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Remedial Investigation Work Plan

Hamilton Hill II – Target Area 1 Site
830 & 834 Albany Street
City of Schenectady
Schenectady County, New York

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"I, Kirk Moline., certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this work plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with DER Technical Guidance for Site Investigation and Remediation (DER-10)."

REMEDIAL INVESTIGATION WORK PLAN
HAMILTON HILL II – TARGET AREA 1 SITE
830 & 834 ALBANY STREET
CITY OF SCHENECTADY, SCHENECTADY COUNTY, NEW YORK

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1.0 INTRODUCTION & PURPOSE

1.1 Introduction

This Remedial Investigation Work Plan (RIWP) will be implemented to further assess environmental conditions at the Hamilton Hill II – Target Area 1 Site (the "Site") located at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York (see Figure 1: Site Location Map).

The Site developer, Hamilton Hill II Limited Partnership, has been accepted into the Brownfield Cleanup Program (BCP) as a "Volunteer" per the executed Brownfield Cleanup Agreement (BCA). The Site will be redeveloped with low to moderate income residential apartments with community centers, open recreational areas and parking.

1.2 Purpose and Scope

The purpose of this RIWP is to establish guidelines and procedures for the Remedial Investigation (RI). The proposed RI incorporates the findings of previous Site investigations that were completed prior to acceptance into the BCP to supplement environmental data that will be collected as a function of this RIWP under the BCP. The environmental data will be used to further assess the nature and extent of Site contaminants and to evaluate the fate and transport mechanisms applied to the contaminants so that an appropriate remedy can be incorporated into the redevelopment plans for the Site.

The New York State Department of Environmental Conservation (NYSDEC) has recently required that Sites in the BCP collect representative soil and groundwater samples for analysis for emerging contaminants. These emerging contaminants are 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS).

The proposed RI includes the collection of surface soil samples for visual and/or olfactory evidence of contamination and laboratory analyses; the advancement of test borings to facilitate the collection of subsurface fill and native subsurface soil samples for visual and/or olfactory evidence of contamination and laboratory analysis; to further evaluate the Site's subsurface conditions; installation of monitoring wells and soil vapor sampling points; and collection of groundwater and soil vapor samples for laboratory analysis.

This RIWP outlines a systematic investigative approach specific to the Site considering its history, geology and hydrogeology, known or suspected contaminants, and surrounding land use. The goal of this RIWP is to support the development of potential remedial alternatives, as necessary, which will allow the Volunteer to develop a Remedial Action Work Plan (RAWP) for NYSDEC review and approval.

The existing Site buildings will be demolished as part of the redevelopment activity. This work will be conducted as a separate scope of work. The site buildings will be demolished to top of the slab on grade floors, and the foundation walls will be left in place. Soils will not be disturbed during the demolition work. Following demolition of the buildings, the site will be secured with chain link fencing.

2.0 SITE DESCRIPTION & HISTORY

2.1 Site Description

The site is located at 830 and 834 Albany Street in the City of Schenectady, Schenectady County, New York (see Figure 1: Site Location Map). The site is approximately 0.81 acres and consists of two irregular shaped parcels occupying the southwest and southeast corners of the intersection of Albany Street and Craig Street. The Site is comprised of vacant lots and dilapidated multi-family residential and commercial buildings. The Site is identified on the City of Schenectady tax map as tax map numbers 49.33-2-33.1 (830 Albany Street) and 49.33-4-10.1 (834 Albany Street).

The Site is improved with four (4) vacant multi-story structures, and vacant lots that were previously developed. The vacant lots contain overgrown vegetation or are covered with gravel and used in part for parking and storage. The Site is accessed from both Albany and Craig Streets.

2.2 Adjacent Land Use

Surrounding land usage consists of single and multi-family residential dwellings and commercial development.

2.3 Site History

Prior to the turn of the 20th Century, the Site and surrounding area were mainly vacant land. Beginning in the early 1900s, the Site and surrounding area began to be developed with residential apartments and homes, and various commercial establishments.

