent flocculation. Weight additives such as pulverized barite, hematite, galena, or other heavy minerals may be added to the mixture to increase the specific gravity in troublesome soils or under artesian conditions. The precise ingredients and their proportions in the mixture must be recorded for future reference, particularly when groundwater from wells installed in their borings is to be tested for dissolved metals and pH.

Borehole Cleaning

Thorough and careful cleaning of the borehole is mandatory for obtaining representative, undisturbed soil samples. Careful measurement of tool length is required. The washing operation should not usually extend below the bottom of the casing (cohesive soils would be an exception). Special bits that deflect the wash water outward or upward should be employed, and only enough wash water should be pumped down the hole to bring the cuttings to the surface. Special shielded auger cleanouts should be employed in cohesive soils prior to obtaining undisturbed piston samples.

4.0 ROCK DRILLING METHODS

There is no universal core barrel or drilling equipment for rock coring. The geologic and topographic conditions, in addition to the requirements of the project will dictate the type of equipment to be employed on any specific project.

For environmental drilling, typically a soil boring will be completed to the top of bedrock using one of the soil boring drilling methods discussed above. Upon refusal of the soil boring at the bedrock surface a bedrock socket will be advanced 2-3 feet below the top of rock and a threaded steel casing will be inserted and grouted in place. This casing effectively seals off bedrock from the overburden soils, groundwater, and/or contamination.

There are two fundamental drilling methods for rock: non-core (destructive) or core drilling.

Non-Core (destructive) Drilling

Non-core drilling is a relatively quick and inexpensive means for advancing a rock borehole when an intact rock sample or detailed logging is not required. Non-core drilling is completed by advancing a cutting bit, rotary roller bit, or rotary drag bit to a predetermined depth with the pulverized rock cuttings removed from the borehole through the use of compressed air, drilling water, or drilling mud. Compressed air (e.g. air hammer drilling methods) is typically not used for environmental drilling as the cuttings are typically blasted to the surface away from the rig which may redistribute contamination. Sample quality considerations with regards to drilling using water or drilling mud are the same as those noted for soil borings.

Because intact rock samples are not recovered in non-core drilling, it is important for the field geologist/engineer to carefully record observations during drilling.

Rock Core Drilling

Bedrock coring for environmental drilling utilizes a rock coring barrel with a diamond or carbide tipped cutting shoe to retrieve relatively undisturbed lengths of rock cores. These core barrels come in various diameters and lengths. The required diameter of the sampler will be outlined in the FAP. NX, NQ, and HQ core sizes are most used for environmental drilling. Generally, a larger core size will produce greater recovery and less mechanical breakage.

Core barrels may consist of a single-tube, double-tube, or triple-tube configuration. Double-tube and is typical standard will provide less disturbed core samples than those from single barrel as the rock core is isolated from the drilling fluids. Triple-tube configurations will provide the least disturbed rock core samples but are less commercially available in some regions.

Core samplers are retrieved using either conventional or wireline equipment. Conventional methods require the entire drill string or rods and the core sampler need to be removed from the borehole to retrieve the rock core. Wireline methods allow for the inner tube in double and triple-tube setups to uncoupled from the outer tube and then raised rapidly to the surface using a wire line hoist. Wireline retrieval has its advantages in that it allows for improved quality of the rock core by limiting the handling of the drill string (raising through the borehole and hammer blows on the casing to separate sections or the core barrel) and allows for rapid retrieval and deployment on deeper bedrock borehole.

5.0 PROCEDURES

This section contains both the responsibilities and procedures involved with drilling oversight and sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

5.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that drilling activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate drilling methodology based on the objectives of the project.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to drilling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

As with any heavy equipment, caution should be taken to minimize the potential for injuries such as crushing and pinching. Additionally, the drill rig has overhead hazards and in most cases noise hazards which should also be considered. Before any drilling is completed, the rig should be set level and the operator should inspect the location to verify that the unit is stable and secure enough to operate. All personnel shall be familiar with the location of the rig's emergency kill switch. All non-essential personnel should be kept clear of exclusion zone or from an area surrounding the rig. Due to the potential of noise, ear protection is required. If needed, hand signals should be developed for communication between engineer and the driller.

5.2 Preparation

Utility Locate

Prior to mobilizing to a site, the PM or FOL will ensure that the local utility "one call" service has been notified (e.g. Dig Safely New York). Typically the drilling subcontractor will be resposnsible to call in the utlity ticket. Confirmation of the notifcation and the ticket number will be requested by the PM or FOL for the public records. No work may procede at the site until the ticket has been logged and all ultilities have responded/marked out.

If conducting borings at an active site, the project or field engineer/geologist must contact the appropriate site personnel necessary to receive clearance to drill at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. The exact location of each boring shall also be reviewed by responsible site personnel to ensure that the area is free of the facility-owned buried utilities. Surface geophysics may be conducted to identify the locations of subsurface facility-specific structures (e.g., drain lines, septic tanks, etc..) and soft dig methods (hand clearing with shovels, post hole diggers, hand augers) may be required.

Drilling locations shall be no closer than 25 feet to overhead utilities or within 10 feet of buried utilities.

Upon arrival at the site the FOL will complete the Utility Clearance Form (**example attached**) to document that utility locate activities and mark out have been completed prior to the initialization of drilling activities.

Equipment Selection

The following materials will be available, as required, during drilling activities:

- Materials (e.g. drums, roll-offs, fractionation tanks) for investigation derived wastes (IDW) as specified in the FAP.
- Personal protective equipment (PPE), monitoring equipment, and other health and safety equipment as specified in the project specific health and safety plan.
- Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as

specified in the QAPP or FAP.

- Monitoring well and other construction materials if specified in the FAP.
- Stainless steel trowels or spatulas.
- Aluminum Foil.
- Paper Towels.
- Measuring device (e.g. engineer's scale tape or rule).
- Appropriate sample containers and Field Data Records.
- Photoionization detector (PID).
- Camera.
- Field notebook.

5.3 Field Procedures

5.3.1 Documentation

In the field book, the supervising geologist/engineer shall record the name of the drilling firm and the names of the driller and his assistant(s). The date, project location, project number, and weather conditions shall be recorded as well.

An accurate time log of drilling activities shall be kept. This log shall be kept in the field logbook and shall include at a minimum, the following:

- Time driller and rig arrive on site
- Time drilling begins
- Any delays in the drilling activities and the cause of such delays
- Time drillers go off site
- Duration of decontamination and investigation derived waste handling
- Down time (those periods when drilling activities cease due to equipment malfunctions, weather, and ordered stoppages)

Monitoring equipment for field screening (PID) and community air monitoring programs (CAMP) will be calibrated daily as per manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**Attachment S16D**). Make note of calibration variances or spanning to non-standard specifications.

Soil boring information including standard penetration depth information, sampling intervals, and soil descriptions will be recorded on the Soil Boring Log FDR (**example attached**). See the **Description and Identification of Soil Samples SOP (SOP # listed on Table A-1)**.

5.3.2 Standard Penetration Tests (SPT) – Split Spoon Soil Sampling

Standard penetration tests (split spoon sampling) can be employed to collect subsurface soils samples during auger and cased-boring drilling methods. Split spoon sampling is described in ASTM Designation D 1586.

This technique should be conducted as follows (assembly, drive and retrieval of the split spoon will be completed by the driller):

1. The split-spoon sampler (spoon) consists of a 2-inch (outside diameter) by1-3/8 inch (inside diameter) 24-inch length, heat-treated, case-hardened steel head, split-spoon, and shoe assembly. Split-spoon or split-tube samplers are the most generally accepted method for obtaining representative soil samples however, from a geotechnical perspective, the samples obtained using a split-spoon are disturbed and unsatisfactory for some analyses. The head is vented to prevent pressure buildup during sampling and must be kept clean. A steel ball check valve is located in the head to prevent downward water pressure from displacing on the sample out the bottom of the spoon during retrieval. Failure of the check due to soil buildup in the head, frequently causes sample loss. Specialized sampling baskets can be inserted into the spoon nose to prevent sample loss in soft and cohesive soils.
2. The drive rods, which connect the spoon to the drive head, should have stiffness equal to or greater than that of the A-rod. In order to maintain only minimal rod deflection, on exceptionally deep holes, it may be preferable to use N-rods. The size of the drive rods must be kept constant throughout a specific exploration program, as the energy absorbed by the rods will vary with the size and weight of the rod employed. This is most important in geotechnical investigations.
3. The drive head consists of a drop hammer (140 pounds) with 30-inch free-fall drop free fall in order to strike the anvil attached to the top of the drill rods. Automatic trip hammers are commercially available which insure the 30-inch free-fall drop and are the preferred tools for environmental and geotechnical investigations. Automatic trip hammers are also inherently safer than older rope and cathead methods.
4. Attach the split-spoon sampler to the drill rods and lower the assembly to the bottom of the borehole. Measure the drill rod stickup to determine if heave or blow-up of the stratum has occurred. The automatic triphammer will raise the 140-pound hammer, 30 inches above the drive head anvil and then allowed to free fall and strike the anvil. This procedure is repeated until the sampler has penetrated the full length of the sampler into the stratum at the bottom of the borehole. Note any penetration of the sampler into the stratum under the weight of the rods or hammer alone.

5. The number of blows of the hammer required for each 6-inch penetration is counted and recorded on the soil boring log. When the number of blow counts exceeds 50 per 6 inches, the split spoon sampling shall be terminated and the number of blow counts per tenths of foot (for the last one-half foot) shall be recorded and noted as sampler refusal.
6. The penetration resistance (N) is determined by adding the second and third 6-inch resistance blow counts together. The blow counts will be tracked by the driller and verbally given to the field geologist/engineer after each SPT. Nomenclature for 6" penetration intervals under just the weight of the rods or hammer can use WR – weight of rods or WH – weight of hammer. When other sizes and types of sampling and drive equipment are employed, ASTM reference tables may be used in converting the obtained blow count to the accepted SPT value.
7. The sampler is then withdrawn from the borehole, preferably by using a threaded lifting plug and with the winch attached to the drill mast. Remove the sampler from the bottom of the borehole slowly to minimize disturbance. Keep the casing full of water during the removal operation.
8. Careful measurement of all drilling tools, samplers, and casing must be exercised during all phases of the test boring operations, to ensure maximum quality and recovery of the sample.
9. The split-spoon will be opened by the driller and handed to the field geologist/engineer. Upon the sampling table the spoon will be opened (split) and a fresh face will be prepared by using a clean flat edged scraper (e.g. paint scraper) in perpendicular motions to the split spoon. The resultant fresh face will be screened using a PID for volatiles and carefully examined, noting all soil characteristics, color seam, disturbance, etc. (See **Description and Identification of Soil Samples SOP [SOP # listed on Table A-1]**). For the field screening of the sample the PID inlet should be just above the soil surface and a hand should be cupped over both for an interval for a period of several seconds to get an accurate reading. This allows for the buildup of VOCs for measurement without interference from ambient air. Colder temperatures will inhibit volatilization and may require longer screening times to get accurate readings.
10. Collect photographs of the soil in the sampler. The spoon and sample should be placed in a good light, preferably against a solid colored background. A ruler for scale and a tag identifying the sample should be placed in the picture. The identifier tag must have the sample number, depth and project name or number written so as to be legible in the photograph. Any photographs taken must be recorded in the field logbook.
11. A representative sample is selected based on the sampling objectives outlined in the FAP and is collected using the appropriate sampling method and container as outlined in (**Soil Sampling and Field Preservation of VOC and GRO Samples [SOP #s listed on Table A-1]**).

12. Following the collection of representative samples for chemical and/or geotechnical analyses, remaining soil material will be collected into a separate container for VOC headspace screening (see below).
13. Steps 4 to 11 will be repeated, as necessary, until the bottom of the borehole, as outlined in the FAP, is reached (e.g. refusal or a predetermined depth). Frequency of sample collection will either be continuous or at predetermined depths. The casing or augers will be advanced through each interval once SPT has been completed.
14. After the terminal depth of the borehole has been achieved, and an environmental monitoring well will not be installed, the borehole should be backfilled with a cement/bentonite grout. Grout will be injected using a small diameter pipe to the base of the borehole. Drilling fluids within the borehole will be displaced upwards, collected in the drilling wash tub, and will be containerized as investigation derived waste. Alternatively, grout may be injected using the drill string in the same manner as the drilling fluids. Care should be taken to ensure the grout does not bridge forming gaps or voids in the grout column. Casing and augers will be slowly retracted during borehole abandonment to prevent the bottom of the casing/auger from rising above the top of the grout column. Grout will be mixed and injected in multiple lifts until flush with the ground surface. Following grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole.
12. If a monitoring well is to be installed see the **Monitoring Well and Microwell Installation SOP** for methodology and installation details.
13. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP.
14. Discard all disposable equipment used during sampling activities in a designated location.
15. The approximate location of the boring will be marked with a wood stake colored with highly visible spray paint and/or flagging. The boring number will also be written on the stake to identify the sample location for surveying purposes.

Records of each exploration shall be made on a Soil Boring Log and in the field logbook. All cuttings or other waste will be containerized or disposed of in accordance with planning documents.

5.3.3 Soil Headspace Screening

The purpose of the soil headspace screening procedure is to screen soil sample headspaces for total ionizing VOCs. This is a semi-quantitative method used to identify the presences, absence, and relative concentrations of VOCs in soil. Headspace screening is performed with a photoionization detector (PID).

Headspace readings may be completed in between sample runs. Headspace readings should be transcribed on to the soil boring log FDR.

1. Record and document background VOC readings in ambient air. If it is not feasible to screen samples in an area with a clean background, document the highest background reading.
2. Half fill a clean jar or Ziplock™ type plastic bag with soil. Quickly cover the jar with aluminum foil or close the plastic bag and label the container.
3. Vigorously shake the sample to disperse soil and wait for approximately 5 minutes. Record the ambient temperature at which screening is performed. If outside temperatures are below 50°F, try to warm the samples in a heated vehicle or building.
4. Shake the sample again after 5 minutes.
5. Insert the tip of the PID through the foil or into the plastic bag and record the highest meter response, typically after approximately 3 to 15 seconds.
6. After screening all samples, re-check background and record significant variations.

The PID has a reliable reporting limit of 1 part per million in air. Readings at or below the reporting limit should be reported as not-detected “ND”.

Screening results will vary based on sample temperature, compounds present, age of the sample, and the degree to which the sample has been agitated and crumbled. Field personnel should remain consistent in their headspace measurement methodology to avoid biasing samples.

5.3.4 Rock Coring

There is no universal core barrel or drilling equipment for rock coring. The geologic and topographic conditions, in addition to the requirements of the project will dictate the type of equipment to be employed on any specific project. Specific methods, equipment, and core sizes will be specified in the FAP.

Non-Core Procedures

The following general procedures will apply to non-coring drilling methods:

1. Upon encountering boring refusal at the soil/bedrock interface, a rock socket will be advanced 2 to 3 feet below the top of rock and a threaded steel casing should be firmly seated and grouted in place. The casing should be allowed to sit for 24-hours to allow the grout to cure.
2. After the grout has cured, a selected cutting bit will be advanced down the casing to the terminal drilling depth Drilling water will be recirculated through the borehole to bring fines to the surface and be contained in a settling basin/wash tub.

3. Pump drill water down the drill rods and observe a return flow before commencing drilling operations.
4. Carefully measure all length of rods, core barrel, and stick-up through all phases of the drilling to insure accurate depth determination.
5. During the drilling a strainer will be used to catch rock chips being carried by the drilling water. Basic descriptions of these rock chips will be recorded on the FDR.
6. Other descriptions that should be included on the FDR include:
   a. Penetration rate (feet per minute)
   b. Sudden dropping of the rods (voids or large fractures)
   c. Unusual drill action (bouncing, chatter, binding)
   d. Loss of drilling fluid or color change of the fluid

<u>Rock Core Procedures</u>

The following general procedures are applicable to rock coring drilling methods:

1. Upon encountering boring refusal at the soil/bedrock interface, a rock socket will be advanced 2 to 3 feet below the top of rock and a threaded steel casing should be firmly seated and grouted in place. The casing should be allowed to sit for 24-hours to allow the grout to cure.
2. After the grout has cured, a roller tri-cone bit will be advanced down the casing to remove any grout inside the casing an create a fresh surface for coring. Drilling water will be recirculated through the borehole to bring fines to the surface and be contained in a settling basin/wash tub.
3. Mount the core barrel on the drilling rods and lower it into the borehole until the bit touches the bedrock surface.
4. Pump drill water down the drill rods and observe a return flow before commencing drilling operations.
5. Carefully measure all length of rods, core barrel, and stick-up through all phases of the drilling to insure accurate depth determination.
6. The diamond-bit core barrel should be started in the hole and the rock drilled in continuous 5-foot length intervals (runs) until the required depth is reached. Runs longer than 5-ft should be avoided as it will reduce core recovery and poor quality in fractured and weathered rock.
7. Drill with minimal vertical pressure and rotation. Most rigs are equipped with a selection of gear ratios and a variable hydraulically controlled feed mechanism. Driller expertise in

selecting the correct combination of speed and feed rate is invaluable. Faster rotation and high down pressures can mechanically fracture the rock, reducing the quality of the retrieved rock core.

8. Water return should be no more than what is just sufficient to bring the borehole cuttings to the surface.
9. Record the start and stop time for each run and factor out stoppages due to drill rod additions to complete a run. These times should be recorded in the field book and a penetration rate of ft/min should be recorded on the FDR.
10. Upon completing each 5-foot core run, the core barrel is spun and lifted to break the core at the bottom of the run. After the core is broken off it should be withdrawn, labeled, and stored in an approved core box.
11. Cores should be carefully handled to ensure their proper identification and placement in correct order. Carefully place the rock core in the core box with wooden partitions so that the cores from each run will be kept separate. The core should always be placed in the core box in book fashion with the top of the run at the upper left corner and the remaining core placed sequentially from left to right and from the top left corner to the lower right corner. Place a wooden partition labelled with the start and end depths at the beginning and end of each core run. The core should fit snugly in the box so that it will not roll or slide and suffer additional breakage.
12. Each core box should only contain cores from a single boring. Never place the core from more than one test boring in a core box. In addition, wherever core is lost due to the presence of a cavity or large discontinuity (open or filled), a spacer should be placed in the proper position in the core box. The spacer should be labeled with the depth range and thickness of the missing core, and the reason for the missing core (e.g., cavity, large joint, etc.).
13. A straight line should be drawn down the length of the core with character markers (e.g. arrows) on fractures to preserve original orientations if the rock core becomes disturbed. Masonry chalk markers are suitable marking tools. If a core is required to be broken in order to fit in the core box, notes of the break depth should be reported on the FDR and in the field book. This break will not be factored into rock quality designation (RQD) calculations.
14. Carefully examine and classify the rock and measure the recovery and RQD in percent (See **Description and Identification of Rock Samples** for guidance). Record all information on the FDR (**example Attached**).

15. If 100% recovery was not obtained, sound the borehole to determine if the missing core still remains in the bottom of the borehole. Always terminate each boring with 100% recovery, in order to ensure that appropriate knowledge is available of their materials.
16. The core box should be marked on the top and two ends with the client's name, site identification, boring number, depth range, and box number. The inner core box lid should include the run number, depth range, recovery, and RQD.
17. The core barrel and drilling tools must be steam-cleaned or washed upon completion of the bore hole to preclude cross contamination between successive bore holes.

The following information shall be included in a rock core run log:

- The depth and length of the core run.
- The coring rates.
- The color of the core wash water. Any changes, loss of return water, or gain of return water will be noted.
- The recovery of the core run recorded as length of rock recovered over the length of the core run.
- The RQD of the run is reported as the sum of inches of all naturally fractured rock core pieces larger than four inches over the total number of inches in the run. The length of the piece will be determined by the distance between naturally occurring fractures.
- The rock type(s) and their location in the core run, rotating color, mineralogy, texture, fossil content, effervescence in HCL, and any other data of geologic significance.
- Any structure in the core, including fractures, clay seams, vugs, bedding, fissility, and any other data of geologic or geotechnical significance.

Rock core samples are photographed in the wooden core box. The rock should be wetted to enhance the color and textural changes in the rock. Due to the relatively large size of most core boxes, the photographer (when possible) should stand up on a chair, tail gate, car bumper or other perch in order to photograph the box from directly above, and get the entire box in the camera's field of view. The photograph must include a ruler for scale and an identifier tag indicating the project name and number, the boring number, the date, and the depths of the various core runs.

5.3.5 Monitoring Well Installation

Bedrock boreholes may either be left open or have discrete monitoring wells installed for groundwater sampling. Well completion details will be outlined in the FAP. Further guidance is available in the **SOP for Monitoring Well and Microwell Installation.**

6.0 ATTACHMENTS

Utility Clearance Form

Soil Boring Log

Rock Coring Log

Field Instrument Calibration Record

Utility Clearance Form

Site Name: ______________________ Project No./Task No.: ____________

Site Address: ______________________ One Call Ticket No.: ____________

Ticket Good until: ____________

Project Manager Name: ______________________ PM Phone No.: ____________

Locations cleared by facility? ______________________ Date Cleared: ____________

Utility Clearance:

Potential Utilities		Identified		Colors	Utility Company Name(s)	Utilities
Member of One Call	*Non Members	Utility Marked	Utility Responded not Present			
						WHITE - Proposed Excavation
						****PINK** - Temporary Survey Markings
						RED - Electric Power Lines, Cables, Conduit and Lighting Cables
						YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
						ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
						BLUE - Potable Water
						PURPLE - Reclaimed Water, Irrigation and Slurry Lines
						GREEN - Sewers and Drain Lines

*Contact local municipality

** Survey markings need to be protected. If disturbed or destroyed, replace markings.

Private Utility Locator/Geophysical Survey

Method to be used:
- ___ Pipe and Cable Location
- ___ Ground Penetrating Radar
- ___ Magnetics and Electromagnetics

Non-Destructive Excavation Method to be used

- ___ *Hand Dig
- ___ Soil Vacuum
- ___ Air Knife
- ___ Water Knife

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

- ___ Overhead power lines
- ___ Cell phone/radio antennas
- ___ Trench patches
- ___ Trench settlement
- ___ Trench drains
- ___ Utility manholes
- ___ Manholes just outside building
- ___ Valve risers
- ___ Floor cleanout covers
- ___ Floor drains
- ___ Patches in concrete floors
- ___ Drainage ditches in area
- ___ Utility vaults
- ___ Transformer pads
- ___ Conduits from power panels into slab
- ___ Above ground propane tanks
- ___ Fire protection rooms
- ___ Fire protection lines
- ___ Fire hydrant locations – valves in ground
- ___ Footings under structural columns
- ___ Guard shack – service utilities
- ___ Bathroom and kitchen facilities
- ___ Radiant heat systems in slabs (ask)
- ___ Cooling units outside building
- ___ Process water to equipment in factory
- ___ Sprinkler system landscaping
- ___ Grounding systems near perimeter
- ___ Water tower on site.
- ___ Foundation drains - building perimeter

Additional Notes/Remarks: ____

____

Confidence Level that All Utilities have been identified:

___ High ___ Medium High ___ *Moderate ___ *Medium Low ___ *Low

*Contact PM. Get PM and OM permission prior to proceeding

*Cleared by PM? ____________________ *Discussed with OM? ____________________

SOIL BORING LOG

MACTEC

511 Congress Street, Portland Maine 04101

	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

ROCK CORING LOG

MACTEC
511 Congress Street, Portland Maine 04101

Project Name:		Boring ID:
Project Location:		Page No.
Project No.:	Client:	of:
Boring Location:	Top of Rock:	Total Depth:	Casing Type:
Weather:	Casing Depth:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	
Driller:	Date Started:	Date Completed:	Core Barrel Type:
Rig Type/Model:	Logged By:	Checked By:	Core Size:
Reference Elevation:	Water Level:	Time:	Core Length:

Drilling Information				Sample Quality				Sample Description and Classification	Lithologic Type	Remarks
Depth (feet bgs)	Run Number	Run Length (ft) / Recovery (ft)	Penetration Rate (ft/min)	RQD (%)	Fracture Depth (feet)	Fracture Type	Fracture Angle			

NOTES:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ____________ TASK NO: ________ DATE: ________
PROJECT NUMBER: ____________ MACTEC CREW: ________
PROJECT LOCATION: ____________ SAMPLER NAME: ________
WEATHER CONDITIONS (AM): ____________ SAMPLER SIGNATURE: ________
WEATHER CONDITIONS (PM): ____________ CHECKED BY: ________ DATE: ________

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

AM CALIBRATION Start Time ________/End Time________

POST CALIBRATION CHECK Start Time ________/End Time________

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	____	+/- 0.1 pH Units			
pH (7)	SU	7.0	____	+/- 0.1 pH Units	7.0	____	+/- 0.3 pH Units
pH (10)	SU	10.0	____	+/- 0.1 pH Units			
Redox	+/- mV	240	____	+/- 10 mV	240	____	+/- 10 mV
Conductivity	mS/cm	1.413	____	+/- 0.5 % of standard	1.413	____	+/- 5% of standard
DO (saturated)	%	100	____	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	____	____	+/- 0.2 mg/L	____	____	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	____	< 0.5 mg/L			
Temperature	°C		____			____	
Baro. Press.	mmHg		____			____	

TURBIDITY METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	____	<0.1	____	+/- 0.3 NTU of stan.
20 Standard	NTU	20	____	20	____	+/- 5% of standard
100 Standard	NTU	100	____	100	____	+/- 5% of standard
800 Standard	NTU	800	____	800	____	+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

Background	ppmv	<0.1	____	<0.1	____	within 5 ppmv of BG
Span Gas	ppmv	100	____	100	____	+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

Methane	%	50	____	50	____	+/- 10% of standard
O_2	%	20.9	____	20.9	____	+/- 10% of standard
H_2S	ppmv	25	____	25	____	+/- 10% of standard
CO	ppmv	50	____	50	____	+/- 10% of standard

OTHER METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.
☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ________
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45µm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ________
- Other ________
- Other ________

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S17

MACTEC STANDARD OPERATING PROCEDURE #S17

DIRECT PUSH SAMPLING

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

April 27. 2020

Jean Firth, PG, Program Manager | Date

Reviewed | Date

DIRECT PUSH SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes methodologies using a direct-push sampling system (e.g. GeoProbe®) that may be used to conduct soil, groundwater, or soil vapor sampling surveys. This technology can be used to collect samples for off-site laboratory analysis or provide screening information that can be used to optimize the future location of soil borings and monitoring well installations and to assess contamination in the vadose zone and saturated overburden.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2017. Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); ASTM D2487-17e1.

Barth, D.S. and B.J. Mason. 1984. Soil Sampling Quality Assurance User's Guide. EPA-600/4-84-043.

Mason, B.J. 1983. Preparation of Soil Sampling Protocol: Techniques and Strategies. EPA-600/4-83-020.

3.0 DRILLING METHODOLOGY

The direct push drilling technique consists of a hydraulic ram unit, usually mounted on a vehicle (ATV, cargo van, or pick-up truck) or drill rig that advances small diameter drill rods to obtain overburden soil, install piezometers and temporary wells for groundwater sampling, and install sample points for vapor samples. Advantages utilizing the method over traditional test boring drilling methods for environmental investigations include low cost, increased maneuverability and access to irregular terrain, and minimization of investigation derived wastes. Disadvantages include depth limitations and small sample volumes for chemical analyses.

The direct push device may employ either dual tube methodology which allows the collection of subsurface soil samples through an outer casing that is set to maintain the integrity of the boring or single-rod method that collects soil into a sleeve liner within the lead rod.

In the dual-tube method borings are advanced by simultaneously driving an outer stainless-steel casing and inner polycarbonate (Lexan®) or acetate tube into the ground. Upon reaching the desired penetration depth, the inner sample tube is withdrawn to collect the discrete subsurface soil samples, leaving the outer casing in place. To sample the next interval of soil, a new length of Lexan® tubing is then inserted into the outer casing (already in the ground) attached to a length of drive pipe, and another length of outer casing is attached to the top of the outer casing that is already in the ground.

In the single-rod method, ¾-inch diameter rods are advanced in 4 to 5-ft sections depending on the length of the sampler. The lead section is fitted with an inner acetate sleeve. When the top of the desired sampling interval is reached, a tool is used to unlock the drive point and the rod is driven ahead to obtain the soil sample. The entire drill rod is retrieved, and the liner removed for characterization. The process is then repeated to collect the next desired sample. This process may be modified to collect groundwater samples or soil gas samples. Procedures for collecting groundwater or vapor samples will be outlined in the FAP, if required.

4.0 PROCEDURES

This section contains both the responsibilities and procedures involved with direct push sampling oversight and sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

4.1 RESPONSIBILITIES

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

4.2 Preparation

Utility Locate

Prior to mobilizing to a site, the PM or FOL will ensure that the local utility "one call" service has been notified (e.g. Dig Safely New York). Typically the drilling subcontractor will be resposnsible to call in the utlity ticket. Confirmation of the notifcation and the ticket number will be requested by the PM or FOL for the public records. No work may procede at the site until the ticket has been logged and all ultilities have responded/marked out.

If conducting borings at an active site, the project or field engineer/geologist must contact the appropriate site personnel necessary to receive clearance to drill at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. The exact location of each boring shall also be reviewed by responsible site personnel to ensure that the area is free of the facility-owned buried utilities. Surface geophysics may be conducted to identify the locations of subsurface facility-specific structures (e.g., drain lines, septic tanks, etc..) and soft dig methods (hand clearing with shovels, post hole diggers, hand augers) may be required.

Direct push locations shall be no closer than 25 feet to overhead utilities or within 5 feet of buried utilities. Direct push methodology allows for small diameter borings that minimize ground disturbance. If project requirements dictate use in proximity to utilities, borings may be advanced if the proper health and safety considerations are applied (e.g. pre-clearing)

Upon arrival at the site the FOL will complete the Utility Clearance Form (**example attached**) to document that utility locate activities and mark out have been completed prior to the initialization of drilling activities.

Equipment Selection and Sampling Considerations

The following materials will be available, as required, during the subsurface soil sampling:

- Personal protective equipment (PPE), monitoring equipment, and other health and safety equipment as specified in the project specific health and safety plan.
- decontamination equipment as specified in the QAPP.
- Stainless steel trowels or spatulas.
- Aluminum Foil.
- Paper Towels.
- Measuring device (e.g. engineer's scale tape or rule).
- Appropriate sample containers and Field Data Records (FDR).
- Photoionization detector (PID).
- Camera
- Field knife with hook blades (if liner sleeves are used to collect the soil samples).
- Field notebook.
- Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as necessary.
- Drums for IDW containment as specified in the work plans.
- Piezometer construction materials if specified in the FAP.

4.3 Field Procedures

Documentation

In the field book, the supervising geologist/engineer shall record the name of the drilling firm and the names of the driller and his assistant(s). The date, project location, project number, and weather conditions shall be recorded as well.

An accurate time log of drilling activities shall be kept. This log shall be kept in the field logbook and shall include at a minimum, the following:

- Time driller and rig arrive on site
- Time drilling begins
- Any delays in the drilling activities and the cause of such delays
- Time drillers go off site
- Duration of decontamination and investigation derived waste handling
- Down time (those periods when drilling activities cease due to equipment malfunctions, weather, and ordered stoppages)

Monitoring equipment for field screening (PID) and community air monitoring programs (CAMP) will be calibrated daily as per manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**). Make note of calibration variances or spanning to non-standard specifications.

Soil boring information including standard penetration depth information, sampling intervals, and soil descriptions will be recorded on the Soil Boring Log FDR (**example attached**). See **the Description and Identification of Soil Samples SOP (see Table A-1 for SOP #)** for soil identification and description methodology.

Field Methodology

The direct-push explorations shall be completed by a qualified direct-push subcontractor, and directed by a qualified field person.

The following procedures will be employed to collect subsurface soil samples. Assembly, advancement, retrieval and opening of the sampler will be completed by the driller.

1. Identify sample locations from the FAP and note the locations in field notebook by measuring 3-point ties to physical features.
2. Drilling contractor will set up an equipment decontamination area and decontaminate equipment as described in the FAP and in accordance with the **Equipment Decontamination SOP S20 (see Table A-1 for SOP #)**. Use new, clean materials for when decontamination is not appropriate

(e.g., disposable gloves and dedicated drive points). Document the decontamination procedure in the field notebook.

3. The driller will assemble the appropriate direct-push sampling apparatus or other direct push tool. Soil samples will be collected using a four to five-foot long 1-to-2-inch diameter core sampler. The FAP will determine if a dual tube split-spoon system or a single rod acrylic liner method will be used for the collection of subsurface soil samples.
4. The driller will drive the sampling tools to the appropriate sampling zone and collect a sample. Retrieve the sampler using an appropriate lifting apparatus (winch or lift hook). Remove the sampler shoe and retrieve the sample in the sample liner.
5. Upon the sampling table the liner will be opened by cutting lengthwise using a hook bladed utility knife or similar cutting implement. Once opened the field staff will prepare a fresh face by using a clean flat edged scraper (e.g. paint scraper) in perpendicular motions to the liner. The resultant fresh face will be screened using a PID for volatiles and carefully examined, noting all soil characteristics, color seam, disturbance, etc. (see the **Description and Identification of Soil Samples SOP identified on Table A-1**). For the field screening of the sample the PID inlet should be just above the soil surface and a hand should be cupped over both for an interval for a period of several seconds to get an accurate reading. This allows for the buildup of VOCs for measurement without interference from ambient air. Colder temperatures will inhibit volatilization and may require longer screening times to get accurate readings.
6. Field staff will take photographs of the soil in the sampler. The sampler should be placed in a good light, preferably against a solid colored background. A ruler for scale and a tag identifying the sample should be placed in the picture. The identifier tag must have the sample number, depth and project name or number written so as to be legible in the photograph. Any photographs taken must be recorded on the FDR.
7. Field staff will collect a representative sample, selected based on the sampling objectives outlined in the FAP and is collected using the appropriate sampling method and container as outlined in **SOPs for Soil Sampling and Field Preservation of VOC and GRO Soil Samples (see Table A-1 for SOP #s)**.
8. Following the collection of representative samples for chemical and/or geotechnical analyses, remaining soil material will be collected into a separate container for VOC headspace screening (see below).
9. Steps 4 to 8 will be repeated, as necessary, until the bottom of the borehole, as outlined in the FAP, is reached (e.g. refusal or a predetermined depth). Frequency of sample collection will either be continuous or at predetermined depths.

10. If a temporary well or piezometer is to be installed see **the Monitoring Well and Microwell Installation SOP (see Table A-1 for SOP#)** for methodology and installation details.
11. The approximate location of the boring will be marked with a wood stake colored with highly visible spray paint and/or flagging. The boring number will also be written on the stake to identify the sample location for surveying purposes.
12. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP.
13. Discard all disposable equipment used during sampling activities in a designated location.

Records of each exploration shall be made on a Soil Boring Log (**example attached**) and in the field logbook. All cuttings or other waste will be containerized or disposed of in accordance with planning documents.

Abandonment of Boreholes

After drilling, logging and/or sampling, boreholes should be backfilled by the method required by the applicable agency and described in the project FAP. This typically consists of backfilling to the surface with bentonite chips, pellets or bentonite-cement grout. If bentonite chips or pellets are used, they should be added to the borehole in two-foot lifts and hydrated with water from a potable water supply. This process should be repeated until the entire borehole is plugged using no less than five gallons' water per ten feet of borehole. The surface hole condition should match the pre-drilling condition (asphalt, concrete, or smoothed flush with native surface), unless otherwise specified in the FAP.

Soil Headspace Screening

The purpose of the soil headspace screening procedure is to screen soil sample headspaces for total ionizing VOCs. This is a semi-quantitative method used to identify the presences, absence, and relative concentrations of VOCs in soil. Headspace screening is performed with a photoionization detector (PID). Headspace readings may be completed in between sample runs. Headspace readings should be transcribed on to the soil boring log FDR.

1. Record and document background VOC readings in ambient air. If it is not feasible to screen samples in an area with a clean background, document the highest background reading.
2. Half fill a clean jar or Ziplock™ type plastic bag with soil. Quickly cover the jar with aluminum foil or close the plastic bag and label the container.
3. Vigorously shake the sample to disperse soil and wait for approximately 5 minutes. Record the ambient temperature at which screening is performed. If outside temperatures are below 50°F, try to warm the samples in a heated vehicle or building.
4. Shake the sample again after 5 minutes.

5. Insert the tip of the PID through the foil or into the plastic bag and record the highest meter response, typically after approximately 3 to 15 seconds.
6. After screening all samples, re-check background and record significant variations.

The PID has a reliable reporting limit of 1 part per million in air. Readings at or below the reporting limit should be reported as not-detected “ND”.

Screening results will vary based on sample temperature, compounds present, age of the sample, and the degree to which the sample has been agitated and crumbled. Field personnel should remain consistent in their headspace measurement methodology to avoid biasing samples.

5.0 ATTACHMENTS

Utility Clearance Form

Soil Boring Log

Field Instrument Calibration Record

Utility Clearance Form

Site Name: ______________________________ Project No./Task No.: ______________
Site Address: ______________________________ One Call Ticket No.: ______________
Ticket Good until: ______________
Project Manager Name: ______________________________ PM Phone No.: ______________
Locations cleared by facility? ______________________________ Date Cleared: ______________

Utility Clearance:

Potential Utilities		Identified		Colors	Utility Company Name(s)	Utilities
Member of One Call	***Non Members**	**Utility Marked**	**Utility Responded not Present**			
						WHITE - Proposed Excavation
						****PINK** - Temporary Survey Markings
						RED - Electric Power Lines, Cables, Conduit and Lighting Cables
						YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
						ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
						BLUE - Potable Water
						PURPLE - Reclaimed Water, Irrigation and Slurry Lines
						GREEN - Sewers and Drain Lines

*Contact local municipality
** Survey markings need to be protected. If disturbed or destroyed, replace markings.

Private Utility Locator/Geophysical Survey

Method to be used:
___ Pipe and Cable Location
___ Ground Penetrating Radar
___ Magnetics and Electromagnetics

Non-Destructive Excavation Method to be used

___ *Hand Dig
___ Soil Vacuum
___ Air Knife
___ Water Knife

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

___ Overhead power lines
___ Cell phone/radio antennas
___ Trench patches
___ Trench settlement
___ Trench drains
___ Utility manholes
___ Manholes just outside building
___ Valve risers
___ Floor cleanout covers
___ Floor drains
___ Patches in concrete floors
___ Drainage ditches in area
___ Utility vaults
___ Transformer pads
___ Conduits from power panels into slab
___ Above ground propane tanks
___ Fire protection rooms
___ Fire protection lines
___ Fire hydrant locations – valves in ground
___ Footings under structural columns
___ Guard shack – service utilities
___ Bathroom and kitchen facilities
___ Radiant heat systems in slabs (ask)
___ Cooling units outside building
___ Process water to equipment in factory
___ Sprinkler system landscaping
___ Grounding systems near perimeter
___ Water tower on site.
___ Foundation drains - building perimeter

Additional Notes/Remarks: ____

____

Confidence Level that All Utilities have been identified:

___ High ___ Medium High ___ *Moderate ___ *Medium Low ___ *Low

*Contact PM. Get PM and OM permission prior to proceeding

*Cleared by PM? ____________________ *Cleared by OM? ____________________

SOIL BORING LOG

MACTEC 511 Congress Street, Portland Maine 04101	Project Name:		Boring ID:
	Project Location:		Page No.
	Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ____ TASK NO: ____ DATE: ____
PROJECT NUMBER: ____ MACTEC CREW: ____
PROJECT LOCATION: ____ SAMPLER NAME: ____
WEATHER CONDITIONS (AM): ____ SAMPLER SIGNATURE: ____
WEATHER CONDITIONS (PM): ____ CHECKED BY: ____ DATE: ____

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

AM CALIBRATION — **Start Time** ____ **/End Time** ____

POST CALIBRATION CHECK — **Start Time** ____ **/End Time** ____

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	____	+/- 0.1 pH Units			
pH (7)	SU	7.0	____	+/- 0.1 pH Units	7.0	____	+/- 0.3 pH Units
pH (10)	SU	10.0	____	+/- 0.1 pH Units			
Redox	+/- mV	240	____	+/- 10 mV	240	____	+/- 10 mV
Conductivity	mS/cm	1.413	____	+/- 0.5 % of standard	1.413	____	+/- 5% of standard
DO (saturated)	%	100	____	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	____	____	+/- 0.2 mg/L	____	____	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	____	< 0.5 mg/L			
Temperature	°C		____			____	
Baro. Press.	mmHg		____			____	

TURBIDITY METER

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	____	<0.1	____	+/- 0.3 NTU of stan.
20 Standard	NTU	20	____	20	____	+/- 5% of standard
100 Standard	NTU	100	____	100	____	+/- 5% of standard
800 Standard	NTU	800	____	800	____	+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Background	ppmv	<0.1	____	<0.1	____	within 5 ppmv of BG
Span Gas	ppmv	100	____	100	____	+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Methane	%	50	____	50	____	+/- 10% of standard
O_2	%	20.9	____	20.9	____	+/- 10% of standard
H_2S	ppmv	25	____	25	____	+/- 10% of standard
CO	ppmv	50	____	50	____	+/- 10% of standard

OTHER METER

METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ____
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45μm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ____
- Other ____
- Other ____

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S18

MACTEC STANDARD OPERATING PROCEDURE #S18

SONIC DRILLING OVERSIGHT

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

_______________________________________ April 27, 2020

Jean Firth, PG, Program Manager Date

Reviewed Date

_______________ _______________

_______________ _______________

_______________ _______________

SONIC DRILLING OVERSIGHT PROCEDURE

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes methodologies for sonic drilling. This procedure includes the minimum required steps and quality checks that employees and subcontractors are to follow when drilling using this technique. This SOP addresses technical requirements and required documentation to be completed during sonic drilling oversight.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

Boart Longyear: http://www.boartlongyear.com

3.0 DEFINITIONS

Cleanout Depth – The depth to which the end of the drill string has reached after an interval of cutting.

Drill String – The complete air rotary/air hammer drill assembly including hammer/bit, casing collars and stabilizers, and drill casing.

Hoist Line – Wire rope used on the draw works to hoist and lower loose augers, the removable center plug, sampling rods and split barrel, or the down-hole sampling hammer assembly.

Mast – A load-bearing structure on a drilling rig used for supporting the rotation head, pulldown hydraulics, hoisting lines, etc. It must be constricted to safely carry the expected loads encountered in drilling and completion of wells of the diameter and depth for which the rig manufacturer specifies the equipment. To allow for contingencies, it is recommended that the rated capacity of the mast should be at least twice the anticipated weight of the load or normal pulling load.

Oscillator Housing – Uses two eccentrics, counter-rotating balance weighs that are timed to direct 100% of the mechanical vibration energy at 0 degrees and 180 degrees to the drill pipe. An air spring system insulates the drill rig from the vibration. Counterbalances produce resonant energy waves that minimize borehole friction on the drill string.

Dual-Casing System – A 4-inch to 8-inch diameter core barrel, which is advanced for sampling purposes with an appropriately sized (6- to 10-inch diameter) outer drill pipe (casing). Typically, the core barrel is advanced ahead of the drill pipe for the length of the core run. The outer pipe is then advanced over the core barrel to keep the hole open for core and barrel retrieval. The outer drill pipe may be kept in the ground once total depth has been reached and may be used as casing material for the installation of wells.

4.0 SONIC DRILLING METHODOLOGY AND CONSIDERATIONS

Sonic drilling is a subsurface exploration technique that utilizes a dual-cased drilling system that is advanced hydraulically and with mechanical vibration (between 50 and 150 Hertz). The dual-cased system uses an inner core barrel, an outer large-diameter drill pipe, and a drill bit that are advanced during drilling. Sonic drilling commonly utilizes the vibration in consortium with a slow rotation and down-pressure to advance the drill string. The drill bit generates sinusoidal vibration waves that cause a cutting action at the bit face.

The cutting actions include fracturing, shearing, or displacement of the subsurface materials. Displacement often occurs as the vibration fluidizes unconsolidated deposits causing the material to move away from the drill string. Most of the formation, however, enters the core barrel and is contained within distinct plastic liners. Fracturing action is typically associated with drilling through cobbles and boulders, while shearing action is associated with drilling through elastic formations such as dense silt, clay, or shale.

Rotosonic/Rotasonic drilling is a modification of sonic drilling in which the core barrel is advanced sonically until full. The casing is then advanced sonically and in some cases with the use of water to cool the drill head and provide additional stability of the core upon retrieval. This method assists in reducing the overall system heat generation, which in turn prolongs equipment life, and reduces time. However, the application of water increases the volume of IDW over traditional sonic drilling methods.

Sonic drilling is typically utilized for soils that are too hard/dense for hollow stem auger borings and in which other methods, such as fluid rotary, are not considered cost or time effective due to proposed borehole depths. Standard penetration tests may be conducted with a sonic drilling rig with the appropriate equipment. Consult the **SOP for Drilling – Soil Boring and Rock Coring Oversight** for method guidance if this testing is designated in the field activities plan (FAP). Sonic drilling methods are also capable of sampling bedrock, however the method results in poor quality rock recovery which may not meet the data objectives of an environmental drilling program. If required to complete bedrock borings it is recommended to complete the soil sampling and casing deployment using the sonic drilling methods and then switch to more conventional rock coring techniques as discussed in the **SOP for Drilling – Soil Boring and Rock Coring Oversight**.

Potential difficulties in using the sonic drilling technique include: the potential for downtime as a result of the complexity of the drill head mechanics; vibration may cause heat to develop which may result in loss of contaminants from samples (particularly volatile organic compounds) or failure of the drill bit; fine-grained particles may migrate to the periphery of the core due to the vibratory action; and during retraction of the outer casing, the casing is vibrated which may cause the pin or box at the joints to fail resulting in casing remaining in the ground.

5.0 PROCEDURE

This section contains both the responsibilities and procedures involved with drilling oversight and sampling. Proper procedures are necessary to ensure the quality and integrity of the samples.

5.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that drilling activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC).

The PM will select the appropriate drilling methodology based on the objectives of the project. The PM is also responsible for ensuring that the site-specific FAP is clear in defining drilling methods.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to drilling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

5.1.1 Preparation

Utility Locate

Prior to mobilizing to a site, the PM or FOL will ensure that the local utility "one call" service has been notified (e.g. Dig Safely New York). Typically the drilling subcontractor will be resposnsible to call in the utlity ticket. Confirmation of the notifcation and the ticket number will be requested by the PM or FOL for the public records. No work may procede at the site until the ticket has been logged and all ultilities have responded/marked out.

If conducting borings at an active site, the project or field engineer/geologist must contact the appropriate site personnel necessary to receive clearance to drill at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. The exact location of each boring shall also be reviewed by responsible site personnel to ensure that the area is free of the facility-owned buried utilities. Surface geophysics may be conducted to identify the locations of subsurface facility-specific structures (e.g., drain lines, septic tanks, etc..) and soft dig methods (hand clearing with shovels, post hole diggers, hand augers) may be required.

Drilling locations shall be no closer than 25 feet to overhead utilities or within 10 feet of buried utilities.

Upon arrival at the site the FOL will complete the Utility Clearance Form (**Attachment S18A**) to document that utility locate activities and markout have been completed prior to the initialization of drilling activities.

Equipment Selection and Materials Considerations

- A drill rig of sufficient horsepower, hoisting capacity, and torque to drill borings of sufficient width and depth as specified in field activities plan (FAP) will be selected to complete the work.
- The rig should have the drill pipe handling system built into the drill mast. Optionally, a support truck may be mobilized with an on-board crane system for handling the drill piping.
- Casing, bit, and core barrel of sufficient size to complete the borings. Drill casings may need to be oversized to install bedrock casings.
- If lubricants are needed on rod joints, non-petroleum based lubricants will be used. If available, Teflon-based thread compound is recommended, however these compounds should be limited in use on site if sampling for emerging contaminants per- and polyfluoroalkyl substances (PFAS).
- A pump and tremie piping for pumping annular grout seal into the borehole. -Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as necessary.

The following materials will be available, as required:

- Materials (e.g. drums, roll-offs, fractionation tanks) for investigation derived wastes (IDW) as specified in the FAP;
- Personal protective equipment (PPE), monitoring equipment, and other health and safety equipment as specified in the project specific health and safety plan (HASP);
- Appropriate decontamination equipment (steam cleaner, materials for a decon pad, etc.) as specified in the QAPP or FAP;
- Monitoring well and other construction materials if specified in the FAP;
- Stainless steel trowels or spatulas;
- Aluminum Foil;
- Paper Towels;
- Measuring device (e.g. engineer's scale tape or rule);
- Appropriate sample containers and Field Data Records (FDRs);
- Photoionization detector (PID);
- Camera;
- Field notebook.

5.2 Field Procedures

Data and Records Management

The following records will be maintained by the field geologist/engineer:

- Field Logbook
- Soil Boring Log FDR
- Well Installation Diagram FDR

In the field book, the field geologist/engineer shall record the name of the drilling firm and the names of the driller and his assistant(s). The date, project location, project number, and weather conditions shall be recorded as well.

An accurate time log of drilling activities shall be kept. This log shall be kept in the field logbook and shall include at a minimum, the following:

- Time driller and rig arrive on site
- Time drilling begins
- Any delays in the drilling activities and the cause of such delays
- Time drillers go off site
- Duration of decontamination and investigation derived waste handling
- Down time (those periods when drilling activities cease due to equipment malfunctions, weather, and ordered stoppages)

Monitoring equipment for field screening (PID) and community air monitoring programs (CAMP) will be calibrated daily as per manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**). Make note of calibration variances or spanning to non-standard specifications.

Soil boring information including standard penetration depth information, sampling intervals, and soil descriptions will be recorded on the Soil Boring Log FDR (**example atached**). See **the Description and Identification of Soil Samples SOP (see Table A-1 for the SOP #)** for description methodology.

Drilling Procedures

1. Prior to mobilizing to the drilling location, the drill operator and the engineer/geologist will inspect the drill equipment for proper maintenance and condition. Out-of-specification materials will not be utilized or will be repaired.
2. Physical barriers or warning lines will be deployed in accordance with the HASP to create an exclusion zone to keep non-qualified personnel away from the rig. All materials and equipment will be staged in the exclusion zone.

3. Once the drill site is prepared, the drill should be stabilized and leveled using the hydraulic outriggers. Wooden blocking should be placed under the outrigger hydraulic rams on soft surfaces to stabilize the rig. The mast should be raised slowly such that no shifting of the rig occurs.
4. Careful measurement of all drilling tools, samplers, and casing must be exercised during all phases of the boring operations, to ensure maximum quality and recovery of the sample.
5. The borehole will be advanced by driving the outer casing, inner casing and core sampler in 5 or 10-ft runs (depending on the rig capacity or tooling capability).
6. The inner casing and core sampler is driven to the length of the chosen run. Drilling water is typically not used during this process to avoid impacting the environmental sample
7. The outer casing is then driven the length of the run to override the inner core casing to allow for retrieval of the soil sample by bringing the inner casing to the surface. Drilling water is typically used during this process to avoid binding the casings.
8. At the surface, a polyethylene or other appropriate material sample bag will be slid over the outside of the core sampler and the soils will be gently extruded into the sample bag.
9. The sample bag will be opened by the driller and laid out for the field geologist/engineer. A fresh face of the sample will be prepared by using a clean flat edged scraper (e.g. paint scraper) in perpendicular motions to the sample orientation. The resultant fresh face will be screened using a PID for volatiles and carefully examined, noting all soil characteristics, color seam, disturbance, etc. (See **the Description and Identification of Soil Samples SOP (see Table A-1 for the SOP #)** for description methodology). For the field screening of the sample the PID inlet should be just above the soil surface and a hand should be cupped over both for an interval for a period of several seconds to get an accurate reading. This allows for the buildup of VOCs for measurement without interference from ambient air. Colder temperatures will inhibit volatilization and may require longer screening times to get accurate readings.
10. Collect photographs of the soil in the sampler. The sample should be placed in a good light, preferably against a solid colored background. A ruler for scale and a tag identifying the sample should be placed in the picture. The identifier tag must have the sample number, depth and project name or number written so as to be legible in the photograph. Any photographs taken must be recorded in the field logbook.
11. A representative sample is selected based on the sampling objectives outlined in the FAP and is collected using the appropriate sampling method and container as outlined in the **Soil Sampling and Field Preservation of VOC and GRO Samples [SOP #s listed on Table A-1]** for soil sampling methods.
12. Following the collection of representative samples for chemical and/or geotechnical analyses, remaining soil material will be collected into a separate container for VOC headspace screening (see below).
13. Steps 4 to 11 will be repeated, as necessary, until the bottom of the borehole, as outlined in the FAP, is reached (e.g. refusal or a predetermined depth). Frequency of sample collection will either be continuous or at predetermined depths.
14. After the terminal depth of the borehole has been achieved, and an environmental monitoring well will not be installed, the borehole should be backfilled with a cement/bentonite grout. Grout

will be injected using a small diameter pipe to the base of the borehole. Drilling fluids within the borehole will be displaced upwards, collected in the drilling wash tub, and will be containerized as investigation derived waste. Alternatively, grout may be injected using the drill string in the same manner as the drilling fluids. Care should be taken to ensure the grout does not bridge forming gaps or voids in the grout column. Casing and augers will be slowly retracted during borehole abandonment to prevent the bottom of the casing/auger from rising above the top of the grout column. Grout will be mixed and injected in multiple lifts until flush with the ground surface. Following grouting, barriers should be placed over grouted boreholes as the grout is likely to settle in time, creating a physical hazard. Grouted boreholes will typically require at least a second visit to "top off" the hole.

15. If a monitoring well is to be installed see **Monitoring Well and Microwell Installation SOP** for methodology and installation details.
16. Decontaminate non-disposable equipment or tools that may have come into contact with subsurface soil in accordance with the FAP.
17. Discard all disposable equipment used during sampling activities in a designated location.
18. The approximate location of the boring will be marked with a wood stake colored with highly visible spray paint and/or flagging. The boring number will also be written on the stake to identify the sample location for surveying purposes.

Once the boring/well installation is complete, the rig mast will be lowered, the outriggers will be lifted and the rig will be moved off of the boring location. All cuttings or other waste will be containerized or disposed of in accordance with the FAP.

Soil Headspace Screening

The purpose of the soil headspace screening procedure is to screen soil sample headspaces for total ionizing VOCs. This is a semi-quantitative method used to identify the presences, absence, and relative concentrations of VOCs in soil. Headspace screening is performed with a PID. Headspace readings may be completed in between sample runs. Headspace readings should be transcribed on to the soil boring log FDR.

1. Record and document background VOC readings in ambient air. If it is not feasible to screen samples in an area with a clean background, document the highest background reading.
2. Half fill a clean jar or Ziplock™ type plastic bag with soil. Quickly cover the jar with aluminum foil or close the plastic bag and label the container.
3. Vigorously shake the sample to disperse soil and wait for approximately 5 minutes. Record the ambient temperature at which screening is performed. If outside temperatures are below 50°F, try to warm the samples in a heated vehicle or building.
4. Shake the sample again after 5 minutes.
5. Insert the tip of the PID through the foil or into the plastic bag and record the highest meter

response, typically after approximately 3 to 15 seconds.

6. After screening all samples, re-check background and record significant variations.

The PID has a reliable reporting limit of 1 part per million in air. Readings at or below the reporting limit should be reported as not-detected “ND”.

Screening results will vary based on sample temperature, compounds present, age of the sample, and the degree to which the sample has been agitated and crumbled. Field personnel should remain consistent in their headspace measurement methodology to avoid biasing samples.

Monitoring Well Installation

Bedrock boreholes may either be left open or have discrete monitoring wells installed for groundwater sampling. Well completion details will be outlined in the FAP. Further guidance is available in **Monitoring Well and Piezometer Installation SOP.**

6.0 ATTACHMENTS

Utility Clearance Form

Soil Boring Log

Field Instrument Calibration Record

Utility Clearance Form

Site Name: ____________________ Project No./Task No.: ____________
Site Address: ____________________ One Call Ticket No.: ____________
Ticket Good until: ____________
Project Manager Name: ____________________ PM Phone No.: ____________
Locations cleared by facility? ____________________ Date Cleared: ____________

Utility Clearance:

Potential Utilities		Identified				
Member of One Call	***Non Members**	**Utility Marked**	**Utility Responded not Present**	**Colors**	**Utility Company Name(s)**	**Utilities**
						WHITE - Proposed Excavation
						****PINK** - Temporary Survey Markings
						RED - Electric Power Lines, Cables, Conduit and Lighting Cables
						YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
						ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
						BLUE - Potable Water
						PURPLE - Reclaimed Water, Irrigation and Slurry Lines
						GREEN - Sewers and Drain Lines

*Contact local municipality
** Survey markings need to be protected. If disturbed or destroyed, replace markings.

Private Utility Locator/Geophysical Survey

Method to be used:
___ Pipe and Cable Location
___ Ground Penetrating Radar
___ Magnetics and Electromagnetics

Non-Destructive Excavation Method to be used

___ *Hand Dig
___ Soil Vacuum
___ Air Knife
___ Water Knife

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

___ Overhead power lines
___ Cell phone/radio antennas
___ Trench patches
___ Trench settlement
___ Trench drains
___ Utility manholes
___ Manholes just outside building
___ Valve risers
___ Floor cleanout covers
___ Floor drains
___ Patches in concrete floors
___ Drainage ditches in area
___ Utility vaults
___ Transformer pads
___ Conduits from power panels into slab
___ Above ground propane tanks
___ Fire protection rooms
___ Fire protection lines
___ Fire hydrant locations – valves in ground
___ Footings under structural columns
___ Guard shack – service utilities
___ Bathroom and kitchen facilities
___ Radiant heat systems in slabs (ask)
___ Cooling units outside building
___ Process water to equipment in factory
___ Sprinkler system landscaping
___ Grounding systems near perimeter
___ Water tower on site.
___ Foundation drains - building perimeter

Additional Notes/Remarks: ____________________

Confidence Level that All Utilities have been identified:

___ High ___ Medium High ___ *Moderate ___ *Medium Low ___ *Low

*Contact PM. Get PM and OM permission prior to proceeding

*Cleared by PM? ____________ *Cleared by OM? ____________

SOIL BORING LOG

MACTEC

511 Congress Street, Portland Maine 04101

Project Name:		Boring ID:
Project Location:		Page No.
Project No.:	Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole OD:

Boring Location:	Refusal Depth:	Total Depth:	Bore Hole OD:
Weather:	Soil Drilled:	Drilling Method:	Casing Size:
Subcontractor:	Rock Drilled:	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	
Reference Elevation:	Water Level:	Time:	

Drilling Information					Sample Information					
Depth (feet bgs)	Sample Number	Penetration (ft) / Recovery (ft)	Blow Counts	N Value	PID Field Screening (ppm)	PID Head Space Reading (ppm)	Analytical Sample Depth (ft)	Sample Description and Classification	USCS Classification	Remarks

NOTES:

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ______ TASK NO: ______ DATE: ______
PROJECT NUMBER: ______ MACTEC CREW: ______
PROJECT LOCATION: ______ SAMPLER NAME: ______
WEATHER CONDITIONS (AM): ______ SAMPLER SIGNATURE: ______
WEATHER CONDITIONS (PM): ______ CHECKED BY: ______ DATE: ______

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

AM CALIBRATION — Start Time ______ /End Time ______

POST CALIBRATION CHECK — Start Time ______ /End Time ______

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	______	+/- 0.1 pH Units			
pH (7)	SU	7.0	______	+/- 0.1 pH Units	7.0	______	+/- 0.3 pH Units
pH (10)	SU	10.0	______	+/- 0.1 pH Units			
Redox	+/- mV	240	______	+/- 10 mV	240	______	+/- 10 mV
Conductivity	mS/cm	1.413	______	+/- 0.5 % of standard	1.413	______	+/- 5% of standard
DO (saturated)	%	100	______	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	______	______	+/- 0.2 mg/L	______	______	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	______	< 0.5 mg/L			
Temperature	°C		______			______	
Baro. Press.	mmHg		______			______	

TURBIDITY METER

METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	______	<0.1	______	+/- 0.3 NTU of stan.
20 Standard	NTU	20	______	20	______	+/- 5% of standard
100 Standard	NTU	100	______	100	______	+/- 5% of standard
800 Standard	NTU	800	______	800	______	+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

Background	ppmv	<0.1	______	<0.1	______	within 5 ppmv of BG
Span Gas	ppmv	100	______	100	______	+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

Methane	%	50	______	50	______	+/- 10% of standard
O_2	%	20.9	______	20.9	______	+/- 10% of standard
H_2S	ppmv	25	______	25	______	+/- 10% of standard
CO	ppmv	50	______	50	______	+/- 10% of standard

OTHER METER

METER TYPE ______
MODEL NO. ______
UNIT ID NO. ______

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ______
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45µm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ______
- Other ______
- Other ______

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S19

MACTEC STANDARD OPERATING PROCEDURE #S19

TEST PIT EXCAVATION AND SAMPLING OVERSIGHT

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples ______________________________ April 27, 2020

Charles Staples, PG, Program Technical Lead Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

1.0 PURPOSE

This Standard Operating Procedure (SOP) has been prepared to direct field personnel in the methods for completing and logging test pits during field investigations at hazardous and non-hazardous waste sites.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 TEST PIT EXCAVATION CONSIDERATIONS

The objectives of completing test pits can include the following: document subsurface conditions, investigate anomalous magnetic readings, observe subsurface geology, identify the vertical extent of contamination, confirm depth to bedrock, complete drum removal activity, obtain subsurface soil samples and identify potential subsurface conduits for ground water flow and potential contaminant migration.

Test pits are a useful tool for environmental investigations in that they allow for quick characterization of shallow soils and contamination across a large area. Test pits provide a visual face to determine important soils contacts or for identifying contamination such as staining, debris or oils. Test pits also provide useful information at sites with significant debris (e.g. scrap yards, metallurgical wastes) that may be present in the subsurface which may not be identified during a drilling or direct push investigation.