Past commercial uses at the Site have included two (2) dry cleaning operations, a bakery and retail store. The former dry cleaner entities occupied buildings on the Site’s two (2) parcels. The bakery and retail store occupied the building on the 834 Albany Street parcel.

2.4 Site Utilities

Site utilities are currently not in service. Electricity and natural gas were previously supplied to the site by National Grid. Municipal water and sewer service were provided by the City of Schenectady. A private utility survey will be conducted prior to the commencement of subsurface investigations during the RI.

2.5 Site Drainage Features

Precipitation generally infiltrates into vegetated areas of the Site and/or sheet flows across impervious portions of the Site towards catch basins located along Craig Street and Albany Street.

2.6 Topographic Description and Nearby Surface Water Bodies

The subject site incorporates approximately 0.81 acres of fairly level land. According to the United States Geological Survey (USGS) Topographic Map, the Site lies at approximately 350 feet above Mean Sea Level. The Site is comprised of fairly level land, sloping gently to the north. The Mohawk River lies approximately 5,800 feet to the northeast of the Site.

2.7 Site Geology

Soils are mapped by the United States Department of Agriculture Web Soil Survey as Urban land-Colonie complex. These well drained soils are found on beach ridges and deltas and consist of loamy fine sand and fine sand. The Site's surficial geology is mapped as lacustrine delta.

Site specific soil conditions generally consist of brown fine to medium sand with traces of silt to depths of approximately 13 to 14 feet beneath the ground surface which is underlain by brown sand and silt to approximately 18 feet beneath the ground surface. Traces of various fill materials (concrete, gravel, brick, asphalt, glass) were noted in the upper seven (7) feet of the soil stratum. Groundwater is located at approximately 10 to 14 feet below the ground surface. Inferred groundwater flow direction is from the south-southwest towards the north-northeast.

2.8 Previous Environmental Investigations

The following environmental reports were completed for the Site. Copies of the reports are provided in the BCP Application document for the project.

-Phase I Environmental Site Assessment, Former Ralph's Cleaners Site, Albany and Craig Streets, City of Schenectady, Schenectady County, New York, prepared by C.T. Male Associates, dated September 28, 2015 (2015 Phase I ESA Report).

-Phase II Environmental Site Assessment, Former Ralph's Dry Cleaners, 830 Albany Street, City of Schenectady, Schenectady County, New York, prepared by C.T. Male Associates, dated August 2, 2016 (2016 Ralph's Dry Cleaners Phase II ESA Report).

-Phase I Environmental Site Assessment Update, Hillside View Phase I Development Site, prepared by C.T. Male Associates, dated November 17, 2016 (2016 Phase I ESA Update Report). *(This ESA includes the 310 Craig Street parcel of the Hamilton Hill II – Target Area 1 Site).

-Phase I Environmental Site Assessment, Hamilton Hill II Target Area 1 Site, 306 & 308 Craig Street and 811, 827, 831, 834 & 840 Albany Street, City of Schenectady, Schenectady County, New York, prepared by C.T. Male Associates, dated August 23, 2017 (2017 Phase I ESA Report).

-Surface Soil Sampling Results Summary, Hamilton Hill II – Target Area 1 Site, prepared by C.T. Male Associates, dated October 12, 2017 (2017 Surface Soil Sampling Report).

-Updates to the Phase II Environmental Site Assessment for the Former Ralph's Dry Cleaners, Hamilton Hill II – Target Area 1 Site, prepared by C.T. Male Associates, dated October 12, 2017 (2017 Ralph's Dry Cleaners Phase II ESA Update Report).

-Supplemental Phase II Environmental Site Assessment Hamilton Hill II Target Area 1, prepared by C.T. Male Associates, dated August 24, 2018 (2018 Phase II ESA Report).

2.9 Environmental Site History

Based upon the investigations conducted to date, the primary contaminants of concern at the Site include semi-volatile organic compounds (SVOCs) and metals in soil, and solvents, petroleum, acetone, SVOCs and metals in groundwater.