3.0 PROCEDURE

This section contains both the responsibilities and procedures involved with test pit excavation oversight and sampling.

3.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviations in the field book and/or field data record (FDR).

3.2 Preparation

Utility Locate

The subcontractor will be responsible for notifying the "one call" service (e.g. Dig Safely New York); the PM or FOL will confirm the notification and document the ticket number (s). No work may proceed at the site until the ticket has been logged and all utilities have responded/marked out. If the site is an active facility, the PM or FOL must also contact the appropriate site personnel to receive clearance to test pit excavation at specified locations. The names of the personnel authorizing clearance will be documented in the field logbook. Surface geophysics may also be conducted to identify the locations of subsurface facility-specific structures (e.g., drain lines, septic tanks, etc..).

Soft dig methods (hand clearing with shovels, post hole diggers, hand augers) is typically not appropriate for test pit locations due to the typical size of the excavation.

Test pit locations shall be no closer than 25 feet to overhead utilities or within 10 feet of buried utilities.

Upon arrival at the site the FOL will complete a Utility Clearance Form (**example attached**) to document that utility locate activities and mark outs have been completed prior to the initialization of test pit excavation activities.

Equipment Selection and Sampling Considerations

The following list of equipment includes items that may be used by field personnel during test pit excavations. Subcontractor personnel typically provide and operate all excavation and steam cleaning equipment. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Measuring tape.
- Appropriate personal protective equipment (as specified in HASP);
- Air monitoring instruments, as specified in the site-specific field activities plan (FAP) and HASP (photo-ionization detector [PID], particulate meter, etc.).
- Field logbook;
- Test pit log FDR (**example attached**).
- Camera.

- Sampling bottles as required based on analytical suite specified in the site-specific FAP and typically provided by the analytical laboratory (along with sample coolers).
- Stainless steel bowls and spoons; and
- Aluminum foil.

3.3 Field Procedures

Monitoring equipment for field screening (e.g., PID) and community air monitoring programs (CAMP) will be calibrated daily as per manufacturer's instructions. Equipment information (make, model, and serial number) and calibration readings shall be recorded on the field instrument calibration record (**example attached**). Make note of calibration variances or spanning to non-standard specifications.

Identify the area to be excavated and position the backhoe. Determine the staging locations for spoils and use ground sheeting if required.

Initiate the excavation in approximate one to two-foot loose lifts segregating materials in the order they were removed. Observations of visual contamination, buried containers, or potential conduits should be recorded, and operations suspended while photographs and measurements of interest within the pit are made and documented on the test pit field data FDR (**example attached)**.

Once the excavation has been completed to the desired depth, the soil should be logged as described in accordance with the methods outlined in **the Soil Description and Identification SOP**. If samples from specific layers for geologic description are desired, the bucket should be used to obtain samples from the edges of the pit in the desired location. Personnel are not to enter the test pit for logging or sample collection.

The dimensions of the final test pit should be measured and recorded. A sketch of the test pit and any unusual features should be completed on the test pit FDR (**example attached**). Photographs of at least one side of the pit and any features of interest exposed in the pit should be taken and recorded in the field logbook. The depth to water (if present) should be measured from a location on the side of the pit at the original grade.

Materials within the pit desired for laboratory analysis should be obtained with the excavator bucket. Samples for volatile organic analysis as described in the **Field Preservation of VOA and GRO Soil Samples SOP** should be collected immediately from available material below the surface of the excavated material within the bucket. Sample material for other analyses should then be withdrawn from the center of the bucket, homogenized in a stainless-steel bowl and placed in the required sample jars as described in the **Soil Sample Collection SOP**.

Backfill the excavated soil into the excavation in the reverse order it was excavated. Make certain the excavator operator compacts the backfilled soil with the excavator bucket and does not leave any surface holes or other hazards when completed. If segregation of contaminated soil has occurred, the disposition of these soils should be in accordance with the FAP. Typically, these materials are not used during backfilling activities.

Document the location of the test pit with a global positioning system and/or labeled stake for future reference or surveying. If practicable, measure location of test pit to at least three permanent fixtures to aid in locating the test pit in the event of the stake being inadvertently moved.

4.0 ATTACHMENTS

Utility Clearance Form

Test Pit Excavation Log

Field Instrument Calibration Record

Utility Clearance Form

Site Name: ______________________________ Project No./Task No.: ____________
Site Address: ______________________________ One Call Ticket No.: ____________
Ticket Good until: ____________
Project Manager Name: ______________________________ PM Phone No.: ____________
Locations cleared by facility? ______________________________ Date Cleared: ____________

Utility Clearance:

Potential Utilities		Identified		Colors	Utility Company Name(s)	Utilities
Member of One Call	***Non Members**	**Utility Marked**	**Utility Responded not Present**			
						WHITE - Proposed Excavation
						****PINK** - Temporary Survey Markings
						RED - Electric Power Lines, Cables, Conduit and Lighting Cables
						YELLOW - Gas, Oil, Steam, Petroleum or Gaseous Materials
						ORANGE - Communication, Alarm or Signal Lines, Cables or Conduit
						BLUE - Potable Water
						PURPLE - Reclaimed Water, Irrigation and Slurry Lines
						GREEN - Sewers and Drain Lines

*Contact local municipality
** Survey markings need to be protected. If disturbed or destroyed, replace markings.

Private Utility Locator/Geophysical Survey

Method to be used:
___ Pipe and Cable Location
___ Ground Penetrating Radar
___ Magnetics and Electromagnetics

Non-Destructive Excavation Method to be used

___ *Hand Dig
___ Soil Vacuum
___ Air Knife
___ Water Knife

* Use electrically insulated gloves if potential for power lines

Field Clues Observed/Evaluated:

___ Overhead power lines
___ Cell phone/radio antennas
___ Trench patches
___ Trench settlement
___ Trench drains
___ Utility manholes
___ Manholes just outside building
___ Valve risers
___ Floor cleanout covers
___ Floor drains

___ Patches in concrete floors
___ Drainage ditches in area
___ Utility vaults
___ Transformer pads
___ Conduits from power panels into slab
___ Above ground propane tanks
___ Fire protection rooms
___ Fire protection lines
___ Fire hydrant locations – valves in ground
___ Footings under structural columns

___ Guard shack – service utilities
___ Bathroom and kitchen facilities
___ Radiant heat systems in slabs (ask)
___ Cooling units outside building
___ Process water to equipment in factory
___ Sprinkler system landscaping
___ Grounding systems near perimeter
___ Water tower on site.
___ Foundation drains - building perimeter

Additional Notes/Remarks: ______________________________

____

Confidence Level that All Utilities have been identified:

___ High ___ Medium High ___ *Moderate ___ *Medium Low ___ *Low

*Contact PM. Get PM and OM permission prior to proceeding

*Cleared by PM? ____________________ *Discussed with OM? ____________________

\\PLD2-FS1\Project\Projects\NYSDEC__General NYSDEC Information D009809\Program Requirements\D. Field Support-Guidance\b. QAPP_SOPs\SOPs\SOP Attachments 2\S16A Utility Clearance Form.doc

TEST PIT RECORD

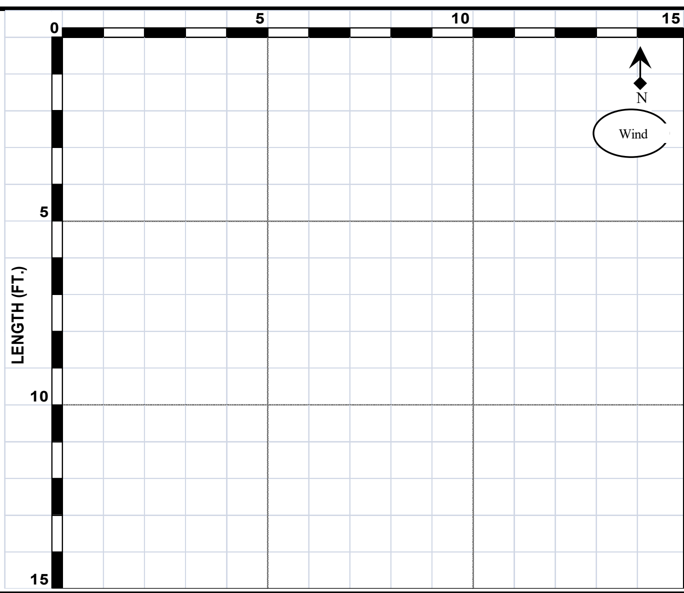
MACTEC

511 Congress Street, Portland Maine 04101

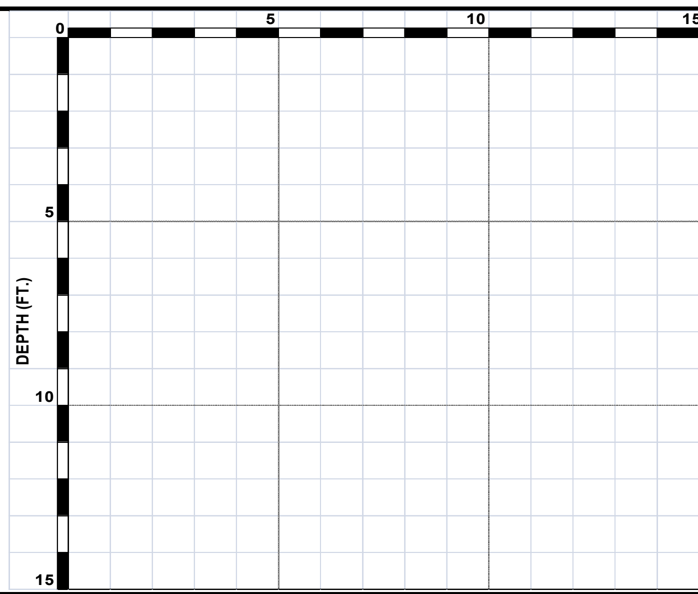
Project Name:		Test Pit ID:
Project Location:		Page No. 1
Project No.:	Client: NYSDEC	of: 1
Test Pit Location:	Monitoring Equipment:	Location Sketch
Weather:	Photographs (Y/N): Protection Level:	
Surface Conditions:	Length of Exc: Width of Exc:	
Subcontractor:	Date Started: Date Completed:	
Operator:	Logged By: Checked By:	
Equipment:	Refusal Depth: Total Depth:	
Reference Elevation:	Water Level: Time:	

Sample Information			Monitoring						
Depth (ft. bgs)	Sample No. & Type	Pocket Pen/ Torvane (Kg/cm^2)	PID Field Scan	PID Headspace	Lab Tests Performed	Lab Sample ID	Sample Description and Classification	USCS Group Symbol	Remarks

PLAN VIEW



CROSS-SECTIONAL VIEW



NOTES:

TEST PIT RECORD

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ____________ TASK NO: ________ DATE: ________
PROJECT NUMBER: ____________ MACTEC CREW: ________
PROJECT LOCATION: ____________ SAMPLER NAME: ________
WEATHER CONDITIONS (AM): ____________ SAMPLER SIGNATURE: ________
WEATHER CONDITIONS (PM): ____________ CHECKED BY: ________ DATE: ________

MULTI-PARAMETER WATER QUALITY METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

AM CALIBRATION — **Start Time** ________ **/End Time** ________

POST CALIBRATION CHECK — **Start Time** ________ **/End Time** ________

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	____	+/- 0.1 pH Units			
pH (7)	SU	7.0	____	+/- 0.1 pH Units	7.0	____	+/- 0.3 pH Units
pH (10)	SU	10.0	____	+/- 0.1 pH Units			
Redox	+/- mV	240	____	+/- 10 mV	240	____	+/- 10 mV
Conductivity	mS/cm	1.413	____	+/- 0.5 % of standard	1.413	____	+/- 5% of standard
DO (saturated)	%	100	____	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	____	____	+/- 0.2 mg/L	____	____	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	____	< 0.5 mg/L			
Temperature	°C		____			____	
Baro. Press.	mmHg		____			____	

TURBIDITY METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	____	<0.1	____	+/- 0.3 NTU of stan.
20 Standard	NTU	20	____	20	____	+/- 5% of standard
100 Standard	NTU	100	____	100	____	+/- 5% of standard
800 Standard	NTU	800	____	800	____	+/- 5% of standard

PHOTOIONIZATION DETECTOR

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

Background	ppmv	<0.1	____	<0.1	____	within 5 ppmv of BG
Span Gas	ppmv	100	____	100	____	+/- 10% of standard

O_2-LEL 4 GAS METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

Methane	%	50	____	50	____	+/- 10% of standard
O_2	%	20.9	____	20.9	____	+/- 10% of standard
H_2S	ppmv	25	____	25	____	+/- 10% of standard
CO	ppmv	50	____	50	____	+/- 10% of standard

OTHER METER

METER TYPE ________
MODEL NO. ________
UNIT ID NO. ________

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.

☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ________
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45µm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ________
- Other ________
- Other ________

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

MACTEC
511 Congress Street, Portland Maine 04101

FIELD INSTRUMENT CALIBRATION RECORD

SOP # S20

MACTEC STANDARD OPERATING PROCEDURE #S20

HEAVY EQUIPMENT DECONTAMINATION OVERSIGHT

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

____ April 27, 2020

Bradley LaForest, NRCC-EAC, Program Manager | Date

Reviewed | Date

____________________ ____________________

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HEAVY EQUIPMENT DECONTAMINATION

1.0 PURPOSE

This Standard Operating Procedure (SOP) establishes guidelines for use by field personnel overseeing the decontamination of heavy equipment when conducting environmental investigations.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), 1985. "Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites." EPA/600/2 85/028.

USEPA, 1987, Compendium of Superfund Field Operations Methods, EPA 540/P-87/001a, OSWER 9355.0-14, September.

USEPA, 1988, EPA Guidelines for Conducting Remedial Investigation and Feasibility Studies under CERCLA, Interim Final OSWER Directive 9355.3-01, August.

USEPA, 1991, Management of Investigation Derived Wastes During Site Inspections, EPA 540/G-191/009, May.

3.0 DEFINITIONS

Heavy Equipment – Drill rigs, excavators, dozers, back-hoes, trucks or other similar type machinery used to drill soil borings, break concrete, excavate soil or other similar type activity.

Laboratory Grade Detergent – A standard brand of laboratory-grade detergent, such as Alconox® or Liquinox®. If investigating for PFAS, Decon 90 or other detergents containing PFAS and will not be utilized for decontamination. Sites being sampled for 1,4-dioxane should use Alconox® detergent instead of Liquinox®.

Potable Water – Water dispensed from a municipal water system or well used and approved for drinking.

4.0 PROCEDURE

This section provides requirements for heavy equipment decontamination procedures to be followed. Decontamination at sites being investigated for PFAS will require a source of PFAS free water.

4.1 Responsibilities

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the project work plans should be reviewed before overseeing heavy equipment decontamination at the project site.

Project Manager

The Project Manager (PM) has the responsibility for ensuring that decontamination of heavy equipment is properly performed through staff training.

Field Operations Lead

The Field Operations Lead (FOL) has the responsibility for periodic review of procedures and documentation associated with the decontamination of heavy equipment. If perceived variances occur, the FOL is also responsible for issuing notices of nonconformances and requesting corrective actions. Additionally, the FOL will perform inspections and monitoring of the decontamination activities.

Field Personnel

Project staff assigned to field activities are responsible for ensuring that subcontractors or equipment operators properly decontaminate heavy equipment associated with those tasks. Project staff are also responsible for documenting the decontamination activities in a field logbook as specified in the FAP.

4.2 Preparation

Equipment Selection Considerations

Subcontractor personnel will provide decontamination materials and operate steam cleaning equipment. The following list of equipment and materials may be used for heavy equipment decontamination:

- Cleaning materials which may include tap (potable) water, soap and/or detergent solutions, nitric acid solutions, and methanol. Specific requirements based on the site contaminants of concern will be detailed in the site- specific FAP.
- Personal protective equipment (PPE) as defined in project Health and Safety Plan (HASP).
- Investigation Derived Waste (IDW) containers (drums, roll offs, fractionation tanks)
- Scrub brushes.
- Pressure washer or steam cleaner.

4.3 Field Procedures

Decontamination Area

A decontamination area will be set up in an area exclusively for decontamination of heavy equipment. which will be conducted within the station.

At a minimum, the station will be constructed such that all rinsates, liquid spray, soil, debris and other decontamination wastes are fully contained and may be collected for appropriate waste management and disposal. The area may be as simple as a bermed pad lined with polyethylene sheeting. More sophisticated designs involving self-contained metal decontamination pads in combination with bermed polyethylene sheeting may also be used, depending on project-specific requirements. These requirements along with specific equipment and construction specifications for the decontamination area will be provided in the FAP.

Decontamination of Downhole Equipment

Downhole drilling equipment (including but not limited to drill pipe, drive casing, drill rods, bits, tools, etc.) will be thoroughly decontaminated before mobilization to site and between borings or wells at each site or as required in the FAP. The standard procedure will be performed as described below. Appropriate PPE (as specified in the project HASP) must be worn by all personnel involved with the task to limit personal exposure.

- Equipment caked with drill cuttings, soil, or other material will initially be scraped or brushed to remove gross soil contamination. The scrapings will be containerized and appropriately disposed of in accordance with the FAP.
- Equipment may be washed with a laboratory grade detergent prior to high-pressure washing or steam cleaning.
- Equipment will then be sprayed with potable water using a high-pressure washer or steam cleaner.
- Rinsate blanks will be collected from washed equipment that directly contacts soils that will be sampled (e.g. split spoon samplers) which will be reused. This will consist of water from the final rinse which is collected directly into sample containers.
- Decontaminated downhole equipment (such as drill pipe, drive casing, bits, tools, bailers, etc.) will be placed on clean polyethylene plastic sheeting to prevent contact with contaminated soil and allowed to air dry.

Decontamination of Heavy Equipment

Heavy equipment (e.g. drill rigs, development rigs, backhoes, trucks, and other earthmoving equipment) will be decontaminated between drilling sites. Decontamination will be performed in accordance with the FAP. The standard procedure will be performed as described below. Appropriate personal protective equipment (as specified in the project HASP) must be worn by all personnel involved with the task to limit personal exposure.

- Heavy equipment caked with drill cuttings, soil, or other material will be initially scraped or brushed to remove bulk soil at the drilling or work location. The scrapings will be containerized and appropriately disposed of in accordance with the FAP.
- Heavy equipment will then be moved to the decontamination pad and configured so that fluids from decontamination activities will be collected by the impermeable liner.

- Equipment may be washed with a laboratory grade detergent prior to high-pressure washing or steam cleaning.
- The equipment is then sprayed with potable water using a high-pressure washer or steam cleaner as outlined in the FAP.
- Between boreholes at the same site, the back end and equipment decks of the drilling rigs will be washed with potable water until surfaces are visibly free of soil buildup.
- During the decontamination effort, fluid systems should be inspected for any leaks or problems, which might potentially result in an inadvertent release at the site, thereby contributing to the volume of waste or contamination.

Decontamination activities will be documented by the field geologist/engineer in the field logbook. Decontamination fluids will be containerized in IDW handling containers as specified in the FAP. Decontamination areas should be covered with plastic when not in use to prevent collection of rainwater which will then be required to be handled as IDW.

SOP # S21

MACTEC STANDARD OPERATING PROCEDURE #S21

FIELD EQUIPMENT DECONTAMINATION

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________ April 27, 2020

Bradley LaForest, NRCC-EAC, Program Manager Date

Reviewed Date

______________________ ______________________

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FIELD EQUIPMENT DECONTAMINATION

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the methods to be used for the decontamination of all field equipment which becomes potentially contaminated during a sample collection task.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), January 1986. "Decontamination Techniques for Mobile Response Equipment Used at Waste Sites (State-of-the-Art Survey)." EPA/600/52-85/105.

USEPA, March 1985. "Guide for Decontaminating Buildings, Structures, and Equipment at Superfund Sites." EPA/600/2 85/028.

3.0 PROCEDURE

All reuseable field equipment that comes in contact with site media to be samples should be included in the decontamination process. Decontamination is performed as a quality assurance measure and a safety precaution. It prevents cross-contamination between samples and helps to maintain a clean working environment for the safety of all field personnel.

Decontamination at sites being investigated for PFAS will require a source of PFAS free water. A standard brand of laboratory-grade detergent, such as Alconox® or Liquinox® will be used. If investigating for PFAS, Decon 90 or other detergents containing PFAS and will not be utilized for decontamination. Sites being sampled for 1,4-dioxane should use Alconox® detergent instead of Liquinox®.

Decontamination is mainly achieved by rinsing with liquids which may include: soap and/or detergent solutions, tap-water, deionized water, acid solutions, and methanol. Equipment will be allowed to air dry after being cleaned or may be wiped dry with clean clothes or paper towels if immediate re-use is needed.

The frequency of equipment use dictates that most decontamination be accomplished at each sampling site between collection points. Waste products produced by the decontamination procedures, such as waste liquids, solids, rags, gloves, etc. must be collected and disposed of properly in accordance with the FAP.

3.1 Responsibilities

Compliance with this procedure is the responsibility of project management and field personnel. This SOP and the project work plans should be reviewed before implementing field equipment decontamination at the project site

Project Manager

The Project Manager (PM) has the responsibility for ensuring that decontamination of field equipment is properly performed through staff training.

Field Operations Lead

The Field Operations Lead (FOL) has the responsibility for periodic review of procedures and documentation associated with the decontamination of field equipment. If perceived variances occur, the FOL is also responsible for issuing notices of nonconformances and requesting corrective actions. Additionally, the FOL will perform inspections and monitoring of the decontamination activities.

Field Personnel

Project staff assigned to field activities are responsible for ensuring that subcontractors or equipment operators properly decontaminate field equipment associated with those tasks. Project staff are also responsible for documenting the decontamination activities in a field logbook.

It is the responsibility of all personnel involved with sample collection or decontamination to maintain a clean working environment and to ensure that any contaminants are not negligently introduced to the environment.

3.2 Preparation

Equipment Selection and Sampling Considerations

Cleaning materials may include tap (potable) water, deionized water, and soap and/or detergent solutions, nitric acid solutions, and methanol. Specific requirements will be detailed in the site-specific FAP. The following list of equipment and materials includes the necessary items for field equipment decontamination:

- Personal protective equipment (PPE) as defined in project Health and Safety Plan (HASP).
- Paper towels
- Disposable gloves
- Waste storage containers (drums, boxes, plastic bags)
- Cleaning containers (Plastic buckets, galvanized steel pail)
- Cleaning brushes
- Laboratory-grade detergent
- Stainless steel spray bottles
- Deionized water or other approved water.

3.3 Field Procedure

Soil, Sediment, Surface Water and Air Sampling Equipment

1. Remove any solid particles from the equipment or material by brushing and then rinsing with clean water. This initial step is performed to remove gross contamination.
2. Wash equipment with a soap or detergent solution and brush.
3. Rinse with tap-water.
4. Rinse with deionized water.
5. Repeat entire procedure or any parts of the procedure if necessary, to remove all traces of solids.
6. If sampling equipment is not to be used immediately at another location, wrap the equipment in aluminum foil and store in a safe place.

Submersible Pump Decontamination Procedures

This procedure will be used to decontaminate submersible pumps between groundwater sample collection points and at the end of each day of use. Dedicated tubing should be used for each well so no decontamination of the tubing is needed. The dedicated tubing will be placed back into the monitoring well and only the pump will be decontaminated as described in the following subsections.

The following materials will be used:

- plastic or PVC upright cylinder or bucket
- 5-10-gallon plastic water storage containers
- soap or detergent solution and brush
- Deionized water or other approved water
- Stainless steel spray bottle
- Paper towels

During decontamination, the submersible pump will be placed on a clean surface (sheet of plastic) or held away from ground.

1. Decontaminate the outer surface of the submersible pump using a potable water rinse followed by a deionized water rinse.
2. Connect discharge tubing to the end of the pump and place the submersible pump upright in the cylinder and fill the cylinder with potable water and detergent. The end of the tubing should be clamped to an empty water storage container
3. Activate the pump in the forward mode withdrawing water from the cylinder.
4. Continue pumping until the water in the cylinder is pumped down and air is drawn through the pump. At this time air pockets, will be observed in the discharge line. Shut off the pump immediately.
5. Using the water remaining in the cylinder, rinse the power cord (excepting the plug or battery connectors) by pouring the water carefully over the coiled lines.
6. Repeat steps 3 to 5 twice using deionized water. Pump or drain all the remaining water from the

tubing.

7. When reaching the next monitoring well place the pump in the well casing and wipe dry both the power lines with a clean paper towel as the pump is lowered.

SOP # S22

MACTEC STANDARD OPERATING PROCEDURE #S22

MONITORING WELL AND MICROWELL INSTALLATION

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

_______________________________	April 27, 2020
Jean Firth, PG, Program Manager	Date
Reviewed	Date
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MONITORING WELL AND MICROWELL INSTALLATION

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides procedures and requirements for the installation of monitoring wells and microwells using various drilling techniques, including but not limited to, direct push technology (DPT), hollow-stem auger (HSA), rotary, and sonic. The details within this SOP should be used in conjunction with the site-specific field activities plan (FAP).

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

ASTM International (ASTM), 2010 *Standard Guide for Installation of Direct Push Ground Water Monitoring Wells, Method D-6724-04*

ASTM, 2010 *Standard Practice for Design and Installation of Groundwater Monitoring Wells, Method D-5092-04*

ASTM, *Standard Guide for the Use of Hollow Stem Auger Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5784/5784M-13*

ASTM, 2012 *Standard Guide for the Use of Direct Air Rotary Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5782-95*

ASTM, *Standard Guide for the Use of Dual Wall Reverse Circulation Drilling for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5781/5781M-13*

ASTM, *Standard Guide for the Use of Casing Advancement Drilling Methods for Geoenvironmental Exploration and Installation of Subsurface Monitoring Devices, Method D5872/5872M-13*

U.S. Environmental Protection Agency (USEPA), 1986, *Resource Conservation and Recovery Act (RCRA) Ground Water Monitoring Technical Enforcement Guidance Document*, OSWER-9950.1, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, U.S. Government Printing Office, Washington D.C.

USEPA, 1987, *A Compendium of Superfund Field Operations Methods*, EPA-500/P-87/001, U.S. Government Printing Office, Washington D.C.

3.0 DEFINITIONS

Cuttings – Pieces of soil, sediment, or rock cut by a bit in the process of drilling borings.

Borehole – Any hole drilled into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing groundwater wells.

Grout – For the purposes of this SOP, the term "grout" consists of a neat cement grout generally containing one 94-pound bag of Portland cement mixed with clean water and bentonite. The grout is emplaced as a slurry, and once properly set and cured, is capable of restricting movement of water.

Monitoring Well/Microwell – A well that provides for the collection of representative groundwater samples, (including the detection and collection of representative light and dense non-aqueous phase organic liquids), and the measurement of fluid levels.

Annular Space – The space between the well screen or casing and the borehole wall.

Filter Pack – Granular filter material (sand, gravel, etc.) placed in the annular space between the well screen and the borehole to increase the effective diameter of the well and prevent fine-grained material from entering the well.

Well Screen – A commercially available, factory-perforated, wire wound, continuous wrap, or slotted casing segment used in a well to maximize the entry of water from the producing zone and to minimize the entrance of sand.

Tremie – A tubular device or pipe used to place grout, bentonite, or filter pack in the annular space.

4.0 PROCEDURE

This section contains both main responsibilities and procedures for well installation activities. Well installation is typically completed during an environmental drilling program after completion of a soil or rock borehole. Tasks and responsibilities in this SOP will apply to only the act of installing the monitoring well/microwell. Tasks and procedures associated with drilling and borehole advancement are described in the following SOPs:

- Drilling – Soil Boring and Rock Coring Oversight
- Direct Push Sampling
- Sonic Drilling Oversight

Site-specific factors need to be considered in the selection of well construction and completion materials, specification of well designs. The project FAP will contain the following information related to well installation:

- Objectives of the monitoring well/microwell.
- Specific location of the well to be installed.

- Zone or depth well is to be installed.
- Well construction materials to be used.
- Specification of well design(s) including Well Construction Diagrams; and,
- Additional procedures or requirements beyond this SOP.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that well installation collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate well installation methodology based on the objectives of the installation.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL.

4.2 Preparation

Equipment Selection and Sampling Considerations

The following list of equipment includes the necessary items to be used by field personnel during well installations. Subcontractor personnel typically provide and operate all installation equipment and materials. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Electronic water level indicator.
- Measuring tape.
- Appropriate personal protective equipment (PPE), as specified in HASP.
- Well construction field data records (FDR).
- Field logbook; and
- Camera.

4.1 Field Procedures

Well Installation Procedures

Upon completion of a borehole remove all drill tooling except for the outer casing or augers. For direct push borings, disengage the expendable drive point. The well construction materials will then be installed inside the open borehole or through the center of the outer casing or augers.

Measure the total depth of the completed boring using a weighted sounding line. The borehole depth is checked to assure that formation material has not heaved to fill the borehole. If heaving has taken place, options for cleaning, re-drilling, or installation in the open section of the boring should be discussed with lead technical personnel.

If the borehole depth is deeper than the proposed well installation (e.g. over-drilled or specific targeting of shallower layers), bentonite pellets or bentonite chips (as specified in the FAP) may be added to the bottom of the boring to raise the bottom of the hole to the desired depth. The bentonite should be pumped through a tremie pipe and fill from the bottom of the boring upward. During pumping of bentonite slurry, the tremie pipe should be submerged below the top of the bentonite column in the borehole to prevent free-fall and bridging. If bentonite chips or pellets are used, it should be added gradually to prevent bridging. Bentonite addition will stop when its level has reached approximately one foot below the desired base of the well string (casing, screen, end plug or sump, etc.). The bentonite plug will be hydrated for at least one hour before installation of a filter pack.

Calculate volumes of filter pack, bentonite pellets/slurry, and grout required, based on borehole and well casing dimensions. If required by the FAP, determine the filter pack and well screen slot size for the well. For most well installations, the filter pack and well screen slot size will be determined in the FAP prior to the start of the installation activities (typically 10 slot screen [0.010" diameter slots] and 20/40 sieve sands [e.g. #1 sand]).

Inspect the casing, screen, and any other well construction materials prior to installation to assure that no damage has occurred during shipment and decontamination activities and the materials comply with the well design.

Connect and carefully lower the well string through the open borehole, drive rods or casing, or inside of the augers until the well string is at the desired depth. The well string should be suspended slightly by the installation rig and should not rest on the bottom of the boring. In the event the well string was dropped, lowered abruptly, or for any other reason suspected of being damaged during placement, the string should be removed from the boring and inspected. In certain instances, the well string may rise after being placed in the borehole due to heaving sands. If this occurs, the driller must not place any drilling equipment (drill pipe, hammers, etc.) to prevent the casing from rising. The amount of rise should be noted by the rig geologist or engineer who should then consult lead technical personnel for an appropriate course of action.

Record the following information on the appropriate field data records and field logbook per the project work plans:

- Well construction material (type, diameter, and screen size).
- Length of well screen.
- Total depth of well boring.
- Depth from ground surface to top of grout or bentonite plug in bottom of borehole (if present).
- Depth to base of well string; and,
- Depth to top and bottom of well screen.

When using the mud rotary drilling technique, tremie the filter pack into the annular space around the screen. Clean, potable water may be used to assist with the filter pack tremie operation. For all other drilling techniques, the filter pack may be allowed to free fall or be tremied per the FAP. For direct push-installed wells, a pre-pack filter may be attached to or fitted around the screen and placed concurrently with the well string.

Drill tooling (casing, augers, and rods) should be removed slowly during filter pack installation in increments no greater than 5 feet. At no time should the bottom of the tooling be pulled above the top of the filter pack during installation.

Filter pack settlement should be monitored by initially measuring the sand level (before beginning to withdraw the drive casing/augers). In addition, depth soundings using a weighted tape shall be taken repeatedly to continually monitor the level of the sand. The top of the well casing shall also be monitored to detect any movement due to settlement or lifting from tooling removal. If the top of the well casing moves upwards at any time during the well installation process, the driller should not be allowed to set drilling equipment (downhole hammers, drill pipe, etc.) on the top of the casing to prevent further movement.

Filter pack should be added until its height is approximately 2 feet above the top of the screen (unless otherwise specified in the FAP), and verification of its placement by sounding with the weighted tape should be conducted. Once the placement of the filter pack is completed, the depth to the top of the pack is measured and recorded on the appropriate forms per the project work plans.

A three-foot thick (unless otherwise specified in the FAP) bentonite seal is then installed on top of the filter pack. If pellets or chips are used, they should be added gradually to avoid bridging. Repeated depth readings will be taken using a weighted tape to ascertain the top of the bentonite seal. Granular bentonite must be used if the seal is placed above the water table.

After hydration of the bentonite seal, neat cement grout (mixture consisting of approximately 9 gallons of water and 94 pounds of Portland cement with bentonite to aid seal, is then pumped through tremie pipe and filled from the top of the bentonite seal upward. The bottom of the tremie pipe should be maintained below the top of the grout to prevent free fall and bridging. When using casing or auger techniques, the drive casing/augers should be raised in incremental intervals, keeping the bottom of the drive casing/augers below the top of the grout. Grouting will cease when the grout level has risen to within approximately one to 2 feet of the ground surface. Grout levels should be monitored to assure that grout taken into the formation is replaced by additional grout. If settling of the grout occurs, additional topping off of the grout may be necessary. In deep wells (including bedrock wells), grout lifts should be limited to prevent excessive grout infiltrating transmissive zones and potentially impacting neighboring monitoring wells. If suspected grout loss is occurring grouting will cease to allow for grout within the zone to harden and block off further loss on subsequent grout lifts.

Once grouting activities have been completed an above ground protective steel casing or a flush mounted road box will be installed with concrete aprons designed to shed water. A minimum of 24 hours after grouting should elapse before installation of the concrete pad and street boxes or vaults for flush mount completions.

After the protective casing has set, a drainage hole may be drilled into the protective casing if required by the project work plans. The drainage hole is positioned approximately 2 inches above ground surface. The protective casing will be painted with a rust-preventive colored paint.

The well head will be labelled with the well ID and a mark or notch will be placed on the casing as a measuring point for survey and subsequent measurements.

Following well completion and demobilization of the rig, the well site should be cleared of all debris and trash and restored to a neat and clean appearance per the project work plans. All investigation-derived waste (IDW) generated at the well site should be appropriately contained and managed per the FAP.

A well construction FDR must be completed for each monitoring well installed (**examples attached**).

5.0 ATTACHMENTS

Well/Piezometer Construction Record – Stickup

Well/Piezometer Construction Record – Flushmount

WELL/PIEZOMETER CONSTRUCTION RECORD
STICKUP

LOCATION ID:

Project Name: ______ Date Started: ______ Date Completed: ______

Project Location: ______ Logged By: ______

Project Number: ______ Task Number ______ Checked By: ______ Checked Date: ______

Subcontractor: ______ Drilling Method: ______

Development Method: ______ Development Date: ______

Bucking Posts/Ballards: ______

Notes: ______

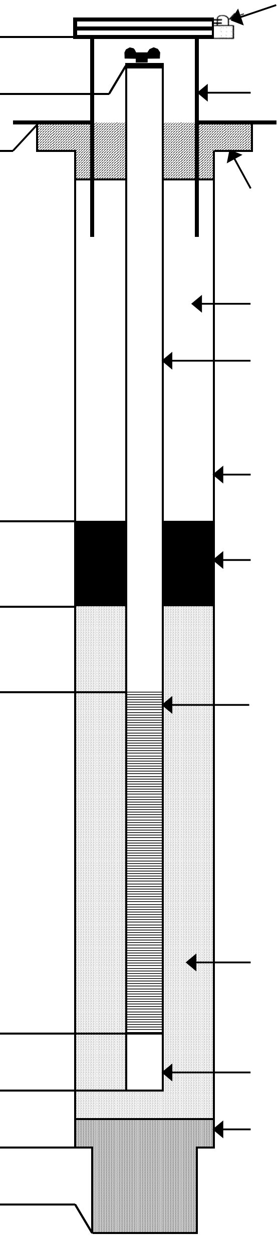
______

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): ______

Item	**Depth BMP (ft)**	**Elevation (ft)**
Stickup		
Riser Pipe (Top)		
Ground Surface Elevation		
Top of Well Seal		
Top of Sand Pack		
Top of Screen		
Base of Screen		
End Cap		
Drilled Depth		
Bottom of Exploration		
Bedrock Surface		



Description

Lock Identification ______

Stickup Casing Type: ______

Stickup Casing Diameter: ______

Surface Seal Type: ______

Backfill/Grout Type: ______

Riser Pipe Type: ______

Riser Pipe ID: ______

Borehole Diameter: ______

Type of Seal: ______

Screen Type: ______

Screen ID: ______

Screen Slot Size: ______

Screen Length: ______

Filter/Sand Pack Type: ______

Sump:

Fallback/Backfill: ______

NOT TO SCALE

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WELL/PIEZOMETER CONSTRUCTION RECORD FLUSHMOUNT

LOCATION ID:

Project Name: ______

Date Started: ______ Date Completed: ______

Project Location: ______

Logged By: ______

Project Number: ______ Task Number ______

Checked By: ______ Checked Date: ______

Subcontractor: ______ Drilling Method: ______

Development Method: ______ Development Date: ______

Bucking Posts/Ballards: ______

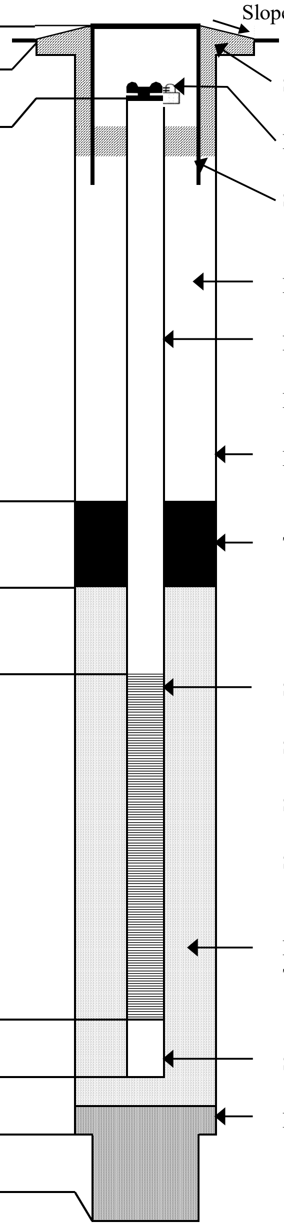
Notes: ______

Measuring Point Information

Measuring Point (MP) Type: Top Of Riser

MP Elevation (ft): ______

Item	Depth BMP (ft)	Elevation (ft)
Surface Casing Elevation		
Ground Surface Elevation		
Riser Pipe (Top)		
Top of Well Seal		
Top of Sand Pack		
Top of Screen		
Base of Screen		
End Cap		
Drilled Depth		
Bottom of Exploration		
Bedrock Surface		



Description

Slope Away

Surface Seal Type: ______

Lock Identification ______

Stickup Casing Diameter: ______

Backfill/Grout Type: ______

Riser Pipe Type: ______

Riser Pipe ID: ______

Borehole Diameter: ______

Type of Seal: ______

Screen Type: ______

Screen ID: ______

Screen Slot Size: ______

Screen Length: ______

Filter/Sand Pack Type: ______

Sump: ______

Fallback/Backfill: ______

NOT TO SCALE

SOP # S23

MACTEC STANDARD OPERATING PROCEDURE #S23

MONITORING WELL DEVELOPMENT PROCEDURE

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________________ April 27, 2020

Bradley LaForest, NRCC-EAC, Project Manager Date

Reviewed Date

____________________ ____________________

____________________ ____________________

____________________ ____________________

MONITORING WELL DEVELOPMENT PROCEDURE

1.0 PURPOSE

This standard operating procedure (SOP) describes the protocol to be followed during the development of monitoring wells. The objectives of monitoring well development are to remove sediment that may have accumulated during well installation, to consolidate the filter pack around the well screen, and to enhance the hydraulic connection between the target zone and the well.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 PROCEDURE

Well development shall be performed as soon as practical after well installation, but not sooner than 48 hours following placement of the grout seal. Weather conditions may increase grout set time and, consequently, further delay development. If the well does not contain a grout seal (e.g. an open rock borehole), then well development can commence immediately after well installation.

The primary objective of well development of environmental monitoring wells is to ensure that an appropriate hydraulic connection is established so that the well will serve its intended purpose to provide water quality and/or groundwater head elevation data. Well development takes on more significance for wells intended for water supply or hydraulic control of groundwater plumes.

This procedure may not be appropriate for wells where gross contamination is observed (e.g., the presence of NAPL).

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training. The PM will select the appropriate sampling methodology and analytical program based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and document the deviation in the field logbook and/or field data record.

2.2 Preparation

Equipment

The following equipment may be used during well development. Site-specific conditions may warrant addition or deletion of items from this list.

- Submersible pump, peristaltic pump, inertial (e.g. Waterra) pump, and/or bailer.
- Surge block.
- Appropriate size/type tubing for selected pump.
- Container for purge water (5-gallon bucket or carboy)
- Container with known volume (e.g., measuring cup) for flow estimation.
- Container for investigation derived purge water (drums or fractionation tank).
- Water level indicator.
- Water quality measurement equipment (YSI, Turbidity meter)
- Stopwatch or timer.
- Clear glass jars (at least 2).
- Well Development Field Data Record.
- Field notebook; and
- Pens with indelible ink.

Extraction Method Considerations

Development of wells will be accomplished with a submersible pump, peristaltic pump, and/or bailer. Bailers should be used to develop wells only where the volume of water is so small that other development methods are clearly inappropriate. Pumps used for well development will be periodically raised and allowed to drain back into the hole in order to induce flow out through the well screen.

A surge block may be used to flush the well screen filter pack of fine sediment in instances where field personnel expect that development may be improved by surging. Surging will be conducted slowly to reduce disruption to the filter pack and screen. Following surging, the well will be pumped or bailed again to remove sediment drawn in by the surging process until suspended sediment is reduced to acceptable levels (see below). Water should not be added to the well to aid in development.

Pump selection for well development will depend on variables specific to each monitoring well program. Factors that must be considered include:

- Depth to water at the site.
- diameter of the well; and
- site specific development criteria (e.g. required minimum purge volumes).

Extraction equipment pros and cons:

Peristaltic Pumps:

Pros: user friendly, suitable for use in small diameter wells (<1-inch), minimal effort to setup, controllable flow rates
Cons: limited to wells with groundwater <25 ft below ground surface, pump head can easily clog in turbid wells, limited flow rates (insufficient for large purge volumes), limited capacity to surge well screens

Submersible Pumps: Bladder Pumps, Impeller Pumps, Pneumatic Pumps.

Pros: capable of pumping in wells with depths to water up to 200 ft bgs, capable of evacuating water at a high flow rate (1 to 5 gpm), less prone to clogging in turbid wells (impeller pumps less so), pumps can serve as surge blocks
Cons: less user friendly, requires additional equipment such as a generator or compressed gases

Note: PVC impeller pumps should be selected over stainless-steel construction as they are typically designed for the harsh conditions observed during well development and are less prone to failure (overheating, seizing).

Inertial Pumps: Waterra Pumps

Pros: suitable for use in small diameter wells (<1-inch), capable of removing water from wells with depths to water up to 200 ft bgs, capable of evacuating water at a high flow rate (up to 4 gpm), less prone to clogging in turbid wells, minimal down well tooling (tubing, check valve, surge block)
Cons: can require additional equipment such as a generator, health and safety considerations to secure pump actuator and tubing, tubing may need to be pulled from the well periodically to replace worn foot valves.

Bailers

Pros: no limit to water depth, simplest evacuation method with minimal equipment, capable of evacuating water at a decent flow rate (0.5 gpm), suitable for evacuating very turbid water, bailer serves as a surge block

Cons: labor intensive, unlikely to meet turbidity goals, impractical for continuous water quality measurements for well stabilization

2.3 Field Procedures

1. Don personal protective equipment (PPE).
2. Upon reaching the well assess the condition of the well and record preliminary measurements:
    a. measure depth to water and depth to bottom of the well (if a measuring point has not been marked, mark on the casing using a permanent marker or notch the casing using a small saw).
    b. compare the measured depth to bottom to the well construction, estimate the amount of accumulated material in the well.
    c. complete calculations for the amount of water in the well (see the field data record for calculations)
3. Set up equipment for desired development method and surge (long up and down motion) the well screen and bottom of the well using the pump, stainless steel bailer or tubing with surge block. This will mobilize fines that have settled in the bottom of the well and in the well screen filter pack for removal during well development.
4. Initiate well development, water should be evacuated at a high enough rate to stress the well without dewatering the well screen.
5. Record flow measurements, depth to water, and water quality measurements periodically (~ 5 to 10 intervals).

For wells where sampling will not occur for at least 14 days the following criteria will be met:

1. the well water is clear to the unaided eye (based on observations of water clarity through a clear glass jar).
2. the sediment thickness remaining in the well is less than one percent of the screen length; or
3. development has been conducted for more than 2 hours.

For wells that will be sampled sooner than 14 days the following criteria should be met:

1. Water quality parameter measurements shall be made using instrumentation. Due to flow rates and methodology the water quality measurements may be collected from a clean container rather than a flow through cell. Water quality parameter instruments will be calibrated daily as per the manufacturer's instructions. Equipment information (make, model, and serial number) and

calibration readings shall be recorded on the field instrument calibration record (**example attached**).

2. water quality parameters have stabilized or 2) the total volume of water removed from the well equals three times the standing water volume in the well plus the volume of drilling fluid lost (whichever occurs first).

Non-dedicated pumps shall be decontaminated prior to use in the next well and dedicated shall be used during subsequent sample collection from the well. The handling of development fluids (IDW) shall be specified in the site-specific FAP.

Documentation

The following data shall be recorded for development on the field data record and in the field book:

- well designation.
- date of well installation.
- date of development.
- static water level before and after development.
- quantity of drilling fluid lost during drilling.
- quantity of standing water in well prior to development.
- depth from top of well casing to bottom of well.
- screen length.
- depth from top of well casing to top of sediment inside well, before and after development.
- physical character of removed water, including changes during development in clarity, color, particulates, and odor.
- type and size/capacity of pump and/or bailer used.
- height of well casing above/below ground surface.
- typical pumping rate.
- estimate of recharge rate; and
- quantity of water removed and time for removal.

3.0 ATTACHMENTS

Well Development Record

Field Instrument Calibration Record

WELL DEVELOPMENT RECORD

MACTEC

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PROJECT NAME		LOCATION ID	PAGE OF
PROJECT NUMBER		START TIME	START DATE
WELL INSTALLATION DATE	WELL DEVELOPMENT DATE	END TIME	END DATE

WELL DIAMETER	IN	**CASING DIAMETER**	IN	**MEASUREMENT POINT (MP)**			
INITIAL WELL DEPTH (BMP)	FT	**FINAL WELL DEPTH (BMP)**	FT	**SCREEN LENGTH**	FT	**PROT. CASING STICKUP (AGS)**	FT
INITIAL DTW (BMP)	FT	**SEDIMENT REMOVED** (final well depth - initial well depth)	FT	**SCREENED INTERVAL (BMP)**	TO	**TOC/TOR DIFFERENCE**	FT
WATER COLUMN (initial well depth - initial depth to water)	FT	**DTW AFTER DEVELOP. (BMP)**	FT	**PUMPING DEPTH (BMP)**	FT	**PID AMBIENT AIR**	PPM
CALCULATED GAL/VOL (column X well diameter squared X 0.041)	GAL	**FINAL RECOVERY DEPTH (BMP)**	FT	**APPROXIMATE RECHARGE RATE**	FT/MIN	**PID WELL MOUTH**	PPM
TOTAL VOL. PURGED (mL per minute X total minutes X 0.00026 gal/mL)	GAL	**FINAL RECOVERY TIME (elapsed)**	MIN	**FLUIDS LOST DURING DRILLING**	GAL	**END OF WELL DEVELOPMENT SAMPLE TAKEN?**	Y ☐ N ☐

FIELD PARAMETERS

TIME	DTW (ft BMP)	PURGE RATE (mL/min)	TEMP. (°C)	SP. CONDUCTANCE (mS/cm)	pH (units)	DISS. O_2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	VOLUME PURGED (gal)	TOTAL GALLONS	COMMENTS

EQUIPMENT DOCUMENTATION

- ☐ DEDICATED SUBMERSIBLE
- ☐ SURGE BLOCK
- ☐ BAILER
  - ☐ 2" ☐ ______
- ☐ GRUNDFOS
  - ☐ 2" ☐ 4"
- ☐ OTHER

- ☐ WATER LEVEL METER
- ☐ PID ____________
- ☐ WQ METER ____________
- ☐ TURB. METER ____________
- ☐ OTHER ____________
- ☐ OTHER ____________
- ☐ OTHER

WELL DEVELOPMENT CRITERIA

	Y	N
Well water clear to the unaided eye?	☐	☐
Sediment thickness remaining in well <1.0% of screen length?	☐	☐
Total water removed = a minimum of 5x calculated well volumes plus 5x drilling fluids lost?	☐	☐
Turbidity < 5NTUs?	☐	☐
10% change in field parameters?	☐	☐

WAS DEVELOPMENT CRITERIA MET? Y ☐ N ☐

ADDITIONAL OBSERVATIONS

PURGE WATER CONTAINERIZED Y ☐ N ☐

NUMBER OF GALLONS GENERATED ____________

SKETCH

NOTES

Well Developer Signature:

Print Name:

Checked By:

Date:

WELL DEVELOPMENT RECORD

FIELD INSTRUMENT CALIBRATION RECORD

PROJECT NAME: ____ TASK NO: ____ DATE: ____
PROJECT NUMBER: ____ MACTEC CREW: ____
PROJECT LOCATION: ____ SAMPLER NAME: ____
WEATHER CONDITIONS (AM): ____ SAMPLER SIGNATURE: ____
WEATHER CONDITIONS (PM): ____ CHECKED BY: ____ DATE: ____

MULTI-PARAMETER WATER QUALITY METER
METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

AM CALIBRATION — Start Time ____ /End Time ____
POST CALIBRATION CHECK — Start Time ____ /End Time ____

	Units	Standard Value	Meter Value	*Acceptance Criteria (AM)	Standard Value	Meter Value	*Acceptance Criteria (PM)
pH (4)	SU	4.0	____	+/- 0.1 pH Units			
pH (7)	SU	7.0	____	+/- 0.1 pH Units	7.0	____	+/- 0.3 pH Units
pH (10)	SU	10.0	____	+/- 0.1 pH Units			
Redox	+/- mV	240	____	+/- 10 mV	240	____	+/- 10 mV
Conductivity	mS/cm	1.413	____	+/- 0.5 % of standard	1.413	____	+/- 5% of standard
DO (saturated)	%	100	____	+/- 2% of standard			
DO (saturated)	mg/L[1] (see Chart 1)	____	____	+/- 0.2 mg/L	____	____	+/- 0.5 mg/L of standard
DO (<0.1)	mg/L	<0.1	____	< 0.5 mg/L			
Temperature	°C		____			____	
Baro. Press.	mmHg		____			____	

TURBIDITY METER
METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
<0.1 Standard	NTU	<0.1	____	<0.1	____	+/- 0.3 NTU of stan.
20 Standard	NTU	20	____	20	____	+/- 5% of standard
100 Standard	NTU	100	____	100	____	+/- 5% of standard
800 Standard	NTU	800	____	800	____	+/- 5% of standard

PHOTOIONIZATION DETECTOR
METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Background	ppmv	<0.1	____	<0.1	____	within 5 ppmv of BG
Span Gas	ppmv	100	____	100	____	+/- 10% of standard

O_2-LEL 4 GAS METER
METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

	Units	Standard Value	Meter Value	Standard Value	Meter Value	*Acceptance Criteria (PM)
Methane	%	50	____	50	____	+/- 10% of standard
O_2	%	20.9	____	20.9	____	+/- 10% of standard
H_2S	ppmv	25	____	25	____	+/- 10% of standard
CO	ppmv	50	____	50	____	+/- 10% of standard

OTHER METER
METER TYPE ____
MODEL NO. ____
UNIT ID NO. ____

See Notes Below for Additional Information

☐ Equipment calibrated within the Acceptance Criteria specified for each of the parameters listed above.
☐ Equipment (not) calibrated within the Acceptance Criteria specified for each of the parameters listed above**.

MATERIALS RECORD

Deionized Water Source: Portland FOS
Lot#/Date Produced: ____
Trip Blank Source: Laboratory provided
Sample Preservatives Source: Laboratory provided
Disposable Filter Type: in-line 0.45µm cellulose
Calibration Fluids / Standard Source:
- DO Calibration Fluid (<0.1 mg/L) Portland FOS
- Other ____
- Other ____
- Other ____

	Cal. Standard Lot Number	Exp. Date
pH (4)		
pH (7)		
pH (10)		
ORP		
Conductivity		
<0.1 Turb. Stan.		
20 Turb. Stan.		
100 Turb. Stan.		
800 Turb. Stan.		
PID Span Gas		
O_2-LEL Span Gas		
Other		

NOTES:

* = Unless otherwise noted, calibration procedures and acceptance criteria are in general accordance with USEPA Region 1 SOPs for Field Instrument Calibration (EQASOP-FieldCalibrat) and Low Stress Purging and Sampling (EQASOP-GW001), each dated 1/19/2010. Additonal acceptance criteria obtained from instrument specific manufacturer recommendations.
** = If meter reading is not within acceptance criteria, clean/replace probe and re-calibrate, or use calibrated back-up meter if available. If project requirements necessitate use of the instrument, clearly document any deviations from acceptance criteria on all data sheets and log book entries.
1 = DO Saturated standard value is calculated based on Oxygen Solubility at Indicated Pressure Chart from the USEPA Region 1 SOP for Field Instrument Calibration (EQASOP-FieldCalibrat), dated 1/19/2010.

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FIELD INSTRUMENT CALIBRATION RECORD

SOP # S24

MACTEC STANDARD OPERATING PROCEDURE #S24

MONITORING WELL DECOMMISSIOING PROCEDURE

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

______________________________ April 27, 2020

Bradley LaForest, NRCC-EAC, Project Manager Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

MONITORING WELL DECOMMISSIOING PROCEDURE

1.0 PURPOSE

This Standard Operating Procedure (SOP) provides procedure for decommissioning monitoring wells. The methods provided in this SOP are designed to prevent contaminant migration from the ground surface to the water table or between separate aquifer systems through penetrations created by monitoring wells.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure in the execution of planned activities must be approved by the project manager and documented in the field logbook and/or field data records.

2.0 REFERENCES

NYSDEC, 2009. Commissioners Policy (CP) 43 - Groundwater Monitoring Well Decommissioning Procedures", August 2009.

3.0 DEFINITIONS

Borehole – Any hole drilled into the subsurface for the purpose of identifying lithology, collecting soil samples, and/or installing groundwater wells.

Grout – For the purposes of this SOP, the term "grout" consists of a mixture of Portland cement, clean water and bentonite. The grout is placed as a slurry, and once properly set and cured, is capable of restricting movement of water.

Monitoring Well – A well that provides for the collection of representative groundwater samples (including the detection and collection of representative light and dense non-aqueous phase organic liquids) and the measurement of fluid levels.

Annular Space – The space between the well screen or casing and the borehole wall.

Filter Pack – Granular filter material (sand, gravel, etc.) placed in the annular space between the well screen and the borehole to increase the effective diameter of the well and prevent fine-grained material from entering the well.

Well Screen – The casing segment used in a well which maximizes the entry of water from the aquifer and minimizes the entrance of the filter pack and formation materials.

Tremie – A tubular device or pipe used to place grout or bentonite in the well or annular space generally from the bottom of the bore hole to the surface.

4.0 PROCEDURE

The NYSDEC presents four primary methods of well abandonment in its guidance document "CP-43: Groundwater Monitoring Well Decommissioning Policy" (**Attached**). These methods include:

1. Grouting in-place.
2. Casing perforation followed by grouting in-place.
3. Grouting in-place followed by removing the casing; and
4. Over-drilling and grouting.

The method of abandonment selected depends on the construction and condition of the monitoring well to be abandoned. The first step in the abandonment process is to review all available well construction information. Figure 2 of the New York State Department of Environmental Conservation **Groundwater Monitoring Well Decommissioning Procedures guidance CP-43** (See **Attached**) presents a flow chart to provide guidance on the selection of the abandonment method. Frequently due to the age of monitoring wells at many sites, available information may be limited making use of the flow chart difficult.

4.1 Responsibilities

Project Manager

The project manager (PM) is responsible for determining the appropriate well abandonment procedures and that these procedures will be conducted in accordance with this SOP and any other appropriate procedures. This will be accomplished through staff training.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to well abandonment activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting the deviation in the field logbook and/or the field data record.

4.2 Preparation

Equipment Selection and Sampling Considerations

The following list of equipment includes the necessary items to be used by field personnel during monitoring well abandonment. Subcontractor personnel typically provide and operate all monitoring well abandonment equipment and materials. Site-specific conditions may warrant the use of additional or deletion of items from this list.

- Appropriate personal protective equipment (PPE) as specified in the site-specific health and safety plan (HASP).
- Appropriate monitoring equipment (e.g. photoionization detector [PID] or particulate monitors)
- Camera.
- Calculator.
- Field logbook; and
- Field data records (FDRs; **example Attached**).

4.3 Field Procedure

Once the well is located identified the well should be opened and screened with a PID to determine if volatile organic compound contamination is present so that appropriate PPE and health and safety related concerns can be addressed. The depth to water and total well depth will then be measured and recorded on an FDR. This information should be checked against the well construction details to ensure that the correct well is being decommissioned. If a well is unlabeled or the label/well ID is not legible then the well measurements may provide evidence that the correct well is being abandoned.

Grouting In-place

Grouting in-place is the most common and simplest method of abandoning a monitoring well. Most shallow monitoring wells that do not penetrate a confining layer can be abandoned by grouting in-place. Overburden monitoring wells that were constructed with grout in the annular space as a seal are also very difficult to remove and are generally abandoned using the grouting in place abandonment method.

Grouting in place is generally the only method that can be used in open borehole bedrock wells with a steel casing seated in bedrock.

The drilling subcontractor will grout the well using a cement and/or bentonite grout injected with a tremie pipe to place the grout from the bottom of the well to 5 feet below ground surface. The drilling subcontractor will then remove the protective casing or road box. Removal of the protective casing may require breaking concrete away from the protective casing and using the drilling rig winch to pull the casing from the ground. Once the protective casing is out of the way the top section of the PVC riser may be unscrewed using hand tools. If the PVC cannot be unscrewed, then the PVC will be cut as far below ground surface as possible and the monitoring well casing will be backfilled with material similar to native soils.

Bedrock wells with steel casing that cannot be removed from the ground will be cut off flush with the ground surface or slightly below the ground surface if possible and backfilled with material similar to native soils.

Casing Perforation

Casing perforation is a specialized grouting in-place method that is the preferred method for abandoning monitoring wells that have poor records regarding well construction (including grouting and backfill details) and are typically large diameter wells (e.g. four inches in diameter or greater). Commercial equipment is available for perforating the riser casings and screens of the larger diameter wells and will be provided by the driller.

In this method the perforating tool is lowered into the PVC casing and the well screen and riser will be punctured to allow for enhanced passage of the grout into the annular space and filter pack.

Once the casing and screen is perforated the monitoring well is then grouted to five feet below ground surface. Surface restoration will be carried out as described in the grouting in-place methodology.

Casing Pulling

Casing pulling is a grouting in-place method in instances where the well riser/casing must be removed to clear the site for future excavation or redevelopment. The casing pulling method can be used when:

1) no contamination is present in the overburden.
2) there is contamination in the overburden, but there are no confining layers present.
3) there is contamination in the overburden and a confining layer is present, but the confining layer will remain sealed after grouting the well.

Casing pulling involves using drill rods, or a downhole casing cutter to puncture the bottom of the monitoring well or cut off the bottom of the screen. Once the monitoring well is punctured, it is grouted to five feet below ground surface using a tremie pipe. The protective casing and well materials are then pulled from the borehole using the drill rig winch or other suitable equipment. Grout will be added to within five feet of the ground surface as sections of the well riser are removed. Once the well materials have been removed, the borehole shall then be backfilled with material similar to native soils.

If the riser pipe breaks during removal, the subcontractor may need to over-drill the original borehole using a hollow-stem auger to remove any remaining well materials. Over-drilling methods are described below.

Over-drilling

Over-drilling is a method that uses hollow stem augers or a rotary bit and casing to physically remove all well materials including the well screen, riser, sand pack, bentonite seals, and grout. It should be used for deeper wells where casing pulling is not a feasible method or will not prevent cross contamination across a confining layer. It is the slowest most labor-intensive method. An experienced drilling subcontractor should be used or consulted if this method is chosen for well abandonment activities.

The protective casing will be removed, and a drill rig will be set up on the monitoring well. Hollow stem augers or large diameter casing will be advanced to around the well to follow the borehole down to the terminal depth. The auger head or rotary bit if using casing will drill out the old well materials as the boring is advanced. Following the old borehole can be difficult and care must be taken to prevent the augers or bit to "walk" off the old borehole and create a new borehole. Once the borehole has been drilled and cleaned out to a depth at least a foot beyond the former well boring, the borehole will be grouted to the surface using a tremie pipe. The augers or casing will slowly be removed from the borehole, adding grout as needed to top off the borehole.

Upon completion of well abandonment activities, the surface should be backfilled with native soils or clean backfill. Ideally the top five feet should be backfilled with materials similar to the natural soils of the area and the surface of the borehole restored to the condition of the surrounding area using soil, concrete, or asphalt as appropriate.

Notes will be taken of all materials removed from the monitoring well, all materials left in place, and the amount of grout used and will be recorded on the Monitoring Well Decommissioning FDR (**example attached**).