In general, several metals were detected at concentrations exceeding regulatory criteria in 20 of 24 shallow soil samples and two (2) subsurface soil samples collected across the Site. Lead, mercury and zinc were detected at the highest frequency followed to a lesser degree by arsenic, barium and copper. Several SVOCs were detected above regulatory criteria in one (1) surface soil sample and two (2) subsurface soil samples collected from the 834 Albany Street Parcel. Petroleum-type contaminants and solvents are present at concentrations exceeding regulatory criteria in groundwater beneath the 830 Albany Street Parcel that contains the former dry cleaning operation and abandoned storage tanks. SVOCs and metals are present at concentrations exceeding regulatory criteria in groundwater beneath the 834 Albany Street Parcel. The following sections provide more detail regarding contaminants in the Site's soil and groundwater.

Shallow Soil (0-2′)

Twenty-four (24) shallow soil samples were collected from within the 830 and 834 Albany Street parcels. The samples were collected from the depth interval of zero to 2 feet below existing grades and beneath any pavement surface, if present. Twenty (20) of these samples exhibited concentrations of metals (namely lead, mercury and zinc) above their respective Unrestricted Use SCOs. Therefore, the upper two-feet of the fill/soils over the entire Site is considered to be impacted above one or more Unrestricted Use SCOs.

Subsurface Soil (>2′)

Other than the zero to 2 foot interval soil samples discussed above, no other subsurface soil samples have been collected or analyzed within the 830 Albany Street parcel. Two (2) subsurface soil samples were collected from the 834 Albany Street parcel from the depth intervals of 2 to 4 and 4 to 6 feet, at two separate boring locations. Several SVOCs were detected above their respective SCOs in the 2 to 4 foot sample interval at GP-12, and lead and barium (no SVOCs) were detected above their SCOs in the 4 to 6 foot sample interval at GP-11.

Groundwater

Groundwater samples were collected from five (5) monitoring wells (MW-1 through MW-5) installed within the 830 Albany Street parcel and one (1) monitoring well (GP8/MW2) installed within the 834 Albany Street parcel.

Four (4) volatile organic compounds (VOCs) were detected at concentrations that moderately exceeded regulatory standards and guidance values in all of the sampled wells at the 830 Albany Street Parcel. The VOCs included two (2) solvents (cis-1,2-dichloroethene and tetrachloroethene), toluene and acetone.

Six (6) SVOCs and four (4) metals (iron, lead, manganese and sodium) were detected at concentrations that moderately exceeded regulatory standards and guidance values in the sampled well at the 834 Albany Street parcel.

2.9.1 Historical Chemical Use

Specific information pertaining to historical chemical use is unknown. Ralph's Cleaners, a former occupant of the 830 Albany Street parcel, was listed on the RCRA generator list with EPA ID No. NYD981082357. Although currently listed as no longer regulated, this tenant is indicated to have previously generated spent halogenated solvents.

2.9.2 Environmental Orders, Decrees and Violations Associated with the Site

There are no United States Environmental Protection Agency (USEPA) or NYSDEC orders, decrees and violations relating to the Site to the best of our knowledge.

NYSDEC Spill No. 1603105 was assigned to the site based on the findings of the Phase II Environmental Site Assessment on the 830 Albany Street Parcel where elevated levels of VOCs were identified in groundwater. The spill was issued a closed, not meeting standards status on November 30, 2016.

3.0 OBJECTIVES, SCOPE & RATIONALE

3.1 Objectives

The objectives of this RIWP are to: delineate the areal and vertical extent of contaminants within Site media; determine the surface and subsurface characteristics of the Site including topography, geology and hydrogeology; identify the sources of contamination, the migration pathways, and actual or potential receptors of contaminants on or through air, soil, bedrock, sediment, groundwater, surface water, utilities, and structures; evaluate public health exposure through completion of a qualitative human heath exposure assessment; and to develop remedial alternative(s) to address environmentally impacted media.

Specific areas of concern identified during previous assessments of the site that will be further evaluated include the former dry cleaning operation on the northeastern corner of the 830 Albany Street parcel; a suspected underground petroleum storage tank to the south of the dry cleaner building within the 830 Albany Street parcel; and petroleum storage tanks located in the basement of the dry cleaner building on the 830 Albany Street parcel.