5.0 ATTACHMENTS

Well Decommissioning Record

NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy

WELL DECOMMISSIONING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

PROJECT NAME		LOCATION ID	PAGE OF
PROJECT NUMBER		Driller	DATE
WELL INSTALLATION DATE	WELL DECOMMISSIONING DATE	Drilling Company	Inspector

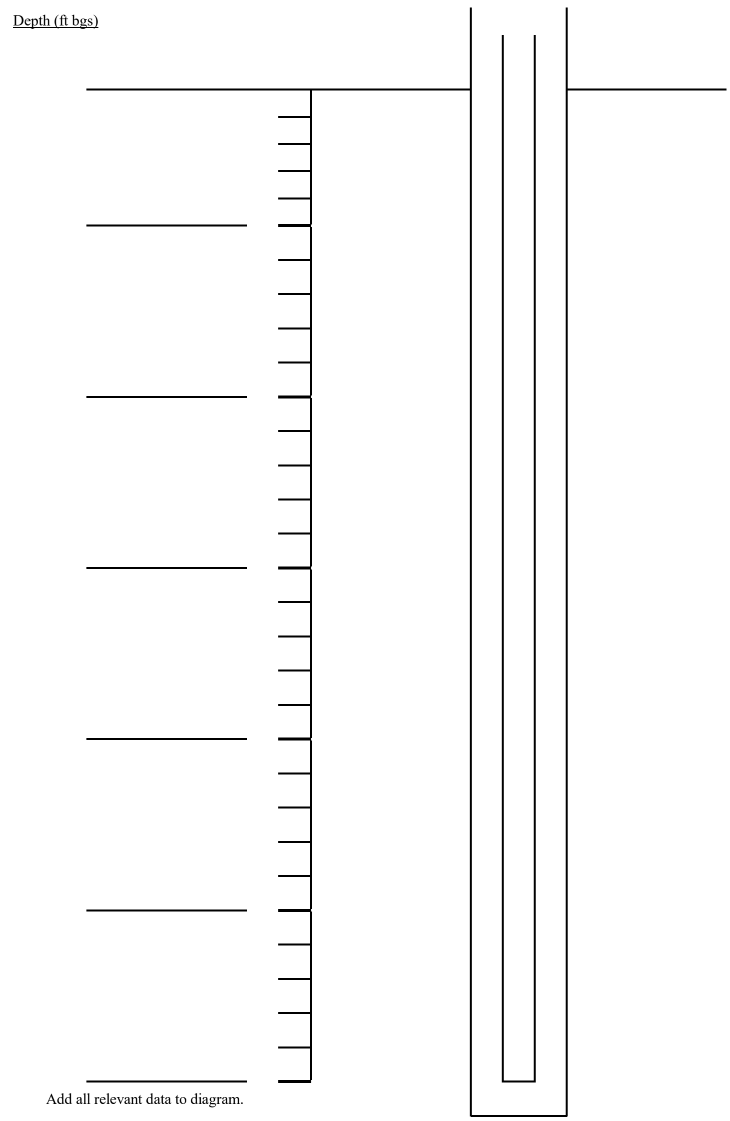
WELL DIAMETER (INCHES) ☐ 1-IN. ☐ 2-IN. ☐ 4-IN. ☐ 6-IN. ☐ 8-IN. ☐ OTHER ____________

CASING DIAMETER (INCHES) ☐ 4-IN. ☐ 6-IN. ☐ 8-IN. ☐ 10-IN. ☐ 12-IN. ☐ OTHER ____________

MEASUREMENT POINT (MP) ☐ TOP OF RISER (TOR) ☐ TOP OF CASING (TOC) ☐ OTHER ____________

INITIAL WELL DEPTH (BMP)	FT	**PROT. CASING STICKUP (AGS)**	FT
INITIAL DTW (BMP)	FT	**TOC/TOR DIFFERENCE**	FT
SCREEN LENGTH	FT	**SCREENED INTERVAL (BMP)**	FT

Well Diagram



Add all relevant data to diagram.

Decommissioning Data

Grouting

- Interval Grouted (ft) ____________
- Type of Grout ____________
- Quantity Used (Gal) ____________
- Type of cement ____________
- Amount of cement (bags) ____________
- Type of Bentonite ____________
- Amount of Bentonite used (bags) ____________

Casing Pulling

- Method used ____________
- Casing retrieved (ft) ____________
- Casing type/diameter ____________

Over drilling

- Interval Drilled ____________
- Drilling Method ____________
- Borehole Diameter ____________

Casing Perforation

- Equipment used ____________
- Number of perforations/foot ____________
- Size of perforations ____________
- Interval perforated ____________

NOTES

DEVIATIONS

Well Decommision Signature: Print Name:

Checked By: Date:

LOCATION SKETCH

WELL DECOMMISSIONING RECORD

CP-43:Groundwater Monitoring Well Decommissioning Policy

New York State Department of Environmental Conservation

DEC POLICY

Issuing Authority: Commissioner Alexander B. Grannis	
Date Issued: November 3, 2009	**Latest Date Revised:**

I. Summary:

Groundwater monitoring wells provide essential access to the subsurface for scientific and engineering investigations (including monitoring wells installed for leak detection purposes). To a degree, every monitoring well is an environmental liability because of the potential to act as a conduit for pollution to reach the groundwater. To limit the environmental risk, a groundwater monitoring well must be properly decommissioned when its effective life has been reached. This document provides procedures to satisfactorily decommission groundwater monitoring wells in New York State. This policy also pertains to other temporary wells such as observation wells, test wells, de-watering wells and other small diameter, non-potable water wells. It does not pertain to water supply wells.

II. Policy:

Environmental monitoring wells should be decommissioned when:

1. they are no longer needed and re-use by another program is not an option; or
2. the well's integrity is suspect or compromised.

The method for decommissioning will be determined based upon well construction and environmental parameters. The method selected must be designed to protect groundwater and implemented according to current best engineering practices while following all applicable federal, state and local regulations. *Groundwater Monitoring Well Decommissioning Procedures* shall be maintained as an addendum to this policy.

This policy is applicable to all New York State Department of Environmental Conservation (DEC) programs that install, utilize and maintain monitoring wells for the study of groundwater, except monitoring wells for landfills regulated under 6 NYCRR Part 360 decommissioned in accordance with those regulations [*see* 6 NYCRR 360-2.11(a)(8)(vi)] and wells installed under the Oil, Gas and Solution Mining Law, Environmental Conservation Law Article 23. There is no specific time frame to dictate when to decommission a well; timing is dependent upon the use and condition of the well and shall be determined on an individual basis. Best professional judgment must be exercised when using the decommissioning procedures. Outside of DEC use, this policy is mandatory when incorporated into the specifications of a state contract, an Order on Consent or a permit. In all other situations, it shall serve as guidance.

III. Purpose and Background:

This document establishes a monitoring well decommissioning policy and provides technical guidance. Synonyms for well decommissioning include "plugging," "capping" and "abandoning. For consistency, only the term "decommissioning" is used within this document.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Since 1980, the DEC has installed, directed or overseen the installation of thousands of monitoring wells throughout New York for various state and federal programs, such as Superfund, solid waste, Resource Conservation and Recovery Act (RCRA), spill response, petroleum bulk storage and chemical bulk storage. This guidance addresses the environmental liability associated with this aging network of wells.

Within its boring zone, a successfully decommissioned well prevents the following:

1. Migration of existing or future contaminants into an aquifer or between aquifers;
2. Migration of existing or future contaminants within the vadose zone;
3. Potential for vertical or horizontal migration of fluids in the well or adjacent to the well; and
4. Any change in the aquifer yield and hydrostatic head, unless due to natural conditions.

Monitoring well construction in New York varies considerably with factors such as age of the well, local geology and either the presence or absence of contamination. The predominant type of monitoring well in New York is the shallow, watertable monitoring well constructed of polyvinyl chloride plastic (PVC). The best method for decommissioning should be selected to suit the conditions and circumstances. Each decommissioning situation is to be evaluated separately using this guidance before a method is chosen and implemented.

IV. Responsibility:

The Division of Environmental Remediation (DER) is responsible for updating this policy and the *Groundwater Monitoring Well Decommissioning Procedures* (addendum) in consultation with the Division of Solid and Hazardous Materials (DSHM) and the Division of Water (DOW). Compliance with the guidance does not relieve any party of the obligation to properly decommission a monitoring well. Oversight responsibility will be carried out by the DEC Regional Engineer.

V. Procedure:

Groundwater Monitoring Well Decommissioning Procedures, the addendum to this policy, provides guidance on proper decommissioning of monitoring wells in New York State.

VI. Related References:

- Groundwater Monitoring Well Decommissioning Procedures, October 1986. Prepared by Malcolm Pirnie, Inc. for the New York State Department of Environmental Conservation, Division of Environmental Remediation.
- Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities, ASTM D 5299-99. American Society for Testing and Materials (ASTM). Philadelphia. 2005.
- 6 NYCRR Part 360 Solid Waste Management Facilities, New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials.
- Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, New York State Department of Environmental Conservation, Region 1 - Water Unit, undated.
- Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034, United States Environmental Protection Agency (EPA).

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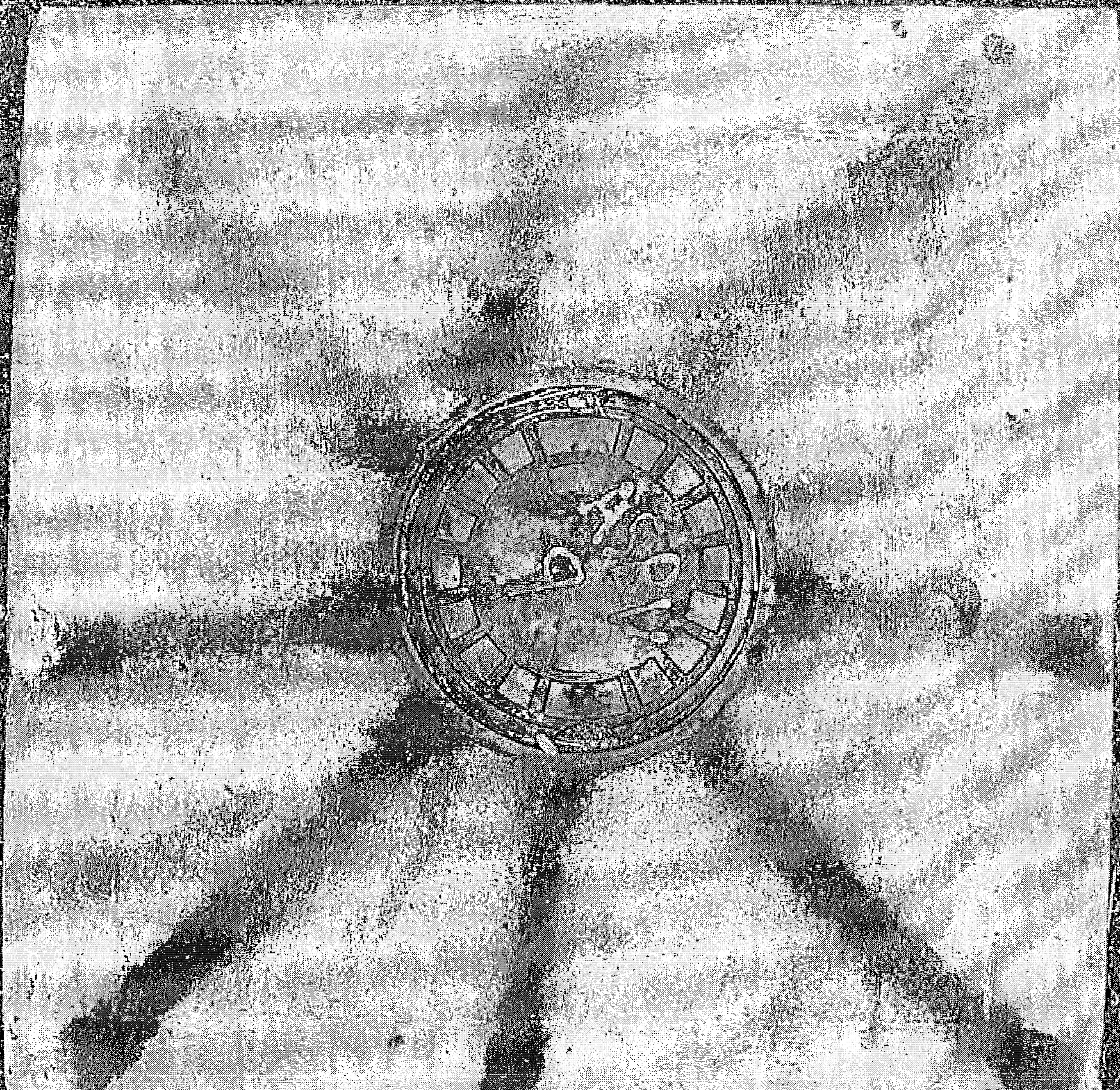
Final - August 2009

GROUNDWATER MONITORING WELL DECOMMISSIONING PROCEDURES



New York State Department of Environmental Conservation
Division of Environmental Remediation

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FIGURES

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FIGURE 2 - DECOMMISSIONING PROCEDURE SELECTION

FIGURE 3 - WELL DECOMMISSIONING RECORD

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APPENDIX A - REPORTS

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INTRODUCTION

This document, *Groundwater Monitoring Well Decommissioning Procedures*, is the addendum to CP-43, Groundwater Monitoring Well Decommissioning Policy, which provides acceptable procedures to be used as guidance when decommissioning monitoring wells in New York State. Please note that this document does not address some site-specific special situations that may be encountered in the field. Compliance with the procedures set forth in this document does not relieve any party of the obligation to properly decommission a monitoring well.

Unprotected, neglected and improperly abandoned monitoring wells are a serious environmental liability. They can function as a pollution conduit for surface contaminants to reach the subsurface and pollute our groundwater. They also can cause unwanted mixing of groundwater, which degrades the overall water quality within an aquifer. Improperly constructed, poorly maintained or damaged monitoring wells can yield anomalous poor data that can compromise the findings of an environmental investigation or remediation project. Unneeded or compromised monitoring wells should be properly decommissioned in order to prevent harm to our groundwater.

Previous versions of this guidance have been issued since 1995. Originally developed as a specification for well decommissioning at Love Canal, the procedures were rewritten to make them applicable across the state. From an engineering standpoint, the guidance has changed very little. Most situations do not require a complex procedure.

If you have any questions, please contact Will Welling at (518) 402-9814.

Sincerely,

Gerald J. Rider, Jr., P.E.
Chief, Remedial Section D
Remedial Bureau E
Division of Environmental Remediation

1.0 PREPARATION

If an unneeded monitoring well remains in good usable condition, an alternative to decommissioning might be the reuse by another agency program. DEC encourages reuse in situations where a well will continue to be used and cared for responsibly.

When reuse is not an option, the first step in the well decommissioning process is to review all pertinent well construction information. One must know the well depth and construction details. GPS coordinates and permanent labeling (if available) will be useful in confirming the well to be decommissioned. An inspection must be performed prior to decommissioning in order to verify the construction and condition of each well. Specific details and subsurface conditions form the basis for decisions throughout the decommissioning process.

Well Details

1. Is the well a single stem riser (all one diameter)?
2. Is the well a simple overburden well (no penetration into bedrock)?
3. Does the well riser consist of telescoping diameters of pipe which decrease with depth?
4. Is the well seal compromised (leaking, inadequate or damaged)?
5. If the well is PVC, is it 25 feet or shallower and not grouted into rock?
6. Can the riser be pulled and is removal of the well desired?
7. Is the well a bedrock well?
8. If the monitoring well is a bedrock well, does it have an open hole?
9. Is there a well assembly (riser and screen) installed within the bedrock hole?

Subsurface Conditions

10. Is the soil contaminated?
11. Does the well penetrate a confining layer?
12. If the well penetrates a confining layer, might overdrilling or casing pulling cause contamination to travel up or down through a break in the confining layer?
13. Does the screened interval cross multiple water-bearing zones?

For additional collection and verification of information, the "Monitoring Well Field Inspection Log" (Figure 1) can be used during a field inspection. After the well has been located and the information gathered, one is ready to select the decommissioning procedure in accordance with Section 2.

Special conditions, such as access problems, well extensions through capped and covered non-Part 360 landfills and seasonal weather patterns affecting construction, should be assessed in the planning stage. Decommissioning work requiring the use of heavy vehicular equipment on landfill caps should be scheduled during dry weather (if possible) so as to minimize damage to the cover. If work must be performed during the spring, winter or inclement weather, special measures to reduce ruts should be employed to maintain the integrity of a completed landfill cover system. As an example, placement of plywood under vehicular equipment can eliminate deep ruts that would require repair.

2.0 DECOMMISSIONING METHODS

The primary rationale for well decommissioning is to remove any potential groundwater pathway. A secondary rationale, often important to the property owner or owner of the well, is to physically remove the well. Removed well materials may be recycled and will not interfere with future construction excavation. The previous versions of these decommissioning procedures have stressed that physical removal of the well by pulling is preferable to leaving casing in the ground. Due to the added effort, expense and risk involved with pulling, the decision of whether to pull or not should be a separate consideration aside from selecting the sealing procedure.

One should select a decommissioning procedure that takes into account the geologic and hydrogeologic conditions at the well site; the presence or absence of contamination in the groundwater; and original well construction details. The selection process for well decommissioning procedures is provided by the flow chart, Figure 2. Answers to the questions in the preceding section are the input for this flow chart. The four primary well decommissioning methods are:

1. Grouting in-place;
2. Perforating the casing followed by grouting in-place;
3. Grouting in-place followed by casing pulling;
4. Over-drilling and grouting with or without a temporary casing.

In a complex situation, one or more decommissioning procedures may be used for different intervals of the same well.

The remainder of Section 2 discusses the well decommissioning methods and the selection process. Refer to Figure 2 for a flow chart diagram of the complete procedure selection process. The DEC Project Manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions and professional judgment.

2.1 Grouting In-Place

Grouting in-place is the simplest and most frequently used well decommissioning method and grouting itself is the essential component of all the decommissioning methods. The grout seals the borehole and any portion of the monitoring well that may be left in the ground. Because dirt and foreign objects can fall into an open well, whenever possible a well should be sealed first with grout before attempting subsequent decommissioning steps.

For the purpose of these decommissioning procedures, the well seal is defined as the bentonite seal above the sand pack. Aside from obvious channeling by in-flowing surface water around the well, an indication of the well seal integrity may be obtained through review of the boring logs and/or a comparison of groundwater elevations if the well is part of a cluster. Any problems noted on the boring logs pertaining to the well seal, such as bridging of bentonite pellets or running sands, or disparities between field notes (if available) and the well log would indicate the potential for a poor (compromised) well seal.

If the well seal is not compromised and there is no confining layer present, a single-stem, 2-inch PVC, monitoring well can be satisfactorily decommissioned by grouting it in-place. If the seal is compromised, casing perforation may be called for as discussed in Section 2.2.

As discussed in Section 2.4 and its sub-sections, this method is specified for the bedrock portion of a well, and is used for decommissioning small diameter cased wells. Grouting in-place involves filling the casing with grout to a level of five feet below the land surface, cutting the well casing at the five-foot depth, and removing the top portion of the casing and associated well materials from the ground. The casing must be grouted according to the procedures in Section 6. In addition, the upper five feet of the borehole is filled to land surface and restored according to the procedures described in Section 7.

For open-hole bedrock wells, the procedure involves filling the opening with grout to the top of rock according to the procedures in Section 5. A thicker grout may be required to fill any bedrock voids. If excessive grout is being lost down-hole, consider grouting in stages to reduce the pressure caused by the height of the grout column.

The standard mix with the maximum amount of allowable water will be required to penetrate the well screen and sand pack when a well assembly has been installed within a bedrock hole. For an assembly such as this, the grout should be mixed thinly enough to penetrate the slots and sand pack. The grout mixes are discussed in Sections 6.1 and 6.2.

2.2 Casing Perforating/Grouting In-Place

Casing perforation followed by grouting in-place is the preferred method to use if there is poor documentation of the grouting of the well annulus, or the annulus was allowed to be back-filled with cuttings. The grout will squeeze through the perforations to seal any porous zones along the outside of the casing. The procedure involves puncturing, cutting or splitting the well casing and screen followed by grouting the well. A variety of commercial equipment is available for perforating casings and screens in wells with four-inch or larger inside diameters. Due to the diversity of applications, experienced contractors must recommend a specific technique based on site-specific conditions. A minimum of four rows of perforations several inches long around the circumference of the pipe and a minimum of five perforations per linear foot of casing or screen is recommended (American Society for Testing and Materials, Standard D 5299-99, 1999). After the perforating is complete, the borehole must be grouted according to the procedures in Section 6 and the upper five feet of borehole restored according to the procedures in Section 7.

2.3 Casing Pulling

Casing pulling should be used in cases where the materials of the well assembly are to be recycled, or the well assembly must be removed to clear the site for future excavation or re-development. Casing pulling is an acceptable method to use when no contamination is present; contamination is present but the well does not penetrate a confining layer; and when both contamination and a confining layer are present but the contamination cannot cross the confining layer. Additionally, the well construction materials and well depth must be such that pulling will not break the riser. When contamination is likely to cross the confining layer during pulling, a temporary casing can be used. See Section 2.4.

Casing pulling involves removing the well casing by lifting. Grout is to be added during pulling; the grout will fill the space once occupied by the material being withdrawn. An acceptable procedure to remove casing involves puncturing the bottom of the well or using a casing cutter to cut away the screen, grouting, using jacks to free casing from the hole, and lifting the casing out by using a drill rig, backhoe, crane, or other suitable equipment. Additional grout must be added to the casing as it is withdrawn. Grout mixing and placement procedures are provided in Section 6. In wells or well points in which the bottom cannot be punctured, the casing or screened interval will be perforated or cut away prior to being filled with grout. This procedure should be followed for wells installed in collapsible formations or for highly contaminated wells.

At sites in which well casings have been grouted into the top of bedrock, the casing pulling procedure should not be attempted unless the casing can be first cut or freed from the rock.

2.4 Over-Drilling

Over-drilling is the technique used to physically remove an entire monitoring well, its sand pack and the old grout column and fill. In situations where PVC screens and risers are expected to sever and removal of all well materials is required, over-drilling will be required. Over-drilling is called for when a riser can't be pulled and it penetrates a confining layer. Compared to the other procedures, over-drilling is the least common method of well decommissioning.

A "temporary casing" may be necessary when extraordinary conditions are present, such as a high concentration of mobile contaminants in the overburden, depth to water is shallow, there is poor construction documentation or shoddy construction practices. The approach involves installing a large diameter steel casing around the outside of the well followed by drilling / pulling /grouting within this casing. The casing is withdrawn at the end of pulling, grouting and (perhaps) drilling. If the confining layer is less than 5 feet thick, the casing should be installed to the top of the confining layer. Otherwise, it is installed to a depth of 2 feet below the top of the confining layer. After the outer casing has been set, the well can be removed and grouted through pulling if possible or removed and grouted by drilling inside the casing.

Over-drilling is used where casing pulling is determined to be unfeasible, or where installation of a temporary casing is necessary to prevent cross-contamination, such as when a confining layer is present and contamination in the deeper aquifer could migrate to the upper aquifer as the well is pulled. The over-drilling method should:

- Follow the original well bore;
- Create a borehole of the same or greater diameter than the original boring; and
- Remove all of the well construction materials.

In over-drilling the difficulty lies in keeping the augers centered on the old well as the bit is lowered; it will tend to wander off. As a precaution, the well column should be filled with grout before over-drilling. Then without allowing the grout to dry, the driller proceeds with over-drilling the well. Grouting first guarantees that if the drill wanders off the old well and the effort is less than 100% successful, the remaining well portion will at least have been grouted. There are many methods for over-drilling. Please note that the following methods are not suitable for all types of casing, and the advice of an experienced driller should be sought.

- Conventional augering (i.e., a hollow stem auger fitted with a pilot bit). The pilot bit will grind the well construction materials, which will be brought to the well surface by the auger.
- A conventional cable tool rig to advance "temporary" casing having a larger diameter than the original boring. The cable tool kit is advanced within the casing to grind the well construction materials and soils, which are periodically removed with large diameter bailer. This method is not applicable to bedrock wells.

- An over-reaming tool with a pilot bit nearly the same size as the inside diameter of the casing and a reaming bit slightly larger than the original borehole diameter. This method can be used for wells with steel casings.

- A hollow-stem auger with outward facing carbide cutting teeth having a diameter two to four inches larger than the casing.

Prior to over-drilling, the bottom of the well should be perforated or cut away, and the casing filled with grout as with casing removal by pulling.

In all cases above, over-drilling should advance beyond the original bore depth by a distance of half a foot to ensure complete removal of the construction materials. Oversight attention should be focused on the drill cuttings, looking for fragments of well materials. Absence of these indicators is a sign that the drill has wandered off the well. If wandering is suspected, having previously filled the well with grout, the remaining portion which cannot be over-drilled can be considered grouted in-place. When the over-drilling is complete, grout should be tremied within the annular space between the augers and well casings. The grout level in the borehole should be maintained as the drilling equipment and well materials are sequentially removed. As with all the other methods, the upper five feet of borehole should be restored according to the procedures in Section 7.

3.0 SELECTION PROCESS AND IMPLEMENTATION

The decommissioning procedure selection flow chart, Figure 2, is to be used to select decommissioning methods. The selection process first identifies the basic monitoring well type. There are only two types of monitoring wells described in this guidance, overburden wells and bedrock wells. Bedrock wells typically have an overburden portion which in the selection process is to be treated as an overburden well. Techniques are specified for wells based upon their type and the other physical conditions present. Decommissioning techniques called for by the selection process have their practical limits; construction details dictate when a well stem can be pulled without breaking and when it cannot be pulled. The DEC project manager has the discretion to deviate from the flow chart, (Figure 2), based on site conditions, budgetary concerns and professional judgment. The remainder of this section will discuss types of monitoring wells in various settings along with recommended decommissioning techniques.

3.1 Bedrock Wells

Referring to Figure 2 and Section 2.1, if the well extends into bedrock, the rock hole portion of the well is to be grouted in-place to the top of the rock. The grout mix, however, may vary according to the conditions. A thicker grout may be required to fill voids and a thinner grout may be necessary to penetrate well screen and sand pack. Refer to the grout mixture specifications given in Section 6.1 and 6.2.

Prior to grouting, the depth of the well will be measured to determine if any silt or debris has plugged the well. If plugging has occurred, all reasonable attempts to clear it should be made before grouting. The borehole will then be tremie grouted according to Section 6.4 from the bottom of the well to the top of bedrock to ensure a continuous grout column.

After the rock hole is grouted, the overburden portion of the well is decommissioned using appropriate techniques described below. If the bedrock extends to the ground surface, grouting can extend to the ground surface or to slightly below so that the site can be restored as appropriate in accordance with Section 7.

3.2 Uncontaminated Overburden Wells

For overburden wells and the overburden portion of bedrock wells, the first factor in determining the decommissioning method is whether the overburden portion of the well exhibits contamination, as determined through historical groundwater and/or soil sampling results. If the overburden is uncontaminated, the next criteria considers whether the well penetrates a confining layer. In the case that the overburden portion of the well does not penetrate a confining layer, the casing can either be tremie-grouted and pulled or tremie grouted and left in place. As a general rule, PVC wells greater than 25-feet deep should not be pulled unless site-specific conditions or other factors indicate that the well can be pulled without breaking. If the well cannot be pulled, the well should be grouted in-place as accordance with Sections 2.1 and 2.2.

If a non-telescoped overburden well penetrates a confining layer, the casing should be removed by pulling (if possible) in accordance with Section 2.3. If the casing cannot be removed by pulling, the well should be grouted in-place or where complete removal is required, removed by over-drilling. Over-drilling will be based upon the site-specific conditions and requirements. If pulling is attempted and fails (i.e., a portion of the riser breaks) the remaining portion of the well should be removed by using the conventional augering procedure identified in Section 2.4. Note that if the riser is broken during pulling, it is highly unlikely that the driller will be able to target it to over-drill it. This is the reason why all wells should be grouted first. In all cases, after the well construction materials have been removed to the extent possible, the borehole will be grouted in accordance with Section 6 and the upper five feet will be restored in accordance with Section 7.

3.3 Contaminated Overburden Monitoring Wells/Piezometers

Contamination in the overburden plays a role in the selection process. Any contamination present in the overburden must not be allowed to spread as a result of the decommissioning construction. For wells and piezometers suspected or known to be contaminated with light non-aqueous phase liquid (LNAPL) and/or dense non-aqueous phase liquid (DNAPL), often referred to as "product," the decision to decommission the well should be reviewed. Such gross contamination is a special condition and requires design of the decommissioning procedure. If decommissioning is determined to be the proper course of action, measurement of the non-aqueous phase liquid volume will be determined and this liquid will be removed.

If an overburden well (or the overburden portion of a bedrock well) is contaminated with LNAPL, DNAPL and /or dissolved fractions as indicated by historical sampling results, one must evaluate the potential for contamination to cross an overburden confining layer (if one exists) during decommissioning. A rock or soil horizon of very low permeability is known as a confining layer. Contamination in the overburden lying above a confining layer is a significant condition to recognize. To prevent mobile contaminants from crossing a confining layer during pulling or over-drilling, a temporary casing should be installed to isolate the work zone. One should follow the procedure selection flow chart. Some contaminated conditions call for over-drilling or a specially designed procedure.

A well in contaminated overburden may be grouted in-place as long as the grout fully seals the well and boring zone. If a well in contaminated overburden was constructed allowing formation collapse as annular backfill or if the well has a compromised well seal, one must either physically remove the well or thoroughly perforate the riser and grout it in-place.

If physical removal of the well is required and the overburden contaminants are likely to be dragged upward or downward during decommissioning, a temporary casing should be used to seal off the construction work zone. Casing pulling and overdrilling can be safely accomplished within the temporary casing. Section 2.4 discusses the temporary casing technique.

3.4 Telescoped Riser

If the riser is telescoped in one or more outer casings, the decommissioning approach depends upon the integrity of the well seal. If there is no evidence that the well seal integrity is compromised, the riser should be grouted in-place in accordance with Sections 2.1 or 2.2 and the upper 5 feet of the well surface should be restored in accordance with Section 7. If indications are that the well seal is not competent, it will be necessary to design and implement a special procedure to perforate and grout or remove the well construction materials. The presence and configuration of the outer casing(s) will be specific in the individual wells and will be a key factor in the decommissioning approach. The special procedure must mitigate the potential for cross-contamination during removal of the well construction materials.

4.0 LOCATING AND SETTING-UP ON THE WELL

Prior to mobilizing to decommission a monitoring well, one should notify the property owner and/or other interested parties including the governing regulatory agency. It is advisable that when at the well location, one should review the proposed well decommissioning procedure. Verify well locations and identification by their identifying markers and GPS coordinates. Lastly, verify the depth of each well with respect to depth recorded on the well construction log.