3.2 Scope and Rationale

The scope of work was developed based on Site conditions, the existing data collected from the previous investigations, the Site's planned future use for multi-family housing and the NYSDEC's new emerging contaminant requirement to assess the Site's surface soil and groundwater for 1,4-dioxane and PFAS.

Based on the previous Site investigations surface and subsurface soils have been impacted by various metals and SVOCs. Groundwater has been impacted by VOCs, SVOCs and metals. The previous environmental investigations did not evaluate Site media for pesticides, polychlorinated biphenyls (PCBs) or cyanide which will be evaluated in Site media (surface soil, subsurface soil and groundwater) as a function of this RI.

PFAS and 1,4-dioxane are included in the Site's potential chemical parameters of concern, not because of Site history, but because of the NYSDEC requirements to assess the Site's surface soil and groundwater for emerging contaminants.

As the upper two-feet of the fill/soils over the entire Site are considered to be impacted above one or more Unrestricted Use SCOs, these soils will be addressed as a function of the Remedial Action. Surface soil samples (0-2 inches or 0-6 inches for VOCs) will be collected in areas of exposed soil or vegetation to further evaluate exposures as discussed further in Section 3.2.1.

The type and analysis for all samples to be collected for laboratory analysis during the RI are summarized in Table 1: Analytical Sampling Program, which is presented at the end of this section.

The scope of work will include the following:

- Collection and laboratory analysis of surface soil samples.
- Advancement of test borings to characterize the Site's subsurface fill and native soils, to aid in the collection of fill and native soil samples for laboratory analysis, and for installation of monitoring wells and soil vapor probes.
- Collection and laboratory analysis of groundwater samples from existing and newly installed monitoring wells.
- Collection and laboratory analyses of soil vapor samples from the soil vapor probes.

3.2.1 Surface Soil Sampling

Six (6) surface soil samples are proposed to be collected at the sampling locations identified as RISS1 to RISS6 on Figure 2. The number of samples to be collected and the distribution of the sampling points provide overall coverage of the Site in consideration of the previous investigations completed within the Site and the contemplated remedial action.

Surface soil samples will be collected within the 830 Albany Street parcel from 4 locations (RISS1 through RISS4). These sample locations were selected in areas of exposed soil or vegetation. The sampling locations are generally located on the western portions of the 830 Albany Street parcel and avoid areas currently or formerly occupied by site buildings, blacktop, and crushed stone driveways/parking areas. RISS5 and RISS6 will be collected from the eastern portion of the 834 Albany Street parcel as the western portion of the parcel is improved with a building.

The samples will be collected from the depth interval of 0-2 inches below existing grades (0-6 inches for VOCs), immediately beneath the vegetative root zone in vegetated areas of the Site. The sampling depth intervals are based on assessing human exposure to soil per DER-10-3.5.1(b)-1. Based on the Site's location in an urbanized area within the City of Schenectady, assessing ecological resource exposure to soil per DER-10-3.5.1(b)-2 is not warranted at this time.

The surface soil samples will be collected utilizing a field decontaminated (alconox wash with tap water rinse) hand auger, shovel, pick-ax, trowel and/or other field sampling equipment in accordance with the Field Sampling Plan (FSP) in Appendix A.

The surface soil samples will be further assessed employing organoleptic perception, and scanned for organic vapors using a photoionization detector (PID). Surface soil samples collected from the 0 to 2 inch depth interval will be submitted for laboratory analyses for the Target Compound List (TCL) for SVOCs, pesticides and PCBs, the Target Analyte List (TAL) for metals (including mercury and hexavalent chromium), and cyanide. Surface soil samples collected from the 0 to 6 inch depth interval will be submitted for laboratory analyses for the TCL for VOCs. The surface soil samples (0 to 6 inches) collected from RISS1, RISS3 and RISS6 will also be analyzed for emerging contaminants 1,4-dioxane and PFAS.

The rationale for the surface soil sampling and the sampling frequency is to evaluate the environmental quality of surface soil across the Site to aid in the selection of a remedy that will be protective of human health and the environment. The number of surface soil samples is based on the proposed remedial action for the site on the basis of the previous shallow sampling conducted at the site.

3.2.2 Subsurface Soil Sampling

The rationale for the subsurface soil sampling and the sampling frequency is to evaluate the environmental quality of subsurface soil/historical fill material across the Site to aid in the selection of a remedy that will be protective of human health and the environment.

Sixteen (16) subsurface soil samples are proposed to be collected at the sampling locations identified as RISB1 to RISB16 on Figure 2. The number of samples to be collected and the distribution of the sampling points provide overall coverage of the Site in consideration of the previous investigations completed within the Site.

The borings will be completed utilizing hollow stem auger (HSA) drilling methods. The locations may be modified at the time of drilling based on buried utility locations and subsurface anomalies mapped by the utility locator. The NYSDEC Project Manager will be notified if the locations of the test borings are modified. The test boring program and sample collection will conform to the FSP in Appendix A. The subsurface soil samples will be further assessed employing organoleptic perception (sight and smell), and scanned for organic vapors using a PID.

Subsurface soil samples representative of historical fill material will be collected within the 830 Albany Street parcel from 14 locations (RISB1 through RISB14), based on a sampling grid of 50 feet by 50 feet with additional locations at the areas of concern. The samples from RISB1 through RISB12 will be collected from the depth interval of 2 to 4 feet below existing grades. If any RI compound(s) of concern (COC) is detected above its Unrestricted Use SCO, additional soil samples from deeper soil sample intervals (i.e. 4 to 6 feet, etc.) will be collected and analyzed for the COC(s) detected above its Unrestricted Use SCO in the sample interval from immediately above. The soil sample from RISB13 will be collected from the depth interval of 8 to 10 feet below existing grades at the anticipated depth of the bottom of the tanks located in the basement of the former dry cleaning building. The soil sample from RISB14 will be collected at a depth interval of 8 to 10 feet below existing grades at the anticipated depth of the underground storage tank (UST) located to the south of the dry cleaning building. In addition, an additional soil sample will be collected from RISB10 from 8 to 10 feet to further evaluate the UST.

Subsurface soil samples will be collected within the 834 Albany Street parcel from two locations (RISB15 through RISB16). The samples will be collected from the depth interval of 6 to 8 feet below existing grades at RISB16 (in the vicinity of GP-11 and GP-12), and 2 to 4 feet below existing grades at RISB15. If any RI compound(s) of concern (COC) is detected above its Unrestricted Use SCO, additional soil samples from deeper soil sample intervals will be collected and analyzed for the COC(s) detected above its Unrestricted SCO in the sample interval from immediately above. The soil samples from the deeper intervals will be collected at the same time as the planned samples to be analyzed in the laboratory will be extracted and placed on-hold at the laboratory until laboratory results are received for the planned intervals as specified above. For VOCs, each of the samples will be extracted within the 48 hour time frame from sample collection. The planned samples will be analyzed on a 48 hour rush turnaround time in order for additional samples to be able to be analyzed within the holding times as presented in Section 15.0 of the Quality Assurance Project Plan (QAPP).

The subsurface soil samples will be collected utilizing a field decontaminated (alconox wash with tap water rinse) split spoon sample barrel and/or other field sampling equipment in accordance with the FSP in Appendix A. New, nitrile gloves will be worn by sampling personnel at each subsurface soil sampling location.

In addition to sampling locations RISB1 through RISB16, four hand auger locations (RIHA1 through RIHA4) will be advanced within the Site following the demolition work. RIHA1 through RIHA3 will be advanced in the basement area of the former dry cleaning building on the 830 Albany Street parcel, and RIHA4 will be advanced in the basement area of the building on the 834 Albany Street parcel building. Hand augers will be employed for these locations as the site building foundations will not allow access to traditional drilling equipment. The hand augers will allow for additional assessment of the areas of concern.