5.0 REMOVING THE PROTECTIVE CASING

Most monitoring wells installed in non-traffic locations are finished with an elevated, protective casing (guard pipe) and a concrete rain pad. Wells at gasoline stations, usually being in high-traffic areas, are typically finished with a flush-mount, curb box and protective 8" dia steel inspection plate rather than a stick-up riser. The curb box is usually easily removed from around the flush-mount well before pulling or over-drilling. In the case of stick-up wells, the riser pipe may be bonded to the guard pipe and rain pad. When the protective casing and concrete pad of a stick-up monitoring well are "yanked out," a PVC riser will typically break off at the bottom of the guard pipe several feet below grade. Once this happens, it may become impossible to center a drill rig upon the well. The riser may become splintered and structurally unstable for pulling. Unless grouted first, the well may fill with dirt. Before pulling a casing or over-drilling a well, a method must be devised for removing these protective surface pieces without jeopardizing the remaining decommissioning effort.

Generally, unless the protective casing is loose and can be safely lifted off by hand, *one* *should fill the monitoring well with grout before removing the outer protective casing.* This will ensure that the well is properly sealed regardless of any problems later when removing the protective casing. Remove the protective casing or road box vault initially only if the stick-up or vault will interfere with subsequent down-hole work which must be done before grouting. This down-hole work may include puncturing, perforating or cutting the screen or riser. But as a general procedure don't remove the protective casing or road box until after initial grouting is complete.

The procedure for removing the protective casing of a well depends upon the decommissioning method specified for the monitoring well. The variety of protective casings available preclude developing a specific removal procedure but often one can simply break up the concrete seal surrounding the casing and jack or hoist the protective casing out of the ground. A check should be made during pulling to ensure that the inner well casing is not being hoisted with the protective casing. If this occurs, the well casing should be cut off after the base of the protective casing is lifted above the land surface. At well locations where the riser has been extended, the burial of a previous concrete pad may require the excavation of soil to the top of the concrete pad to remove the well.

Steel well casing should be removed approximately five feet below the land surface so as to be below the frost line and out of the way of any subsequent shallow digging. The upper five feet of casing and the protective casing can be removed in one operation if a casing cutter is used.

Waste handling and disposal must be consistent with the methods used for the other well materials unless an alternate disposal method can be employed (i.e., steam cleaning followed by disposal as non-hazardous waste).

6.0 SELECTING, MIXING, AND PLACING GROUT

This section gives recipes for the "standard grout mixture" and the thicker "special grout mixture." Mixing and placing grout is also discussed in this section. The goal of well decommissioning is to eliminate the capability of water to travel up or down within the volume of the former well and its boring. Success depends upon the correct grout mixture and placement where it is needed. There are two types of grout mixes that may be used to seal monitoring wells: a standard mix and a special mix. Both mixes use Type 1 Portland cement and four percent bentonite by weight. However, the special mix uses a smaller volume of water and is used in situations where excessive loss of the standard grout mix is possible (e.g., highly-fractured bedrock or coarse gravels).

6.1 Standard Grout Mixture

For most boreholes, the following standard mixture will be used:

- One 94-pound bag Type I Portland cement;
- 3.9 pounds powdered bentonite; and
- 7.8 gallons potable water.

Slightly more water may be used in order to penetrate a sand pack when a well screen transects multiple flow zones. This mixture results in a grout with a bentonite content of four percent by weight and will be used in all cases except in boreholes where excessive use of grout is anticipated. In these cases a special thicker mixture will be used.

6.2 Special Mixture

In cases where excessive use of grout is anticipated, such as high permeability formations and highly fractured or cavernous bedrock formations, the following special mixture will be used:

- one 94-pound bag type I Portland cement;
- 3.9 pounds powdered bentonite;
- 1 pound calcium chloride; and
- 6.0-7.8 gallons potable water (depending on desired thickness).

The special mixture results in a grout with a bentonite content of four percent by dry weight. It is thicker than the standard mixture because it contains less water. This grout is expected to set faster than the Standard Grout Mixture due to the added calcium chloride. The least amount of water that can be added for the mixture to be readily pumpable is 6 gallons per 94-pound bag of cement.

6.3 Grout Mixing Procedure

To begin the grout-mixing procedure, calculate the volume of grout required to fill the borehole. If possible, the mixing basin should be large enough to hold all of the grout necessary for the borehole.

Mix grout until a smooth, homogeneous mixture is achieved. Grout can be mixed manually or with a mechanized mixer. Colloidal mixers should not be used as they tend to excessively decrease the thickness of the grout for the above recipes.

6.4 Grout Placement

This guidance requires that grout be placed in the well from the bottom to the top by means of a "tremie." A tremie is a pipe, a hose or a tube extending from the grout supply to the bottom of the well. The tremie delivers the grout all the way down through the water column without its being diluted and mixed with the water that may be present in the well. The tremie pipe or tube is withdrawn as (or after) the well is filled with grout.

Using the tremie, grout is placed in the borehole filling from the bottom to the top. Two-inch and larger wells should use tremie tubing of not less than 1-inch diameter. Smaller diameter wells will call for a smaller tremie pipe. Grout will then be pumped in until the grout appears at the land surface (when grouting open holes in bedrock, the grout level only needs to reach above the bedrock surface). Any groundwater displaced during grout placement, if known to be contaminated, will be contained for proper disposal.

At this time the rate of settling should be observed. If grouting the well in place, the well casing remains in the hole. But if the decommissioning method has involved down-hole tools such as hollow-stem augers or temporary casing for overdrilling, these will be removed from the hole. As each section is removed, grout will be added to keep the level between 0 and 5 feet below grade. If the grout level drops below the land surface to an excessive degree, an alternate grouting method must be used. One possibility is to grout in stages; i.e., the first batch of grout is allowed to partially cure before a second batch of grout is added.

As previously described in Section 5.0, the outer protective casing "stick-up" should be removed only after a well has been properly filled with grout. This will ensure that the well is properly sealed regardless of any breakage which may occur when removing the stick-up. It is important to reiterate that when either casing pulling or over-drilling are required, due to the uncertainty of successfully pulling a well or over-boring a well, we insist that the driller tremie grout the well first. Then without allowing the grout to dry, the driller proceeds with pulling the casing or over-drilling the well.

Upon completion of grouting, ensure that the final grout level is approximately five feet below land surface. A ferrous metal marker will be embedded in the top of the grout to indicate the location of the former monitoring well. Lastly, a fabric "utility" marking should be placed one foot above the grout so an excavator can see it clearly.

7.0 BACKFILLING AND SITE RESTORATION

The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

8.0 DOCUMENTATION

A form which may be used in the field to record the decommissioning construction is included as Figure 3. Additional documentation may be required by a DEC project manager and samples are included in Appendix A. Programs within the DEC that maintain geographic data on monitoring wells strive to keep that data up to date. Owners of these data sets must be notified when a well is decommissioned. Historical groundwater quality data is linked to monitoring well locations so when a well is decommissioned, existing GIS data must be updated to reflect that fact but the coordinate location in the GIS database should not be eliminated. A metal detector may not be able to detect a deeply buried marker so if this locator is important for future utility runs or foundations, a map should be submitted to the property owner and the town engineer showing the decommissioned well locations. Global Positioning System (GPS) coordinates should be indicated on this map. Lastly, whatever documentation is produced should be provided to the property owner, the DEC, and all other parties involved.

9.0 FIELD OVERSIGHT

Over-drilling requires careful observation to detect whether the drill has wandered off the well. Grout preparation and tremie work should be carefully observed. The successful implementation of a decommissioning work plan depends upon proper direction, observation and oversight. Methods to be employed must be clearly worked through and all parties must understand what they have to do before going into the field. Flexibility is allowed where necessary but the work effort must be thorough and effective to protect our groundwater.

10.0 RELATED REFERENCES

- *Groundwater Monitoring Well Decommissioning Procedures*, October 1986. Prepared by Malcolm Pirnie, Inc., for the New York State Department of Environmental Conservation, Division of Environmental Remediation.

- American Society for Testing and Materials, A.S.T.M. D 5299-99, Standard Guide for the Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities. A.S.T.M.. Philadelphia. 2005.

- New York State Department of Environmental Conservation, Division of Solid and Hazardous Materials, 6 NYCRR Part 360, Solid Waste Management Facilities.

- New York State Department of Environmental Conservation, Region I - Water Unit, Specifications for Abandoning Wells and Boreholes in Unconsolidated Materials, undated.

- United States Environmental Protection Agency, The Handbook of Suggested Practices for the Design and Installation of Groundwater Monitoring Wells, EPA 600/4-89/034.

FIGURES

FIGURE 1 - MONITORING WELL FIELD INSPECTION LOG

FIGURE 2 - DECOMMISSIONING PROCEDURE SELECTION

FIGURE 3 - WELL DECOMMISSIONING RECORD

APPENDICES

APPENDIX A - REPORTS

APPENDIX A1 - INSPECTOR'S DAILY REPORT

APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

APPENDIX A3 - CORRECTIVE MEASURES REPORT

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FIGURE 1

MONITORING WELL FIELD INSPECTION LOG

FIGURE 1

SITE NAME:

SITE ID.: ______
INSPECTOR: ______
DATE/TIME: ______
WEll ID.: ______

MONITORING WELL FIELD INSPECTION LOG
NYSDEC WELL DECOMMISSIONING PROGRAM

	YES	NO
WELL VISIBLE? (If not, provide directions below)		
WELL I.D. VISIBLE?		
WELL LOCATION MATCH SITE MAP? (if not, sketch actual location on back)		

WELL I.D. AS IT APPEARS ON PROTECTIVE CASING OR WELL: ......

	YES	NO
SURFACE SEAL PRESENT?		
SURFACE SEAL COMPETENT? (If cracked, heaved etc., describe below)		
PROTECTIVE CASING IN GOOD CONDITION? (If damaged, describe below)		

HEADSPACE READING (ppm) AND INSTRUMENT USED ______
TYPE OF PROTECTIVE CASING AND HEIGHT OF STICKUP IN FEET (If applicable) ______
PROTECTIVE CASING MATERIAL TYPE: ______
MEASURE PROTECTIVE CASING INSIDE DIAMETER (Inches): ......

	YES	NO
LOCK PRESENT?		
LOCK FUNCTIONAL?		
DID YOU REPLACE THE LOCK?		
IS THERE EVIDENCE THAT THE WELL IS DOUBLE CASED? (If yes,describe below)		
WELL MEASURING POINT VISIBLE?		

MEASURE WELL DEPTH FROM MEASURING POINT (Feet): ______
MEASURE DEPTH TO WATER FROM MEASURING POINT (Feet): ______
MEASURE WELL DIAMETER (Inches): ______
WELL CASING MATERIAL: ______
PHYSICAL CONDITION OF VISIBLE WELL CASING: ______
ATTACH ID MARKER (if well ID is confirmed) and IDENTIFY MARKER TYPE ______
PROXIMITY TO UNDERGROUND OR OVERHEAD UTILITIES ______

DESCRIBE ACCESS TO WELL: (Include accessibility to truck mounted rig, natural obstructions, overhead power lines, proximity to permanent structures, etc.); ADD SKETCH OF LOCATION ON BACK, IF NECESSARY.

DESCRIBE WELL SETTING (For example, located in a field, in a playground, on pavement, in a garden, etc.) AND ASSESS THE TYPE OF RESTORATION REQUIRED.

IDENTIFY ANY NEARBY POTENTIAL SOURCES OF CONTAMINATION, IF PRESENT (e.g. Gas station, salt pile, etc.):

REMARKS:

FIGURE 2

DECOMMISSIONING PROCEDURE SELECTION

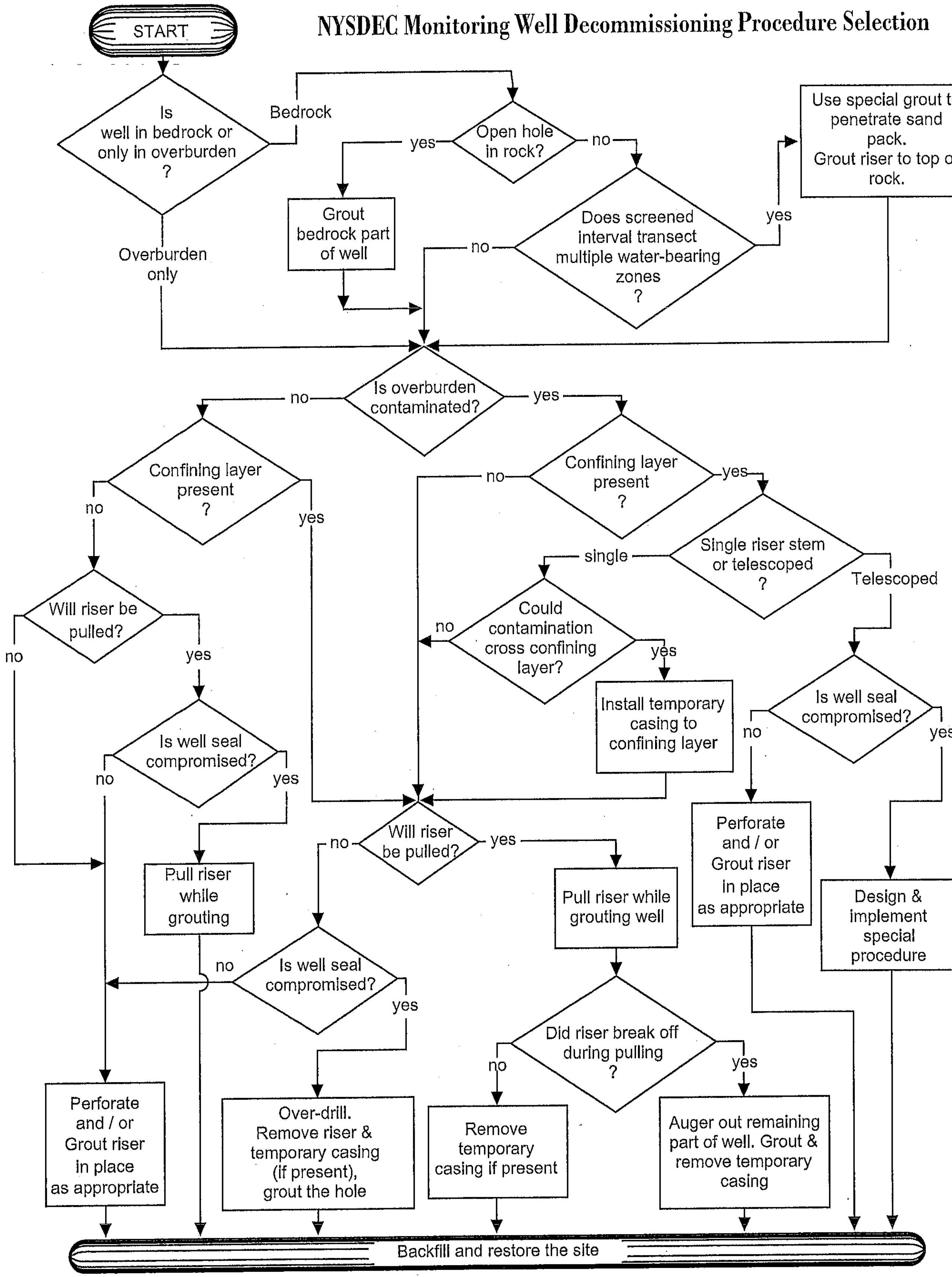

START
NYSDEC Monitoring Well Decommissioning Procedure Selection
Is well in bedrock or only in overburden ?
Bedrock
Overburden only
Open hole in rock?
yes
no
Grout bedrock part of well
Does screened interval transect multiple water-bearing zones ?
Use special grout to penetrate sand pack. Grout riser to top of rock.
Is overburden contaminated?
Confining layer present ?
Will riser be pulled?
Is well seal compromised?
Pull riser while grouting
Single riser stem or telescoped ?
single
Telescoped
Could contamination cross confining layer?
Install temporary casing to confining layer
Will riser be pulled?
Pull riser while grouting well
Did riser break off during pulling ?
Perforate and / or Grout riser in place as appropriate
Design & implement special procedure
Over-drill. Remove riser & temporary casing (if present), grout the hole
Remove temporary casing if present
Auger out remaining part of well. Grout & remove temporary casing
Backfill and restore the site

FIGURE 2

FIGURE 3

WELL DECOMMISSIONING RECORD

FIGURE 3

WELL DECOMMISSIONING RECORD

Site Name:	Well I.D.:
Site Location:	Driller:
Drilling Co.:	Inspector:
	Date:

DECOMMISSIONING DATA
(Fill in all that apply)

OVERDRILLING

Interval Drilled	
Drilling Method(s)	
Borehole Dia. (in.)	
Temporary Casing Installed? (y/n)	
Depth temporary casing installed	
Casing type/dia. (in.)	
Method of installing	

CASING PULLING

Method employed	
Casing retrieved (feet)	
Casing type/dia. (in)	

CASING PERFORATING

Equipment used	
Number of perforations/foot	
Size of perforations	
Interval perforated	

GROUTING

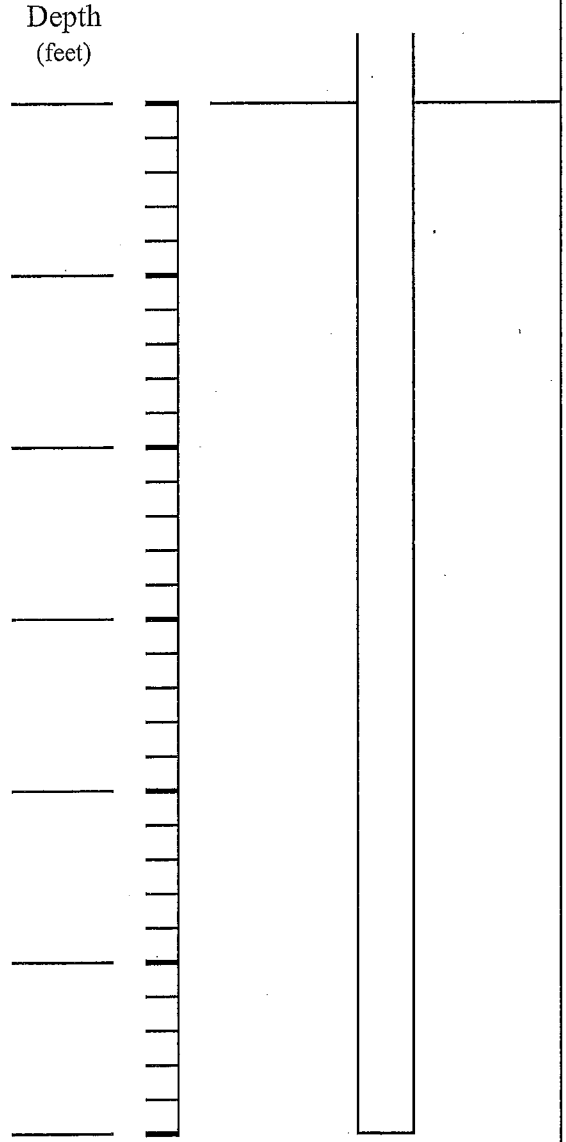
Interval grouted (FBLS)	
# of batches prepared	

For each batch record:

Quantity of water used (gal.)	
Quantity of cement used (lbs.)	
Cement type	
Quantity of bentonite used (lbs.)	
Quantity of calcium chloride used (lbs.)	
Volume of grout prepared (gal.)	
Volume of grout used (gal.)	

WELL SCHEMATIC*

Depth
(feet)



COMMENTS:

* Sketch in all relevant decommissioning data, including: interval overdrilled, interval grouted, casing left in hole, well stickup, etc.

Drilling Contractor

Department Representative

APPENDIX A - REPORTS

APPENDIX A1 - INSPECTOR'S DAILY REPORT

APPENDIX A2 - PROBLEM IDENTIFICATION REPORT

APPENDIX A3 - CORRECTIVE MEASURES REPORT

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Inspector's Daily Report

CONTRACTOR:
ADDRESS:

TELEPHONE:
LOCATION ______________________ FROM __________ TO __________
WEATHER ______________________ TEMP ______ A.M. ______ P.M. ______ DATE __________

CONTRACTOR'S WORK FORCE AND EQUIPMENT											
DESCRIPTION	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*	*DESCRIPTION*	*H*	*#*
Field Engineer						Equipment			Front Loader Ton		
Superintendent			Ironworker			Generators			Bulldozer		
						Welding Equip.					
Laborer Foreman			Carpenter								
Laborer									Backhoe		
Operating Engineer			Concrete Finisher								
Carpenter						Paving Equip. & Roller					
						Air compressor					

SEE REVERSE SIDE FOR SKETCH YES ☐ NO ☐ ______________________

WORK PERFORMED: ______________________

PAY ITEMS

CONTRACT		STA		DESCRIPTION	QUANTITY	REMARKS
Number	ITEM	FROM	TO			

TEST PERFORMED: ______________________
PICTURES TAKEN: ______________________

VISITORS: ______________________

QA PERSONNEL
SIGNATURE ______________________

REPORT NUMBER __________
SHEET ______ Of __________

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PROBLEM IDENTIFICATION REPORT

Date ____________

Project ____________ Job Number ________

Contractor ____________

Subject ____________

Day	Su	M	T	W	Th	F	Sa

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

PROBLEM DESCRIPTION Reference Daily Report Number 1: ____________

PROBLEM LOCATION - REFERENCE TEST RESULTS AND LOCATION (Note: Use sketches on back of form as appropriate):

PROBABLE CAUSES: ____________

SUGGESTED CORRECTIVE MEASURES: ____________

APPROVALS:

QA ENGINEER: ____________

PROJECT MANAGER: ____________

Distribution:
1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: ____________

MEETINGS HELD AND RESULTS

REMARKS

REFERENCES TO OTHER FORMS

SKETCHES

SAMPLE LOG

SAMPLE NUMBER

APPROXIMATE LOCATION OF STOCKPILE

NUMBER OF STOCKPILE

DATE OF COLLECTION

CLIMATIC CONDITIONS

FIELD OBSERVATION

SHEETS OF

Appendix A3

CORRECTIVE MEASURES REPORT

Date ____________________

Project ______________________ Job Number ________

Contractor ______________________

Subject ______________________

Day

Su	M	T	W	Th	F	Sa

Sky/Precip.	Clear	Partly Cloudy	Cloudy	Rainy	Snow
TEMP.	<32F	32-40F	40-70F	70-80F	80-90F
WIND	No	Light	Strong		
HUMIDITY	Dry	Mod.	Humid		

CORRECTIVE MEASURES TAKEN (Reference Problem Identification Report No.): ____________________

RETESTING LOCATION: ____________________

SUGGESTED METHOD OF MINIMIZING RE-OCCURRENCE: ____________________

SUGGESTED CORRECTIVE MEASURES: ____________________

APPROVALS:

QA ENGINEER: ____________________

PROJECT MANAGER: ____________________

Distribution:

1. Project Manager
2. Field Office
3. File
4. Owner

QA Personnel
Signature: ____________________

SOP # S25

MACTEC STANDARD OPERATING PROCEDURE #S25

SOIL VAPOR AND AIR SAMPLING

April 22, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Charles R Staples

April 27, 2020

Charles Staples, PG, Program Technical Lead

Date

Reviewed

Date

SOIL VAPOR AND AIR SAMPLING

1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the methods to be used for substructure soil vapor, exterior soil vapor, indoor air and/or ambient air sampling used to evaluate human exposure to VOCs through vapor intrusion.

This procedure is not intended to obviate the need for professional judgment to accommodate unforeseen circumstances. Deviation from this procedure must be approved by the project manager and documnted in the field logbook and/or field data record.

2.0 PROCEDURE

This section contains both the responsibilities and procedures involved with substructure soil vapor, exterior soil vapor, indoor air, and/or ambient air sampling. Proper sampling procedures are necessary to ensure the quality and integrity of the samples.

2.1 Responsibilities

Project Manager

The project manager (PM) is responsible for ensuring that sample collection activities are conducted in accordance with this SOP and any other appropriate procedures based on the objectives of the sampling.

Field Operations Lead

The field operations lead (FOL) is responsible for periodic observation of field activities and review of field generated documentation associated with this SOP. The FOL is also responsible for implementation of corrective action (i.e. retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if problems occur.

Field Personnel

Field personnel assigned to sampling activities are responsible for completing tasks according to specifications outlined in this SOP and other appropriate procedures. All staff are responsible for reporting deviations from procedures to the PM or FOL and documenting them in the field logbook and on the field data records.

2.2 Preparation

In Office Preparation

If collecting soil vapor and indoor air samples:

- Make contact with property owners to explain sampling and ensure access.
- Schedule time for sample collection and sample retrieval (if collecting time-averaged samples (e.g., 8-hour or 24-hour). Anticipate one to 1.5 hours per location for completing indoor air questionnaire and building inventory form and set up for collection of subslab soil vapor and indoor air samples. Anticipate 30 minutes for sample retrieval.
- Prepare equipment for anticipated sampling (see below).

Equipment Selection and Sampling Considerations

General Considerations – For SUMMA® type canisters;

- Canisters should arrive from the laboratory with approximately 30-inches mercury of vacuum (guages may be a little innacurate-tap lightly to double check reading). If initial canister vacuums are observed in the field to be less than 25-inches mercury, canister should be replaced and not used, since it is not known if air has already entered the canister.
- If possible for canisters that will collect samples for 8-hours or 24-hours, the canisters should be reviewed after initially opened to ensure that 1) the canister vacuum is dropping, and 2) that the canister vacuum did not drop immediately to zero (i.e., a leak in the regulator). For residential samples, it is often not possible, practical to review canisters after the sampling crew has left the property and before the scheduled canister pick up.
- At sample completion, canisters should have between one and five inches mercury vacuum. If canister has greater than 10-inches mercury vacuum and the field crew has access and time, the canisters should be allowed to sit for longer to lower the vacuum. If there are questions, discuss readings with the FOL and/or PM. Larger vacuums could result in elevated detection limits.

Subslab Soil Vapor Sampling – Subslab soil vapor samples will be collected from beneath residential, commercial, industrial, institutional, and multiuse buildings using SUMMA® type air canisters equipped with metering flow controllers for the purpose of collecting either a "time-averaged" (e.g., 8-hour or 24-hour) soil vapor sample, or a “grab” (e.g., less than one hour) soil vapor sample. Typically, substructure soil vapor samples are collected as subslab soil vapor sample obtained via a temporary installed sampling port through apparent vapor barrier (such as floor slab or plastic liner). Substructure samples collected from a crawl space or basement without an apparent vapor barrier will be collected similar to indoor air samples, described further below.

<u>Subslab Soil Vapor Sampling will require the following equipment:</u>

- stainless steel (e.g., 1.4 or 6-liter), pre-evacuated SUMMA®-type canister - laboratory provided
- Pressure gauge with integrated metering valve based on sample duration desired (e.g., 20 minute, 8-hour, 24-hour) - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range -for screening crawl space/cracks
- Helium Leak Testing Setup (if conducted)
    - Stainless steel shroud with sample ports and pipe insulation foam backing
    - Helium detector capable of measuring parts per million and percent helium (LACO Technologies LHHLD-2002 or equivalent)

- Helium canister with regulator (check for lab availability)

- Utility Knife
- Electric hammer drill with 3/8-inch diameter drill bits
- 50-ft long electrical extension cord
- ¼-inch O.D. Teflon® tubing (confirm with laboratory that sizing matches canister type)
- ¼-inch stainless steel valve and stainless steel "tee" type fitting
- 60 cc polyethylene syringe for purging tubing
- Non-hardening, non-VOC emitting modeling clay (e.g., Plastalina by VanAken)
- Quick-drying expansive Portland cement
- Wristwatch
- Flashlight
- Dustpan and broom
- Chain of Custody (COC) form - laboratory provided
- Field Data Forms (FDRs) (**example attached)**, pens
- NYSDEC Structure Sampling Questionnaire and Building Inventory (**attached)**
- Personal Protective Equipment

Indoor and Ambient Air Sampling – Indoor air samples will be collected from residential, commercial, industrial, institutional, and multiuse buildings. Ambient air sample will be collected from exterior locations. For the purposes of sampling procedures, crawl space samples can be collected following procedures for indoor air. Indoor air and ambient air samples will be collected using SUMMA®-type air canisters equipped with metering flow controllers for the purpose of collecting a "time-averaged" indoor air sample. This procedure is intended for 8-hour or 24-hour sample collection and may be collected in conjunction with 8-hour or 24-hour substructure soil vapor sampling.

Indoor and ambient air sampling will require the following equipment:

- stainless steel (e.g., 1.4 or 6-liter), pre-evacuated SUMMA®-type canister - laboratory provided
- Pressure gauge with integrated 8- or 24-hour metering valve - laboratory provided
- Two, 9/16-inch, open-end wrenches
- PID – part per billion range detectors for screening indoor air
- Wristwatch
- Indoor Air Quality Questionnaire and Building Inventory Form (**Form Attached**)
- COC form -laboratory provided
- FDRs, pens
- NYSDEC Structure Sampling Questionnaire and Building Inventory (**attached)**

- Personal Protective Equipment

Direct Push (GeoProbe®) Deep and Shallow Soil Vapor Sampling – Soil vapor grab samples can be collected at exterior locations from shallow (3 to 5 feet below ground surface [bgs] or shallower if located under parking lot pavement) and deep (greater than five feet bgs) depths. Permanent or semi-permanent sampling points can be installed, allowed to equilibrate over a 24-hour period, and sampled using SUMMA® type air canisters equipped with metering flow controllers. This technique is intended for collection of a grab sample (i.e., less than one hour).

<u>Exterior soil vapor grab sampling will require the following equipment:</u>

- GeoProbe® soil vapor implant installation equipment – subcontractor provided
- stainless steel (e.g., 1.4-liter or 6-liter), pre-evacuated SUMMA® canister - laboratory provided
- Pressure gauge with integrated metering valve such that sampling will not proceed faster than 200 ml per minute (sample time dependent on canister size)- laboratory provided
- ¼-inch outside diameter, six-inch-long soil vapor implants
- Hand auger
- Glass beads – 60 to 100 mesh
- Bentonite chips -16 mesh
- funnel
- PID
- Utility Knife
- ¼-inch O.D. Teflon® tubing
- ¼-inch stainless steel valve and stainless steel "tee" type fitting
- 3/16-inch I.D. silastic tubing
- 60 cc polyethylene syringe or geopump for purging tubing
- Wristwatch
- COC form - laboratory provided
- FDRs, pens
- Personal Protective Equipment

2.3 Field Procedures

Sub-Slab Soil Vapor Sampling

Procedure for Subslab Soil Vapor Sample Collection:

Subslab soil vapor sample obtained via temporary installed sampling port through apparent vapor barrier (i.e. floor slab or plastic liner) will be collected as follows:

1. **Select and prepare the sample collection point.**

- Observe the condition of the building floor slab for apparent penetrations such as concrete floor cracks, floor drains, or sump holes.
- Note the floor conditions on the FDR and select a potential location or locations for a temporary subsurface probe.
- The location or locations should be central to the building away from foundation walls and apparent penetrations.
- Review the proposed location or locations with the occupant/owner describing how the sampling port or ports will be installed.
- Mark the proposed location(s) and describe the location(s) on the sampling form.
- Using the PID, screen indoor air in the area of floor penetrations such as concrete floor cracks, floor drains, or sump holes. Record the indoor air PID readings on the sampling form.

2. Installation of temporary subsurface sample point

- Drill a hole through thickness of the slab using a 3/8-inch drill bit. Extend the hole about three inches into the subslab material using either the drill bit or a steel probe rod. Sweep hole to remove excess dust.
- Insert a section of ¼-inch O.D. Teflon® tubing to the bottom of the floor slab. Seal the annular space between the hole and 1/4-inch tubing using the non-hardening modeling clay. Be sure that clay sticks to floor.
- Connect the ¼ -inch Teflon® tubing to a stainless-steel valve using compression fittings (unless the laboratory canisters are fitted with quick connectors). Open the in-line valve and purge the probe tubing using a polyethylene 60 cc syringe. Close the valve, remove and cap the syringe, and connect the ¼-inch Teflon® tubing and in-line valve to a SUMMA®-type canister. The air/soil vapor syringe will be discharge out of doors. For duplicate sample locations connect a second canister before purging by installing a 1/4-inch stainless steel "tee" fitting between the probe discharge tubing and the stainless-steel valve.

3. Conduct helium leak test, if required

- After purging the tubing, connect the PID to collect a measurement for VOC concentration and record on the Soil Vapor Sampling FDR.
- Connect the sample tubing to the inside of a stainless-steel shroud using a short piece of silastic tubing. Carefully install the stainless-steel shroud over the sampling point.
- The shroud has three sampling ports: one that connects to the sub-slab tubing and two that are connected to the air pocket under the shroud. Insert the helium detector through one of the air pocket sample ports and introduce helium through the remaining air pocket sample port. Release helium in a controlled manner to avoid over pressurizing the shroud (if using a laboratory provided shroud and helium, refer to their directions for use).
- Helium concentration within the air pocket should reach a minimum concentration in the percent range. If values remain low, remove shroud and check for leaks. Pipe insulation or hydrated bentonite on the base of the shroud creates a good seal with minimal pressure.
- Once helium concentration within the shroud has reached an acceptable level (e.g.,

10% or more helium), connect the helium detector to the sample tubing or sample port using silicone tubing and continue purging the sample line with the helium detector for approximately one minute. Record the final concentration of helium in both the shroud and the sample tubing on the FDR. The helium test is considered successful if the concentration of helium from the sample tubing is less than 10% of the concentration that is observed in the shroud (e.g. 90ppm He in the sample tubing and 10% He in the shroud is considered a successful test).

- If the helium test passes, carefully disassemble and remove the helium testing apparatus and cap the sample tubing in preparation for connecting to the sample canister. If the test is unsuccessful, reseal the sampling point and re-attempt.

4. Preparation of SUMMA®-type canister and collection of samples

- Place SUMMA®-type canister adjacent to the temporary sampling port.
- Record SUMMA®-type canister serial number on sampling summary form and COC.
- Record sample identification on canister identification tag, and record on sampling summary form and COC.
- Remove brass plug from canister fitting.
- Install pressure gauge/metering valve on canister valve fitting and tighten.
- Connect subsurface probe to end of in-line particular filter on gauge/metering valve via ¼-inch O.D. Teflon® tubing and "swagelok®-type" fittings (unless canisters use quick release fittings).
- Open canister valve and in-line stainless steel valve to initiate sample collection.
- Record initial gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.
- Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA®-type canister and surrounding area.

5. Termination of sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 8-hour or 24 hours after initiation of sample collection) and record gauge pressure on sampling form and COC. If collecting grab sample, monitor vacuum during sampling. Vacuum should read between 1 and 5- inches mercury.
- Record date and local time (24-hour basis) of valve closing on sampling form and COC.
- Close canister valve.
- Disconnect Teflon® tubing and remove pressure gauge / flow valve from canister.
- Reinstall brass plug on canister fitting and tighten.
- Remove SUMMA®-type canister from sample collection area.
- Remove temporary probe and fill the hole with quick drying hydraulic cement. Finish

flush with floor surface.

Preparation and shipment of sample to analytical laboratory

- Pack SUMMA®-type canister in shipping container, note presence of brass plug installed in tank fitting.
- Complete chain of custody per the **Chain of Custody Procedures SOP** and place requisite copies in shipping container.
- Close shipping container and affix custody seal to container closure.

Quality Assurance/Quality Control (QA/QC) samples:

The collection of QA/QC samples will include the submittal of sample duplicates to the analytical laboratory for analyses of target compounds, refer to the site-specific Field Activities Plan (FAP). Duplicate samples will be obtained using a stainless steel "tee" type fitting and 1/4-inch O.D. Teflon®- tubing connected to the same subsurface probe.

Indoor Air Sampling

Procedure for Indoor Air Sample Collection

The following section provides a general guidance on the collection of indoor air samples.

For the purposes of evaluating the potential vapor migration from soils and groundwater into indoor air, samples will typically be collected from the lowest usable area of the building but may include samples from upper floors based on the site-specific FAP. Indoor air samples may be collected from the following areas:

1. Unfinished or finished basement (special note should be taken if dirt floor)
2. Finished first floor (either over basement, or in slab-on-grade building
3. Although not technically indoor air samples, samples collected from unoccupied crawl space will follow the same procedure.

Selection and Preparation of indoor air sample collection area

- Conduct interview with occupant/owner. Complete Indoor Air Quality Questionnaire and Building Inventory Form (**Form Attached**).
- Observe the area for the apparent presence of items or materials that may potentially produce or emit VOCs and interfere with analytical laboratory analysis of the collected sample. Record relevant information on Building Inventory Form and document with digital photographs.
- Using the PID, screen indoor air in the location intended for sampling and in the vicinity of potential VOC sources (i.e. paints, glues, household cleaners, dry cleaned clothes, etc.) to assess the potential gross presence of VOCs. Record PID readings on the sampling form.

Preparation of SUMMA®-type canister and collection of indoor air sample

- Place SUMMA®-type canister at breathing zone height (approximately 3 to 5 ft above floor) (crawl space samples can be placed on the ground). Canister can be placed on a stable surface, such as a table or bookshelf, or affixing to a wall or ceiling support with nylon rope. Avoid placing canisters near windows or other potential sources of drafts and air supply vents.

- Record SUMMA®-type canister serial number on sampling summary form and COC.
- Record sample identification on canister identification tag, and record on sampling summary form and COC.
- Remove brass plug from canister fitting and store for later use.
- Install pressure gauge / metering valve on canister valve fitting and tighten.
- Open canister valve to initiate sample collection.
- Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.
- Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA®-type canister and surrounding area.

Termination of indoor air sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 8-hour or 24-hours after initiation of sample collection) and record gauge pressure on sampling form and COC.
- Record date and local time (24-hour basis) of valve closing on sampling form and COC.
- Close canister valve.
- Remove pressure gauge / flow valve from canister.
- Reinstall brass plug on canister fitting and tighten.
- Remove SUMMA®-type canister from sample collection area.

Preparation and shipment of sample to analytical laboratory

- Pack SUMMA®-type canister in shipping container, note presence of brass plug installed in tank fitting.
- Complete chain of custody per the **Chain of Custody Procedures SOP** and place requisite copies in shipping container.
- Close shipping container and affix custody seal to container closure.

Quality Assurance/Quality Control (QA/QC) samples:

The collection of QA/QC samples will include the submittal of blind sample duplicates to the analytical laboratory for analyses of target compounds. Duplicate samples will be collected "side-by-side" over the same time interval.

Ambient Air Sampling

Procedure for Ambient (outdoor) Air Sample Collection

The following section provides a general guidance on the collection of ambient air samples.

Selection and Preparation of ambient sample collection area

- Choose an area for sample collection that is upwind of the property (properties) being assessed, if possible. Collect sample away from wind breaks, if possible.
- Observe the area for the apparent presence of items or materials that may potentially produce or emit VOCs and interfere with analytical laboratory analysis of the collected sample (i.e. fuel tanks, gasoline, paint storage, etc.). Record relevant information on Building Inventory Form and document with digital photographs.
- Using the PID, screen ambient air in the location intended for sampling to assess the potential gross presence of VOCs. Record PID readings on the sampling form.

Preparation of SUMMA® canister and collection of ambient samples

- Place SUMMA®-type canister approximately 5 ft above ground (or equivalent to the mid-point of the ground story of the building(s). Canister can be placed on a stable surface or suspended from structure with nylon rope.
- Record SUMMA®-type canister serial number on sampling summary form and COC.
- Record sample identification on canister identification tag, and record on sampling summary form and COC.
- Remove brass plug from canister fitting and store for later use.
- Install pressure gauge/metering valve on canister valve fitting and tighten.
- Open canister valve to initiate sample collection.
- Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA®-type canister if gauge pressure reads <25 inches Hg.
- Remove brass plug from gauge fitting
- Record date and local time (24-hour basis) of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA®-type canister and surrounding area.

Termination of ambient sample collection

- Revisit SUMMA®-type canister approximately at end of sample collection period (e.g., 8-hours or 24-hours after initiation of sample collection) and record gauge pressure on sampling form and COC.
- Record date and local time (24-hour basis) of valve closing on sampling form and COC.
- Close canister valve.
- Remove pressure gauge / flow valve from canister.
- Reinstall brass plug on canister fitting and tighten.
- Remove SUMMA®-type canister from sample collection area.

Preparation and shipment of sample to analytical laboratory

- Pack SUMMA®-type canister in shipping container, note presence of brass plug installed in tank fitting.
- Complete COC and place requisite copies in shipping container.
- Close shipping container and affix custody seal to container closure.

Direct Push (GeoProbe®) Soil Vapor Sampling

Procedure for Direct Push (GeoProbe®) Soil Vapor Grab Sample Collection

Survey the known site characteristics including source areas, groundwater data, utility trench locations, groundwater flow, and potentially impacted areas to assess applicability of sampling technique. The steps provided below should be considered a general guidance on the collection soil vapor samples (shallow or deep).

Selection and preparation of sample collection point

- Identify utilities prior to the selection of deep soil vapor sample locations (**utility clearance form attached)**.
- Assess utility clearance at all locations. Review the proposed location or locations with the site representative.
- Mark the proposed location(s) and describe the location(s) on the sampling form (**example**

attached).

Installation of soil vapor sample point

- Collect continuous soil samples using direct push technology to characterize subsurface soils (See **Direct Push Drilling SOP**). Soil characteristics (such as soil type, moisture, color) and photoionization detector (PPB-Rae) field screening results will be recorded on a field data record. PID screening, as well as soil characteristics will be used to select vapor implant depths. Consideration will be given to more permeable soils encountered during sampling. The PID will be calibrated to a 10 parts per million isobutylene standard and set point of 1.0.
- Soil vapor implants will be installed by either lowering the implant down the direct push rods to the desired depth or attaching the implant to a GeoProbe® implant Anchor/Drive point (GeoProbe® PR-14) prior to driving the rods to the desired depth.
- Attach quarter inch outside diameter Teflon tubing to the soil vapor implant allowing approximately two feet to extend above the ground surface and be sealed at the surface with a plastic cap.
- Using the funnel, pour a sufficient volume of glass beads down the rods to fill the space around the implant. Depending on project, sand may be used in place of glass beads – see site-specific FAP).
- Using the funnel, pour a sufficient volume of bentonite chips to create an approximate two-foot bentonite seal above the glass beads.
- Retract the rods prior to hydrating the bentonite.
- Pour a sufficient volume of ASTM Type II water down the direct push hole to hydrate the volume of bentonite chips installed, being careful not to saturate the hole and the sampling screen.
- Use native backfill, or a cement/bentonite grout mixture to backfill the boring to the ground surface.
- If shallow and deep implants are to be installed at one location, both implants can be placed within the same boring. The upper implant will be surrounded by glass beads and a bentonite seal will be installed both below and above the glass beads.
- If sample points will be permanent, install four-inch flush mount casing with concrete apron.
- Complete a Soil Vapor Probe Construction Diagram for each sample location and record field data and observations on the GeoProbe® Soil Vapor Sampling Record (**example attached)**.

Preparation of SUMMA® canister and collection of samples

- Place SUMMA® canister adjacent to the temporary sampling port.
- Record SUMMA® canister serial number on sampling summary form and COC.
- Record sample identification on canister identification tag, and record on sampling summary form and COC.
- Remove plastic cap or brass fitting from canister and attach pressure gauge/flow controller.
- Connect canister to silastic tubing already connected to the subsurface probe (may be Swagelok fittings or by quick connect tubing, depending on canister type).
- Open canister valve and in-line stainless steel valve (if present) to initiate sample

collection.

- Record gauge pressure on sample summary form and COC. Gauge pressure must read >25 inches Hg. Replace SUMMA® canister if gauge pressure reads <25 inches Hg.
- Record date and local time of valve opening on sampling summary form and COC.
- Take digital photograph of SUMMA® canister and surrounding area.

Termination of sample collection

- Sample collection duration may vary based on the size of the canister and the direction of the client but is typically less than one hour (flow should be less than 200 milliliters per minute). If canisters are equipped with flow controllers, sample valves should remain open until the vacuum in the canister is at 3 to 5-inches Hg.
- Upon completion of sample collection, record gauge pressure on sampling form and COC.
- Record date and local time of valve closing on sampling form and COC.
- Close canister valve.
- Disconnect tubing and recap pressure gauge (or remove gauge depending on canister set up.
- Remove SUMMA® canister from sample collection area.
- If permanent sampling point, cap tubing and close flush mount casing. If temporary point, remove temporary probe from hole and backfill to match surrounding ground (e.g., native soil, asphalt, concrete).

Preparation and shipment of sample to analytical laboratory

- Pack SUMMA®-type canister in shipping container, note presence of brass plug installed in tank fitting.
- Complete COC and place requisite copies in shipping container.
- Close shipping container and affix custody seal to container closure.

3.0 ATTACHMENTS

NYSDEC Structure Sampling Questionnaire and Building Inventory

Soil Vapor Intrusion Sampling Record

Soil Vapor Implant Sampling Record

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: ____________________ Site Code: __________ Operable Unit: __________

Building Code: ____________________ Building Name: ____________________

Address: ____________________ Apt/Suite No: __________

City: ____________________ State: ______ Zip: ______ County: __________

Contact Information

Preparer's Name: ____________________ Phone No: __________

Preparer's Affiliation: ____________________ Company Code: __________

Purpose of Investigation: ____________________ Date of Inspection: __________

Contact Name: ____________________ Affiliation: [ ]

Phone No: __________ Alt. Phone No: __________ Email: __________

Number of Occupants (total): ______ Number of Children: ______

☐ Occupant Interviewed? ☐ Owner Occupied? ☐ Owner Interviewed?

Owner Name (if different): ____________________ Owner Phone: __________

Owner Mailing Address: ____________________

Building Details

Bldg Type (Res/Com/Ind/Mixed): [ ] Bldg Size (S/M/L): [ ]

If Commercial or Industrial Facility, Select Operations: [ ]

If Residential Select Structure Type: [ ]

Number of Floors: ______ Approx. Year Construction: ______ ☐ Building Insulated? ☐ Attached Garage?

Describe Overall Building 'Tightness' and Airflows(e.g., results of smoke tests): [ ]

Foundation Description

Foundation Type: [ ] Foundation Depth (bgs): ______ Unit: FEET

Foundation Floor Material: [ ] Foundation Floor Thickness: ______

Foundation Wall Material: [ ] Foundation Wall Thickness: ______ Unit: INCHES

☐ Floor penetrations? Describe Floor Penetrations: ____________________

☐ Wall penetrations? Describe Wall Penetrations: ____________________

Basement is: [ ] Basement is: [ ] ☐ Sumps/Drains? Water In Sump?: [ ]

Describe Foundation Condition (cracks, seepage, etc.) : ____________________

☐ Radon Mitigation System Installed? ☐ VOC Mitigation System Installed? ☐ Mitigation System On?

Heating/Cooling/Ventilation Systems

Heating System: [ ] Heat Fuel Type: [ ] ☐ Central A/C Present?

Vented Appliances

Water Heater Fuel Type: [ ] Clothes Dryer Fuel Type: [ ]

Water Htr Vent Location: [ ] Dryer Vent Location: [ ]

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

PRODUCT INVENTORY

Building Name: ______ Bldg Code: ______ Date: ______

Bldg Address: ______ Apt/Suite No: ______

Bldg City/State/Zip: ______

Make and Model of PID: ______ Date of Calibration: ______

Location	Product Name/Description	Size (oz)	Condition *	Chemical Ingredients	PID Reading	COC Y/N?
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐
						☐

* Describe the condition of the product containers as **Unopened (UO)**, **Used (U)**, or **Deteriorated (D)**

** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

Product Inventory Complete? ☐ Were there any elevated PID readings taken on site? ☐ ☐ Products with COC?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Site Name: ______________________ Site Code: __________ Operable Unit: __________

Building Code: __________________ Building Name: ______________________

Address: ______________________________ Apt/Suite No: __________

City: ____________________ State: ______ Zip: ________ County: __________

Factors Affecting Indoor Air Quailty

Frequency Basement/Lowest Level is Occupied?: [ ] Floor Material: [ ]

- [ ] Inhabited?
- [ ] HVAC System On?
- [ ] Bathroom Exhaust Fan?
- [ ] Kitchen Exhaust Fan?

Alternate Heat Source: [ ] ☐ Is there smoking in the building?

☐ Air Fresheners? Description/Location of Air Freshener: ______________________

☐ Cleaning Products Used Recently?: Description of Cleaning Products: ______________________

☐ Cosmetic Products Used Recently?: Description of Cosmetic Products: ______________________

☐ New Carpet or Furniture? Location of New Carpet/Furniture: ______________________

☐ Recent Dry Cleaning? Location of Recently Dry Cleaned Fabrics: ______________________

☐ Recent Painting/Staining? Location of New Painting: ______________________

☐ Solvent or Chemical Odors? Describe Odors (if any): ______________________

☐ Do Any Occupants Use Solvents At Work? If So, List Solvents Used: ______________________

☐ Recent Pesticide/Rodenticide? Description of Last Use: ______________________

Describe Any Household Activities (chemical use,/storage, unvented appliances, hobbies, etc.) That May Affect Indoor Air Quality:

☐ Any Prior Testing For Radon? If So, When?: ______________________

☐ Any Prior Testing For VOCs? If So, When?: ______________________

Sampling Conditions

Weather Conditions: [ ] Outdoor Temperature: [ ] °F

Current Building Use: [ ] Barometric Pressure: [ ] in(hg)

Product Inventory Complete? [ ] ☐ Building Questionnaire Completed?

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

Building Code: ____________________ Address: ____

Sampling Information

Sampler Name(s): ______________________________ Sampler Company Code: ________________

Sample Collection Date: [ ] Date Samples Sent To Lab: ________________

Sample Chain of Custody Number: ______________________ Outdoor Air Sample Location ID: ____________

SUMMA Canister Information

Sample ID:					
Location Code:					
Location Type:					
Canister ID:					
Regulator ID:					
Matrix:					
Sampling Method:					

Sampling Area Info

Slab Thickness (inches):					
Sub-Slab Material:					
Sub-Slab Moisture:					
Seal Type:					
Seal Adequate?:	☐	☐	☐	☐	☐

Sample Times and Vacuum Readings

Sample Start Date/Time:					
Vacuum Gauge Start:					
Sample End Date/Time:					
Vacuum Gauge End:					
Sample Duration (hrs):					
Vacuum Gauge Unit:					

Sample QA/QC Readings

Vapor Port Purge:	☐	☐	☐	☐	☐
Purge PID Reading:					
Purge PID Unit:					
Tracer Test Pass:	☐	☐	☐	☐	☐

Sample start and end times should be entered using the following format: MM/DD/YYYY HH:MM

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

LOWEST BUILDING LEVEL LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the lowest building level .
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or F	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

FIRST FLOOR BUILDING LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the first floor of the building.
The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

Structure Sampling Questionnaire and Building Inventory

New York State Department of Environmental Conservation

OUTDOOR PLOT LAYOUT SKETCH

Please click the box with the blue border below to upload a sketch of the outdoor plot of the building as well as the surrounding area. The sketch should be in a standard image format (.jpg, .png, .tiff)

Clear Image

Design Sketch

Design Sketch Guidelines and Recommended Symbology

- Identify and label the locations of all sub-slab, indoor air, and outdoor air samples on the layout sketch.
- Measure the distance of all sample locations from identifiable features, and include on the layout sketch.
- Identify room use (bedroom, living room, den, kitchen, etc.) on the layout sketc
- Identify the locations of the following features on the layout sketch, using the appropriate symbols:

B or **F**	Boiler or Furnace	o	Other floor or wall penetrations (label appropriately)
HW	Hot Water Heater	**xxxxxxx**	Perimeter Drains (draw inside or outside outer walls as appropriate)
FP	Fireplaces	**######**	Areas of broken-up concrete
WS	Wood Stoves	● SS-1	Location & label of sub-slab samples
W/D	Washer / Dryer	● IA-1	Location & label of indoor air samples
S	Sumps	● OA-1	Location & label of outdoor air samples
@	Floor Drains	● PFET-1	Location and label of any pressure field test holes.

SOIL VAPOR INTRUSION SAMPLING RECORD

PROJECT NAME:		LOCATION ID:	DATE:
PROJECT NO./TASK NO.:		CLIENT:	
PROJECT LOCATION:		SAMPLER NAME:	
WEATHER CONDITIONS (AM):		SAMPLER SIGNATURE:	
WEATHER CONDITIONS (PM):		CHECKED BY:	DATE:

SUMMA Canister Record Information

SUB-SLAB SOIL VAPOR SAMPLE		BASEMENT INDOOR AIR SAMPLE		FIRST FLOOR AIR SAMPLE		AMBIENT AIR SAMPLE	
Flow Regulator Number:		Flow Regulator Number:		Flow Regulator Number:		Flow Regulator Number:	
Flow Rate (mL/min):		Flow Rate (mL/min):		Flow Rate (mL/min):		Flow Rate (mL/min):	
Canister Serial Number:		Canister Serial Number:		Canister Serial Number:		Canister Serial Number:	
Start Date/Time		Start Date/Time		Start Date/Time		Start Date/Time	
Start Pressure ("Hg):		Start Pressure ("Hg):		Start Pressure ("Hg):		Start Pressure ("Hg):	
Stop Date/Time		Stop Date/Time		Stop Date/Time		Stop Date/Time	
Stop Pressure ("Hg):		Stop Pressure ("Hg):		Stop Pressure ("Hg):		Stop Pressure ("Hg):	
Sample ID:		Sample ID:		Sample ID:		Sample ID:	

Other Sampling Information:

Finished Basement, Crawl Space, Unfinished Basement		Story/Level:		Story/Level:		Direction from Building	
Floor Slab Thickness:		Room:		Room:		Distance from Building:	
Potential Vapor Entry Points:		Potential Vapor Entry Points:		Potential Vapor Entry Points:		Distance from Roadway:	
Floor Surface:		Floor Surface:		Floor Surface:		Ground Surface:	
Noticable Odor:		Noticable Odor:		Noticable Odor:		Noticable Odor:	
PID Reading (ppb):		PID Reading (ppb):		PID Reading (ppb):		PID Reading (ppb):	
Intake Depth/Height:		Intake Height:		Intake Height:		Intake Height above Ground Surface:	
Helium Test Conducted? Breakthrough %:		Indoor Air Temp		Indoor Air Temp		Intake tubing?	

Comments/Location Sketch:

MACTEC

511 Congress Street, Portland, ME 04101

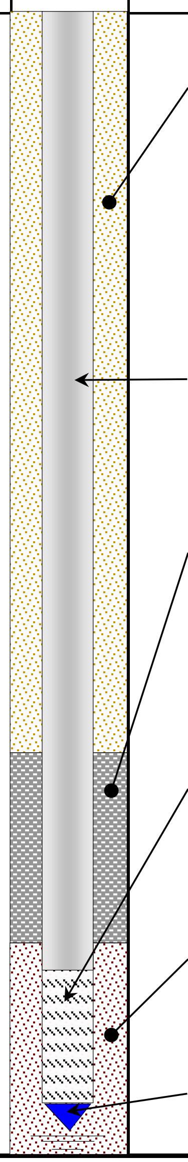
SOIL VAPOR INSTRUSION SAMPLING RECORD

SOIL VAPOR IMPLANT SAMPLING RECORD

MACTEC

511 Congress Street, Portland Maine 04101

Project Name:			Boring ID:
Project Location:			Page No.
Project No.:		Client:	of:
Boring Location:	Refusal Depth:	Total Depth:	Bore Hole ID/OD:
Weather:	Soil Drilled:	Method:	Casing Size:
Subcontractor:	P.I.D (eV):	Protection Level:	Sampler:
Driller:	Date Started:	Date Completed:	Sampler ID/OD:
Rig Type/Model:	Logged By:	Checked By:	Hammer Wt/Fall:
Reference Elevation:	Water Level:	Time:	Hammer Type:
He Breakthrough %:	Initial He %:	Final He %:	

Sample Information					Monitoring						
Depth (feet bgs)	Sample Number	Penetration/ Recovery (feet)	SPT Blows/6"	N Value	PID Field Scan	PID Headspace	Lab Sample Collected	Lab Sample ID	USCS Group Symbol	Soil Vapor Diagram	Overburden Drilling Notes:
											Soil Vapor Point Construction Notes:

NOTES:

SOIL VAPOR IMPLANT SAMPLING RECORD

SOP # S26

MACTEC STANDARD OPERATING PROCEDURE #S26

QUALITY ASSURANCE AND SYSTEM AUDIT PROCEDURES

April 20, 2020

New York State Department of Environmental Conservation

Program QAPP – D009809

Revision 0

APPROVED:

Chris Ricardi Quality Assurance Officer ______ April 20, 2020 ______

Chris Ricardi, Quality Assurance Officer Date

Reviewed Date

______________________ ______________________

______________________ ______________________

______________________ ______________________

QUALITY ASSURANCE AND SYSTEM AUDIT PROCEDURES

1.0 PURPOSE

This Standard Operating Procedure (SOP) was prepared to direct the MACTEC Quality Assurance Officer (QAO), or designee, in the procedures for QA audit and/or technical system audit (TSA) planning, execution, and reporting as determined on a project-specific basis. QA audits or TSAs may be identified in the Work Assignment issuance from the NYSDEC or may be deteremined to be appropriate as corrective actions during field investigations at hazardous and non-hazardous waste sites. The objective of a QA audit or TSA is to evaluate targeted techincal activities conducted as part of the field investigation and reporting process to determine compliance with procedures established in the QAPP and FAP. If deviations from established investigation procedures are identified, the need for corrective action will be determined and implementation of any necessary corrective measures will be documented.

2.0 PROCEDURE

The following procedures should be followed during QA audits and TSAs. Procedures may vary depending on the specific reasons identified for conducting the audit. Refer to Section 11.0 and Subsections 11.1 through 11.7 of the MACTEC Quality Assurance Program Plan and Program Field Activities Plan for descriptions of audit activities that may be performed.

2.1 Responsibilities

Quality Assurance Officer

The QAO is responsible for determining with the Program Manager or Project Manager when a QA audit or TSA is to be performed. The QAO, or designee, is responsible for planning, execution, and reporting of the audit and audit findings, and for reviewing and approving any corrective measures to be implemented as a result of audit findings.

Project Manager

The project manager (PM) is responsible for reviewing audit findings with project personnel and advising on any corrective actions to be implemented as a result of audit findings. This will be accomplished through staff training and by maintaining quality assurance/quality control (QA/QC). The PM, or designee, is responsible for providing written documentation addressing all audit findings.

Field Operations Lead

The field operations lead (FOL) is responsible for implementation of procedures specified in the QAPP and applicable project FAPs by field personnel. The FOL will routinely make observation of field activities and review of field generated documentation and also assist with implementation of corrective measures taken as a result of the audit findings. The FOL is also responsible for implementation of corrective action (i.e., retraining personnel, additional review of work plans and SOPs, variances to QC sampling requirements, issuing non-conformances, etc.) if future corrective action is needed.

Field Personnel

Field personnel assigned to activities identified in the audit findings are responsible for completing tasks according to specifications and corrective measures identified in the audit response prepared by the FOL, or designee, and approved by the QAO. All staff are responsible for reporting deviations from procedures to the PM or FOL.

2.2 Preparation

Audit Planning Considerations

The following steps may be taken in preparation of the QA audit or TSA. Audit-specific considerations may warrant the use of additional or deletion of items from this list.