The proposed hand auger locations are depicted on Figure 2; however, if subjective evidence of impacts or a former release area are evident (staining/odors), the sample locations will be adjusted accordingly. At each sample location a concrete coring machine or similar power tool will be utilized to core through the concrete floor slab. A hand auger will then be utilized to advance a boring to depths up to 4 feet below the elevation of the basement floor surface. The soil samples will be assessed employing organoleptic perception, and scanned for organic vapors using a PID. If groundwater is not present, soil samples will be collected from each of the hand auger locations from the depth interval of 0 to 2 feet below the bottom of the floor slab. If subjective evidence of contamination is present, a second sample will be collected from the depth interval of 2 to 4 feet below the foundations' floor slab if groundwater is not encountered.

The soil samples from the soil borings and hand auger locations will be submitted for laboratory analyses for the TCL VOCs, SVOCs, pesticides and PCBs, TAL metals (including mercury and hexavalent chromium), and cyanide.

3.2.3 Advancement of Test Borings - Native Soil Sampling

Nine test borings, each converted to monitoring wells, will be installed at the approximate locations identified on Figure 2. Deeper wells will be constructed at three of the locations to assess chlorinated solvents in groundwater deeper within the overburden strata.

The borings will be completed utilizing HSA drilling methods. The locations may be modified at the time of drilling based on buried utility locations and subsurface anomalies mapped by the utility locator. The NYSDEC Project Manager will be notified if the locations of the test borings are modified. The test boring program and sample collection will conform to the FSP in Appendix A.

The borings will be completed to further assess the environmental quality of the soils beneath the fill materials mantling the Site, and support the installation of the shallow and deep monitoring wells to assess groundwater at shallow and deeper depths within the aquifer.

Test borings/monitoring wells RIMW1 through RIMW6 are shallow borings advanced to depths of approximately 20 feet. Borings RIMW3D, RWMW4D and RIMW6D are deeper borings advanced to the top of the first hydrostratigraphic confining layer which may be encountered at depths of approximately 50 feet below existing grades.

Discrete samples that are representative of native soil above the water table (approximately 10 to 15 feet below existing grade) will be collected from each of the borings for visual and/or olfactory evidence of contamination and laboratory analyses. In addition one sample representative of native soil will be collected from RISB1. At least one soil sample will be collected from each of the shallow borings above the water table. The samples will be analyzed for the TCL for VOCs, SVOCs, pesticides and PCBs, the TAL for metals (including mercury and hexavalent chromium), and cyanide. The samples will be placed in laboratory provided containers and stored on ice in laboratory provided coolers.

The subsurface native soil samples will be collected by advancing a field decontaminated (alconox wash and tap water rinse) two (2) foot long split-spoon sampling barrel to the desired sampling depth interval employing a drill rig. The drilling inspector will then retain the requisite samples for visual and/or olfactory evidence of contamination and laboratory analyses. The drilling inspector will wear a new pair of nitrile gloves for each sample collected. Soil samples exhibiting visual and/or olfactory evidence of petrochemical type contamination will be subjected to laboratory analysis. The soil sample interval exhibiting the greatest level of impact based on subjective observation will be selected for laboratory analysis. If none of the recovered soil samples exhibit subjective impacts, a soil sample will be collected from the immediately above the water table. The soil sampling procedures will conform to the FSP in Appendix A.

The sample barrels with be decontaminated between use with an Alconox wash and tap water rinse. Other drilling tools coming in contact with Site fill materials and native soils during advancement of the borings will be decontaminated using a high pressure/temperature washer and tap water prior to the commencement of the borings and between each boring over a temporary decontamination pad prior to the commencement of the borings and between each boring.

3.2.4 Installation of Monitoring Wells

Two (2)-inch diameter monitoring wells with PVC slotted screens and risers will be installed in the open boreholes. For the shallow monitoring wells (RIMW1 through RIMW6), the screened portion of the monitoring well will straddle the water table approximately five (5) feet above and five (5) feet below the water table. For the deeper monitoring wells (RIMW3D, RWMW4D and RIMW6D), an approximate five (5) foot screen will be set at the bottom of the borehole and sealed off from the overburden above the screened interval. The monitoring wells will be finished with a surface seal and protected with lockable protective enclosures. Monitoring well depths, and screen lengths and depths will be determined by the environmental scientist/geologist by maintaining measurements of screen and riser placed in the borehole. The monitoring wells will be installed in accordance with the FSP in Appendix A.