- Review project FAP and QAPP
- Prepare checklist based on project plans or other applicable guidance documents
- Schedule audit to observe target processes
- Identify project contacts

2.3 Audit Procedures

Audit Execution

- Travel to and from project location
- Pre-audit meeting with project staff
- Observation and evaluations of target processes and personnel
- Post-audit meeting and summary of observations and findings
- Implement corrective actions if necessary

Audit Reporting

- Complete audit report
- Review observations and findings with PM
- Implement additional corrective actions if necessary
- Track corrective actions and document closure of actions

APPENDIX B

LABORATORY-SPECIFIC STANDARD OPERATING PROCEDURES

(Laboratory procedures will be added once the request for proposal is completed)

APPENDIX C

DATA VALIDATION CHECKLISTS

Hexavalent Chromium

NYSDEC CATEGORY A REVIEW RECORD
Project: ________________________________
Method :________________________________
Laboratory and SDG(s): ________________________
Date:____________________________________
Reviewer:_________________________________

Review Level ☒ CATEGORY A

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all samples prepped and analyzed with the holding time (24hrs water)? YES NO

   Were all samples properly preserved? YES NO

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are rinse blanks free of contamination? YES NO

4. ☐ **Laboratory Control Sample Results**
   Were all LCS recoveries within 80-120? YES NO

5. ☐ **Matrix Spike Results**
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results within Lab limits? YES NO NA (circle one)

6. ☐ **Field Duplicates**
   Were Field Duplicates submitted/analyzed? YES NO

   Aqueous RPD within limit? (20%) YES NO NA (circle one)

   Soil RPD within limit? (35%) YES NO NA (circle one)

7. ☐ **Reporting Limits**: Were samples analyzed at a dilution? YES NO (circle one)

8. ☐ **Electronic Data Review and Edits:** Does the EDD match the Form I's? YES NO (circle one)

9. ☐ **Table Review:**
   Table 1 (Samples and Analytical Methods)
   Table 2 (Analytical Results)
   Table 3 (Qualification Actions)

   Were all tables produced and reviewed? YES NO (circle one)

GENERAL CHEMISTRY

NYSDEC PROJECT CATEGORY A REVIEW RECORD
Project: ______________________________________
Method :______________________________________
Laboratory and SDG(s): __________________________
Date:____
Reviewer:____
Review Level ☒ Category A Review

1. ☐ **Case Narrative Review and Data Package Completeness**

   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**

   Were all samples properly preserved? YES NO (circle one)

   Were all samples analyzed within the method/project holding times? YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Laboratory Control Sample Results**
   Were all results were within 80-120% limits? YES NO (circle one)

5. ☐ **Matrix Spike** (Lab Limits)

   Were MS/MSDs submitted/analyzed? YES NO (circle one)

   Were all results were within limits? YES NO NA (circle one)

6. ☐ **Field Duplicates** (RPD limits for soil=100, water = 50)
   Were Field Duplicates submitted/analyzed? YES NO
   Were RPDs within the limits? YES NO NA (circle one)

7. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

8. ☐ **Electronic Data Review and Edits**

   Does the EDD match the Form Is? YES NO (circle one)

9. ☐ **Table Review:**
   Table 1 (Samples and Analytical Methods)
   Table 2 (Analytical Results)
   Table 3 (Qualification Actions)
   Were all tables produced and reviewed? YES NO (circle one)

METALS

NYSDEC CATEGORY A REVIEW RECORD
Project: ________________________________
Method :________________________________
Laboratory and SDG(s): ________________________
Date:____________________________________
Reviewer:________________________________

Review Level ☒ CATEGORY A

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all samples prepared and analyzed with the holding time (6 months)? YES NO

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Laboratory Control Sample Results**
   Were all results were within 80-120% limits? YES NO (circle one)

5. ☐ **Matrix Spike**
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within 75-125% limits? YES NO NA (circle one)

6. ☐ **Field Duplicates**
   Were Field Duplicates submitted/analyzed? YES NO

   Aqueous RPD within limit? (20) YES NO NA (circle one)
   Soil RPD within limit? (35) YES NO NA (circle one)

7. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

8. ☐ **Electronic Data Review and Edits:** Does the EDD match the Form Is? YES NO (circle one)

9. ☐ **Table Review**:
   Table 1 (Samples and Analytical Methods)
   Table 2 (Analytical Results)
   Table 3 (Qualification Actions)
   Were all tables produced and reviewed? YES NO (circle one)

PCBs

NYSDEC PROJECT CATEGORY A REVIEW RECORD
Project: ______________________________________
Method :______________________________________
Laboratory and SDG(s): __________________________
Date:____
Reviewer:_______________________________________
Review Level ☒ Category A Review

1. ☐ **Case Narrative Review and Data Package Completeness**

   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   There is no holding time requirement in Method 8082 (Chapter 4, Table 4-1 of SW-846)

   Were samples properly preserved? YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Laboratory Control Sample Results**
   Were all results within limits? (50-150 project limits) YES NO (circle one)

5. ☐ **Matrix Spike** (soil and water limits: 29-135% and RPD of 20, RPD is 15 for Aroclor 1016)

   Were MS/MSDs submitted/analyzed? YES NO (circle one)

   Were all results were within limits? YES NO NA (circle one)

6. ☐ **Surrogate Recovery**
   Were all percent recoveries within limits? (30-150 project limits) YES NO (circle one)

7. ☐ **Field Duplicates** (RPD limits for soil=100, water = 50)
   Were Field Duplicates submitted/analyzed? YES NO
   Were RPDs within the limits? YES NO NA (circle one)

8. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

9. ☐ **Electronic Data Review and Edits**
   Does the EDD match the Form I's? YES NO (circle one)

11. ☐ **Table Review** **Table 1** (sample Listing), **Table 2** (results summary), **Table 3** (Reason Codes).
   Table 1 (Samples and Analytical Methods)
   Table 2 (Analytical Results)
   Table 3 (Qualification Actions)

Were all tables produced and reviewed? YES NO (circle one)

PESTICIDES

NYSDEC PROJECT CATEGORY A REVIEW RECORD
Project: ____________________________________
Method :____________________________________
Laboratory and SDG(s): _________________________
Date:____
Reviewer:______________________________________

Review Level ☒ Category A

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS

   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time (HT) and Sample Collection**
   Aqueous is 7days to extraction, solid is 14 days. HT met for all samples? YES NO (circle one)

   Were samples properly preserved? YES NO

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Laboratory Control Samples** (Use lab limits; refer to limits in SOP HW-44 Oct 2006 if no lab limits)

   Were all results within laboratory limits? YES NO (circle one)
   Limits used were: Lab Limits Region II SOP HW-44 Oct 2006 (circle one)

5. **Matrix Spike** (Use lab limits) (refer to limits listed in SOP HW-44 Oct 2006 if no lab limits are listed)

   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within laboratory limits? YES NO NA (circle one)

6. ☐ **Surrogate Recovery** (soil and water limits: 30-150%)

   Were all results within limits? YES NO (circle one)

7. **Field Duplicates** (RPD limits for soil=100, water = 50)

   Were Field Duplicates submitted/analyzed? YES NO

   Were RPDs within the limits? YES NO NA (circle one)

8. **Electronic Data Review and Edits**: Does the EDD match the Form I's? YES NO (circle one)

9. **Reporting Limits**: Were samples analyzed at a dilution? YES NO (circle one)

10. **Table Review**:
    Table 1 (Samples and Analytical Methods)
    Table 2 (Analytical Results)
    Table 3 (Qualification Actions)

Were all tables produced and reviewed? YES NO (circle one)

PFAS

NYSDEC PROJECT CATEGORY A REVIEW RECORD
Project:
Method : Modified 537
Laboratory and SDG(s): **SDG#**
Date:
Reviewer:
Review Level ☒ CATEGORY A

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all water samples extracted within the 14 day holding time, and extracts analyzed within 28 days? YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are field reagent blanks free of contamination? YES NO NA (circle one)

4. ☐ **Laboratory Control Sample Results** (70-130)
   Were all results within limits? YES NO (circle one)

5. ☐ **Matrix Spike** (water & soil limits: 70-130)
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within limits? YES NO NA (circle one)

6. ☐ **Surrogate Recovery (**Extracted Isotope Dilution Standards**)** (50-150)
   Were all results within limits? YES NO (circle one)
   Were any recoveries < 10%? (use professional judgment)

7. ☐ **Field Duplicates** (RPD limits = water:30, soil:30)
   Were Field Duplicates submitted/analyzed? YES NO

   Were RPDs within criteria. YES NO NA (circle one)

8. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

9. ☐ **Electronic Data Review and Edits**: Does the EDD match the Form I's? YES NO (circle one)

10. ☐ **Table Review**
    Table 1 (Samples and Analytical Methods)
    Table 2 (Analytical Results)
    Table 3 (Qualification Actions)
    Were all tables produced and reviewed? YES NO (circle one)

SVOC

NYSDEC PROJECT CATEGORY A REVIEW RECORD
Project:
Method : SW-846 8270D
Laboratory and SDG(s): **SDG#**
Date:
Reviewer:
Review Level ☒ CATEGORY A

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted? YES NO (circle one)

   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all water samples extracted within the 7 day holding time, and/or soil within 14 days?

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are field blanks free of contamination? YES NO NA (circle one)

4. ☐ **Laboratory Control Sample Results** (water&soil limits: Base/Neutral 50-140%, Acid 30-140%)
   Were all results within limits? YES NO (circle one)

5. ☐ **Matrix Spike** (water & soil limits: Base/neutral 50-140; Acid 30-140; RPD water = 20; RPD soil = 35)
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within limits? YES NO NA (circle one)

6. ☐ **Surrogate Recovery** (water and soil limits: Base/Neutral 50-140%, Acid 30-140%)
   Were all results within limits? YES NO (circle one)
   Were any recoveries < 10%? (Reject fraction compounds if recoveries are < 10%)

7. ☐ **Field Duplicates** (RPD limits = water:50, soil:100)
   Were Field Duplicates submitted/analyzed? YES NO

   Were RPDs within criteria. YES NO NA (circle one)

8. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

9. ☐ **Electronic Data Review and Edits**: Does the EDD match the Form Is? YES NO (circle one)

10. ☐ **Table Review**
    Table 1 (Samples and Analytical Methods)
    Table 2 (Analytical Results)
    Table 3 (Qualification Actions)

Were all tables produced and reviewed? YES NO (circle one)

Total Petroleum Hydrocarbons (TPH)

NYSDEC PROJECT CATEGORY A REVIEW RECORD
Project:
Method :
Laboratory and SDG(s): **SDG#**
Date:
Reviewer:
Review Level ☒ CATEGORY A REVIEW

1. ☐ **Case Narrative Review and COC/Data Package Completeness** COMMENTS
   Were problems noted?

   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all samples prepared and analyzed within the 14 day holding time? YES NO (circle one)

   Were all samples properly collected and preserved? YES NO

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)
   Are Trip blanks free of contamination? YES NO (circle one)
   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Matrix Spike** - Lab Limits (water and soil _________, water RPD ____, soil RPD ____)

   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within the Lab limits? YES NO NA (circle one)

5. ☐ **Laboratory Control Sample Results** - Region II (Water and soil 70-130%)

   Were all results were within Region II control limits? YES NO (circle one)

6. ☐ **Field Duplicates** – Nominal Limits (water RPD 50, soil RPD 100)

   Were Field Duplicates submitted/analyzed? YES NO
   Were all results were within Limits? YES NO NA (circle one)

7. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

8. ☐ **Electronic Data Review and Edits**
   Does the EDD match the Form Is? YES NO (circle one)

9. ☐ **Table Review:**
   Table 1 (Samples and Analytical Methods)
   Table 2 (Analytical Results)
   Table 3 (Qualification Actions)
   Were all tables produced and reviewed? YES NO (circle one)

VOCs

PROJECT CATEGORY A REVIEW RECORD
Project:
Method : SW-846 8260C
Laboratory: **SDG(s):**
Date:
Reviewer:
Review Level ☒ CATEGORY A

1. ☐ Case **Narrative Review and COC/Data Package Completeness** COMMENTS
   Were problems noted?

   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   All samples were analyzed within the 14 day holding time. YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are Trip blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Matrix Spike** - Region II limits (water and soil 70-130%, water RPD 20, soil RPD 35)
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results within the Region II limits? YES NO NA (circle one)

5. ☐ **Laboratory Control Sample Results** - Region II (Water and soil 70-130%)

   Were all results were within Region II control limits? YES NO (circle one)

6. ☐ **Surrogate Recovery** - Region II limits (water 80-120%, soil 70-130%)

   Were all results within Region II limits? YES NO (circle one)

7. ☐ **Field Duplicates** - Region II Limits (water RPD 50, soil RPD 100)
   Were Field Duplicates submitted/analyzed? YES NO

   Were all results within Region II Limits? YES NO NA (circle one)

8. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

9. ☐ **Electronic Data Review and Edits**
   Does the EDD match the Form Is? YES NO (circle one)

10. ☐ **Table Review**
    Table 1 (Samples and Analytical Methods)
    Table 2 (Analytical Results)
    Table 3 (Qualification Actions)
    Were all tables produced and reviewed? YES NO (circle one)

    Table 4 (TICs) Did lab report TICs? YES NO (circle one)

GENERAL CHEMISTRY

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method :
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all samples were all prepped and analyzed with the method holding time? YES NO

3. ☐ **QC Blanks**
   Are method blanks clean? YES NO (circle one)
   Are Initial and continuing calibration blanks clean? YES NO (circle one)

4. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify analytes that were not within criteria in the initial and/or continuing calibration standards? YES NO
   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Laboratory Control Sample Results**
   Were all results were within 80-120% limits? YES NO (circle one)

6. ☐ **Matrix Spike**
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within 75-125% limits? YES NO NA (circle one)

7. ☐ **Duplicates**
   Were Field Duplicates submitted/analyzed? YES NO

   Aqueous RPD within limit? (20%) YES NO NA (circle one)
   Soil RPD within limit? (35%) YES NO NA (circle one)
   Lab dup RPD <20% for water, 35% for soil values > 5X the CRQL (or ± CRQL) YES NO NA

8. ☐ Were both **Total and Dissolved** parameters reported? YES NO NA (circle one)
   If the dissolved concentration is > 20% of the total concentration then estimate (J) both results

9. ☐ **Percent Solids** < 50% for any soil/sediment sample? YES NO NA (circle one)
   If yes, use professional judgment

10. ☐ **Raw Data Review and Calculation Checks**

11. ☐ **Electronic Data Review and Edits** Does the EDD match the Form Is? YES NO (circle one)

12. ☐ **DUSR Table Review**
    Table 1 (Samples and Analytical Methods)
    Table 2 (Analytical Results)
    Table 3 (Qualification Actions)
    Were all tables produced and reviewed? YES NO (circle one)

METALS

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method(s):
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were all samples were all prepped and analyzed with the holding time (6 month). YES NO

3. ☐ **QC Blanks**
   Are method blanks clean? YES NO (circle one)

   Are Initial and continuing calibration blanks clean? YES NO (circle one)

4. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify any results that were not within criteria in the initial and/or continuing calibration standards? YES NO (circle one)

   Initial calibration criteria based on method guidance and continuing calibration standards recovery 90-110% (80-120% Hg)

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Laboratory Control Sample Results**
   Were all results were within 80-120% limits? YES NO (circle one)

6. ☐ **Matrix Spike**
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results were within 75-125% limits? YES NO NA (circle one)

7. ☐ **Duplicates**
   Were Field Duplicates submitted/analyzed? YES NO

   Aqueous RPD within limit? (20%) YES NO NA (circle one)
   Soil RPD within limit? (35%) YES NO NA (circle one)
   Lab Dup RPD <20% for water, 35% for soil values > 5X the CRQL (or ± CRQL) YES NO NA

8. ☐ Were both **Total and Dissolved** metals reported? YES NO NA (circle one)
   If the dissolved concentration is > 20% of the total concentration then estimate (J) both results using professional judgment

9. ☐ **Percent solids** < 50% for any soil/sediment sample? YES NO NA (circle one)
   If yes, estimate all results using professional judgment

10. ☐ **Raw Data Review and Calculation Checks**

11. ☐ **Electronic Data Review and Edits**
Does the EDD match the Form Is? YES NO (circle one)

12. ☐ **DUSR Tables Review**
Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

PCBs

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method:
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**

   Soil: 14 days from collection to extraction; 40 days from extraction to analysis
   Water: 7 days from collection to extraction; 40 days from extraction to analysis
   Hold time met for all samples? YES NO (circle one)

3. ☐ **QC Blanks**

   Are method blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. **Second Column Confirmation – Data Package Narrative Review**
   Did the laboratory narrative identify sample results for which the percent difference between columns was $\geq$ 25 (Region II criteria) for PCBs? YES NO NA (circle one)

   Did the laboratory qualify results based on the percent difference between columns? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify compounds that were not within criteria in the initial and/or continuing calibration standards? YES NO (circle one)

   Aroclors ICAL %RSD criteria = 20
   Aroclors Continuing Calibration %D criteria = 15

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

6. ☐ **Surrogate Recovery**

   Were all percent recoveries within limits? (30-150 project limits) YES NO (circle one)

7. ☐ **Matrix Spike**

   Were MS/MSDs submitted/analyzed? YES NO

   Were all percent recoveries and RPDs within limits? (soil and water project limit 29-135, RPD<20) YES NO NA (circle one)

8. ☐ **Duplicates**

Were Field Duplicates submitted/analyzed? YES NO

Were all results within Region II limits? (soil RPD<100, water RPD<50)

9. ☐ **Laboratory Control Sample Results**

Were all results within limits? (50-150 project limits) YES NO (circle one)

10. ☐ **Raw Data Review and Calculation Checks**

11. ☐ **Electronic Data Review and Edits**
Does the EDD match the Form Is? YES NO (circle one)

12. ☐ **Tables Review**
Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

PESTICIDES

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method:
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

2. ☐ **Holding time (HT) and Sample Collection**

   Soil: 14 days from collection to extraction; 40 days from extraction to analysis
   Water: 7 days from collection to extraction; 40 days from extraction to analysis
   Hold time met for all samples? YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)
   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Second Column Confirmation – Data Package Narrative Review**
   Did the laboratory narrative identify sample results for which the percent difference between columns was $\geq$ 25 (Region II criteria) for PCBs? YES NO NA (circle one)

   Did the laboratory qualify results based on the percent difference between columns? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify compounds that were not within criteria in the initial and/or continuing calibration standards? YES NO (circle one)

   Initial Calibration criteria %RSD=20 (alpha-BHC, delta-BHC = 25, Toxaphene = 30)
   Continuing Calibration criteria %D=20

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

6. ☐ **Surrogate Recovery** (soil and water limits: 30-150%)

   Were all results within limits? YES NO (circle one)

7. ☐ **Matrix Spike** (Use lab limits; refer to limits listed in SOP HW-44 Oct 2006 if no lab limits are listed)

   Were MS/MSDs submitted/analyzed? YES NO

   Were all results within laboratory limits? YES NO NA (circle one)

8. ☐ **Field Duplicates** (RPD limits for soil=100, water = 50)

   Were Field Duplicates submitted/analyzed? YES NO

   Were RPDs within the limits? YES NO NA (circle one)

9. ☐ **Laboratory Control Samples** (Use lab limits; refer to limits in SOP HW-44 Oct 2006 if no lab limits)

Were all results within laboratory limits? YES NO (circle one)
Limits used were: Lab Limits Region II SOP HW-44 Oct 2006 (circle one)

10. ☐ **Raw Data Review and Calculation Checks**

11. ☐ **Electronic Data Review and Edits**
Does the EDD match the Form Is? YES NO (circle one)

12. ☐ **Tables Review**
Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

PFAS

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method:
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Water: 14 days from collection to extraction; 28 days from extraction to analysis
   Hold time met for all samples? YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)
   Are rinse blanks free of contamination? YES NO NA (circle one)
   Are field reagent blanks free of contamination? YES NO NA (circle one)

4. ☐ **Instrument Tuning – Data Package Narrative Review**
   Did the laboratory narrative identify any results that were not within method criteria? YES NO (circle one)
   If yes, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Internal Standards – Data Package Narrative Review**
   (Area Limits = -50% to +100%, RTs within 30 seconds of daily CCAL standard (or ICAL mid-point if samples follow ICAL))
   Did the laboratory narrative identify any sample internal standards that were not within criteria? YES NO (circle one)

   Did the laboratory qualify results based on internal standard exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

6. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify compounds that were not within criteria in the initial and/or continuing calibration standards? YES NO (circle one)

   Initial Calibration %RSD = 15%, Continuing Calibration %D = 20%

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

7. ☐ **Surrogate Recovery** (Extracted Isotope Dilution Standards) (50-150)
   Were all results within limits? YES NO (circle one)
   Were any recoveries < 10%? (use professional judgment)

8. ☐ **Matrix Spike** (70-130)
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results within limits? YES NO NA (circle one)

9. ☐ **Duplicates** (RPD limits = water 30)

Were Field Duplicates submitted/analyzed? YES NO

Were RPDs within criteria? YES NO NA (circle one)

10. ☐ **Laboratory Control Sample Results** (70-130)

Were all results within limits? YES NO (circle one)

11. ☐ **Raw Data Review and Calculation Checks**

12. ☐ **Electronic Data Review and Edits**

Does the EDD match the Form Is? YES NO (circle one)

13. ☐ **Tables**

Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

SVOC

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method:
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Soil: 14 days from collection to extraction; 40 days from extraction to analysis
   Water: 7 days from collection to extraction; 40 days from extraction to analysis
   Hold time met for all samples? YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)
   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Instrument Tuning – Data Package Narrative Review**
   Did the laboratory narrative identify any results that were not within method criteria? YES NO (circle one)
   If yes, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Internal Standards – Data Package Narrative Review**
   (Area Limits = -50% to +100%, RTs within 30 seconds of daily CCAL standard (or ICAL mid-point if samples follow ICAL))
   Did the laboratory narrative identify any sample internal standards that were not within criteria? YES NO (circle one)

   Did the laboratory qualify results based on internal standard exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

6. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify compounds that were not within criteria in the initial and/or continuing calibration standards? YES NO (circle one)

   Control Limits (Region II HW-22): Initial Calibration %RSD = 15%, Continuing Calibration %D = 20%
   Average RRF should be ≥ 0.05 (or reject NDs, J detects or use professional judgment to J/UJ)

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

7. ☐ **Surrogate Recovery** (water and soil limits: Base/Neutral 50-140%, Acid 30-140%)
   Were all results within limits? YES NO (circle one)
   Were any recoveries < 10%? (Reject fraction compounds if recoveries are < 10%)

8. ☐ **Matrix Spike** (water & soil limits: Base/Neutral 50-140%, Acid 30-140%) (RPD soil=35,water=20)
   Were MS/MSDs submitted/analyzed? YES NO

   Were all results within limits? YES NO NA (circle one)

9. ☐ **Duplicates** (RPD limits = water:50, soil:100)
Were Field Duplicates submitted/analyzed? YES NO

Were RPDs within criteria? YES NO NA (circle one)

10. ☐ **Laboratory Control Sample Results** (water&soil limits: Base/Neutral 50-140%, Acid 30-140%)
Were all results within limits? YES NO (circle one)

11. ☐ **Raw Data Review and Calculation Checks**

12. ☐ **Electronic Data Review and Edits**
Does the EDD match the Form Is? YES NO (circle one)

13. ☐ **Tables and TIC Review**
Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

Table 4 (TICs) Did lab report TICs? YES NO (circle one)

VOCs

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method:
Laboratory: **SDG(s):**
Date:
Reviewer:

Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

1. ☐ **Case Narrative Review and COC/Data Package Completeness** COMMENTS
   Were problems noted?
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   All samples were analyzed within the 14 day holding time. YES NO (circle one)

3. ☐ **QC Blanks**
   Are method blanks free of contamination? YES NO (circle one)

   Are Trip blanks free of contamination? YES NO (circle one)

   Are Rinse blanks free of contamination? YES NO NA (circle one)

4. ☐ **Instrument Tuning – Data Package Narrative Review**
   Did the laboratory narrative identify any results that were not within method criteria? YES NO (circle one)
   If yes, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Instrument Calibration – Data Package Narrative Review**
   Did the laboratory narrative identify compounds that were not within criteria in the initial and/or continuing calibration standards? YES NO (circle one)

   Initial Calibration %RSD = 20% **(30% for 1,1-DCE, chloroform, 1,2-DCP, toluene, ethylbenzene, VC)**
   Initial Avg RRF and Continuing RRF should be ≥ 0.05 and 0.10 for Chloromethane, 1,1-Dichloroethane, Bromoform and 0.30 for Chlorobenzene and 1,1,2,2-Tetrachloroethane

   Continuing Calibration %D = 20%

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

6. ☐ **Internal Standards – Data Package Narrative Review**
   (Area Limits = -50% to +100%, RTs within 30 seconds of daily CCAL standard (or ICAL mid-point if samples follow ICAL)
   Did the laboratory narrative identify any sample internal standards that were not within criteria? YES NO (circle one)

   Did the laboratory qualify results based on internal standard exceedances? YES NO
   If yes to above, use professional judgment to evaluate data and qualify results if needed

7. ☐ **Surrogate Recovery** - Region II limits (water 80-120%, soil 70-130%)

   Were all results within Region II limits? YES NO (circle one)

8. ☐ **Matrix Spike** - Region II limits (water and soil 70-130%, water RPD 20, soil RPD 35)

   Were MS/MSDs submitted/analyzed? YES NO

   Were all results within the Region II limits? YES NO NA (circle one)

9. ☐ **Duplicates** - Region II Limits (water RPD 50, soil RPD 100)

Were Field Duplicates submitted/analyzed? YES NO

Were all results within Region II limits? (soil RPD<100, water RPD<50) YES NO NA

10. ☐ **Laboratory Control Sample Results** - Region II (Water and soil 70-130%)

Were all results were within Region II control limits? YES NO (circle one)

11. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

12. ☐ **Raw Data Review and Calculation Checks**

13. ☐ **Electronic Data Review and Edits**
Does the EDD match the Form Is? YES NO (circle one)

14. ☐ **Tables and TIC Review**
Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

Table 4 (TICs) Did lab report TICs? YES NO (circle one)

VOCs in Air

NYSDEC DUSR PROJECT CHEMIST REVIEW RECORD
Project:
Method : TO-15
Laboratory and SDG(s): **SDG#**
Date:
Reviewer:
Review Level ☒ NYSDEC DUSR ☐ USEPA Region II Guideline

Control limits are from EPA Region 2 - SOP# HW-31, October 2006.

1. ☐ **Case Narrative Review and Data Package Completeness** COMMENTS
   Were problems noted?
   Are Field Sample IDs and Locations assigned correctly? YES NO (circle one)
   Were all the samples on the COC analyzed for the requested analyses? YES NO (circle one)

2. ☐ **Holding time and Sample Collection**
   Were samples analyzed within the 30 day holding time? YES NO (circle one)

3. ☐ **QC Blanks** (use 5x rule for calculating action levels)
   Are method blanks free of contamination? YES NO (circle one)

4. ☐ **Instrument Tuning – Data Package Narrative Review**
   Did the laboratory narrative identify any results that were not within method criteria? YES NO (circle one)
   If yes, use professional judgment to evaluate data and qualify results if needed

5. ☐ **Instrument Calibration - Data Package Narrative Review**
   Did the laboratory narrative identify compounds that were not within method criteria (%RSD $\leq$30; %D $\leq$30) in the initial calibration and/or continuing calibration standards? YES NO

   Did the laboratory qualify results based on initial or continuing calibration exceedances? YES NO NA
   If yes to above, use professional judgment to evaluate data and qualify results if needed

6. ☐ **Internal Standards – Data Package Narrative Review**
   (Area Limits = +40% to -40%, RTs within 20 seconds of daily CCAL standard (or ICAL mid-point if samples follow ICAL))
   Did the laboratory narrative identify any sample internal standards that were not within criteria? YES NO (circle one)

   Did the laboratory qualify results based on internal standard exceedances? YES NO NA
   If yes to above, use professional judgment to evaluate data and qualify results if needed

7. ☐ **Surrogate Recovery**

   Were all results within laboratory limits? YES NO (circle one)

8. ☐ **Field Duplicates**
   Were Field Duplicates submitted/analyzed? YES NO

   Were all results were within criteria (Field Dup RPD goal = 50). YES NO NA (circle one)

9. ☐ **Laboratory Control Sample Results** (limits 70-130%)

   Were all results within limits? YES NO (circle one)

10. ☐ **Reporting Limits:** Were samples analyzed at a dilution? YES NO (circle one)

11. ☐ **Raw Data Review and Calculation Checks**

12. ☐**Electronic Data Review and Edits**

Does the EDD match the Form Is? YES NO (circle one)

13. ☐ **Tables Review**

Table 1 (Samples and Analytical Methods)
Table 2 (Analytical Results)
Table 3 (Qualification Actions)
Were all tables produced and reviewed? YES NO (circle one)

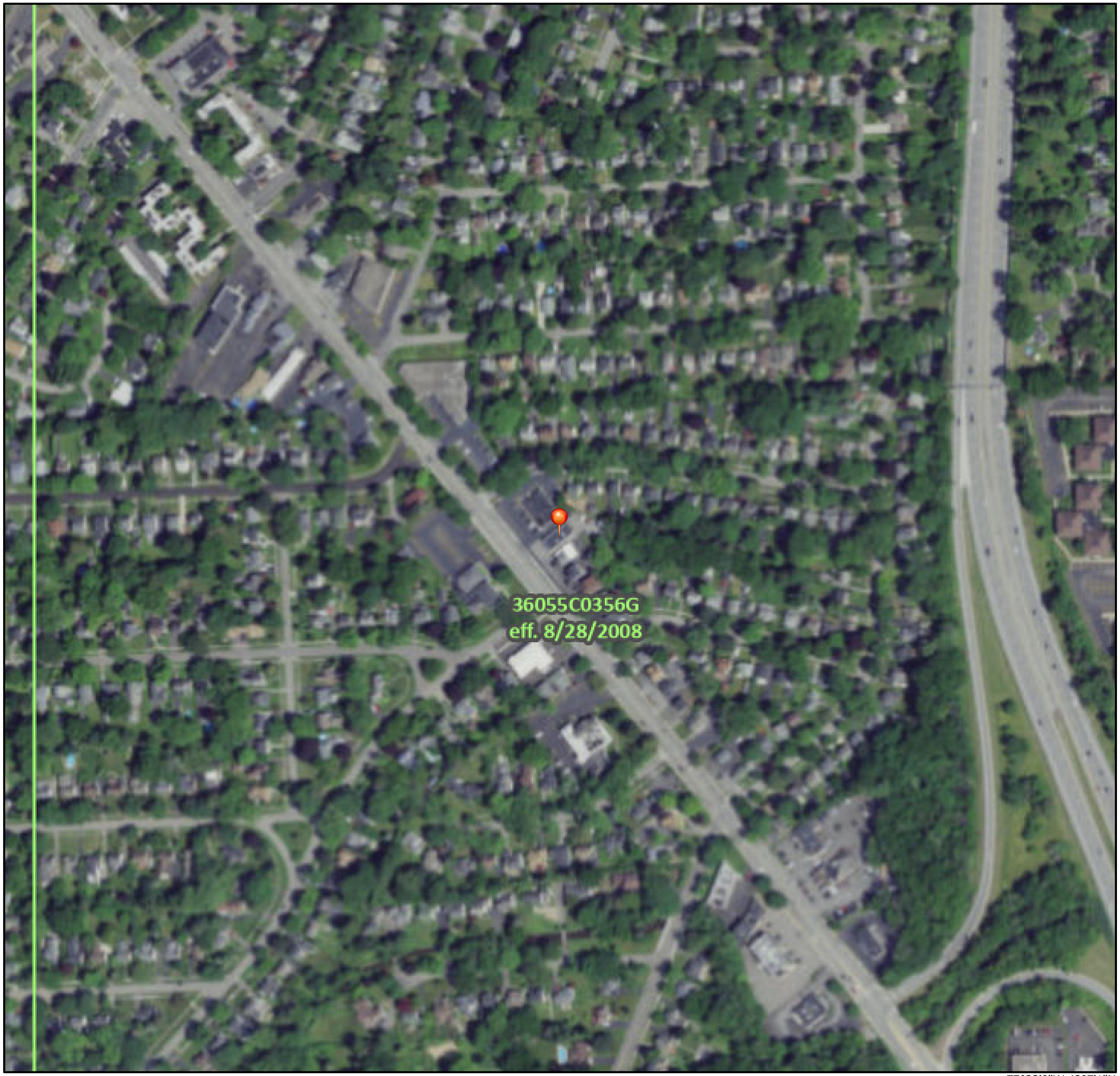
Table 4 (TICs) Did lab report TICs? YES NO (circle one)

APPENDIX F – FEMA FLOOD INSURANCE MAP

National Flood Hazard Layer FIRMette

FEMA

77°33'46"W 43°7'27"N



77°33'9"W 43°7'1"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- B 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- 8 Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 1/27/2022 at 11:09 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

APPENDIX G - SITE MANAGEMENT FORMS

Summary of Green Remediation Metrics for Site Management

Site Name: ______________________________ Site Code: ____________________
Address: ________________________________ City: _________________________
State: ____________ Zip Code: _________ County: _______________________

Initial Report Period (Start Date of period covered by the Initial Report submittal)
Start Date: ____________________

Current Reporting Period
Reporting Period From: ____________________ To: _________________________

Contact Information
Preparer's Name: __________________________ Phone No.: ___________________
Preparer's Affiliation: ________________________________

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	**Total to Date**
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	**Total to Date (miles)**
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	**Total to Date (gallons)**
Total quantity of water used on-site		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	**Total to Date (acres)**
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR
I, ____________________________ (**Name**) do hereby certify that I am ______________________ (**Title**) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application. ____ **Date** **Contractor**