3.2.5 Monitoring Well Development

Once installed, each monitoring well will be developed to remove accumulated fine sediment within the well and to establish a hydraulic connection with the surrounding saturated soils. Wells will be developed at an appropriate time interval (at least 24 hours) post-installation using pumping techniques. Monitoring of temperature, specific conductivity, pH, and turbidity for defining stabilization will be completed. The monitoring wells will be developed in accordance with the FSP in Appendix A.

3.2.6 Groundwater Sampling

Groundwater samples will be collected for laboratory analysis from the existing and newly installed monitoring wells to assess the environmental quality of the Site's groundwater. Existing monitoring wells MW-3 and MW-4 have been destroyed and therefore will not be sampled. Groundwater samples will be collected in accordance with the FSP in Appendix A.

Groundwater purging and sampling will be conducted employing low-flow purging/sampling methods with a peristaltic pump and new, dedicated tubing for each monitoring well in accordance with the FSP in Appendix A. The groundwater samples will be collected in order of decreasing volatility beginning with VOCs and SVOCs followed by the remaining parameters to be analyzed. Field sampling personnel will wear a new pair of nitrile gloves at each monitoring well sampling location. The groundwater samples will be collected in laboratory provided containers and placed on ice in laboratory provided coolers.

Samples submitted for laboratory analysis from all monitoring wells will be analyzed for TCL VOCs, SVOCs, pesticides and PCBs, and TAL metals (including mercury and hexavalent chromium), and cyanide. Samples submitted for laboratory analysis from select monitoring wells RIMW1, RIMW4 and RIMW6 will also be analyzed for PFAS and 1,4-dioxane. The rationale for the selection of these wells for PFAS and 1,4-dioxane analysis is that RIMW1 is an up-gradient well and RIMW4 and RIMW6 are down-gradient wells within each Site parcel. These sampling locations are subject to change based on field conditions (in consultation with NYSDEC).

3.2.7 Soil Vapor Assessment

A soil vapor assessment will be conducted in the approximate footprint of the Site's proposed building and near the perimeter of the site. The assessment will be conducted to evaluate the potential presence of environmentally impacted soil vapor and the potential for impacted soil vapor to migrate into the interior of the proposed building and neighboring buildings. The assessment will include the collection of seven soil vapor samples depicted as RISV1 through RISV7 on Figure 2 with three of the soil vapor sampling points being co-located with three of the monitoring wells (RISV1 with RIMW4; RISV2 with RIMW1; and RISV7 with RIMW6). One (1) ambient outdoor air sample will also be collected to assess ambient background air levels in the vicinity of the soil vapor sampling points. The samples will be collected in accordance with the FSP in Appendix A.

The soil vapor samples will be collected at no less than five (5) feet bgs by advancing a test boring to the desired depth employing HSA drilling techniques. A stainless steel perforated sampling point attached to inert tubing will be used for sample collection. The sampling point and tubing will be installed to the desired sampling depth within the boring. The borehole will then be backfilled with an inert, porous media such as silica sand to create a soil vapor sampling zone of approximately two vertical feet. The remainder of the boring will be backfilled with a bentonite/cement mixture having a 20:1 ratio to provide a seal from outside ambient air.

3.2.8 Field Quality Control

Quality Assurance/Quality Control (QA/QC) samples at a ratio of 1 set of QA/QC samples per 20 media samples will be collected and analyzed. The QA/QC samples for subsurface fill, native soil and groundwater will include a blind duplicate sample, matrix spike (MS) sample, matrix spike duplicate (MSD) sample and equipment (field) blank sample. Laboratory prepared Trip Blanks will be submitted with aqueous samples requiring analysis for TCL VOCs and PFAS. Field Trip Blanks will be submitted with aqueous samples requiring analysis for PFAS.

For the soil vapor sampling, a duplicate (replicate) sample will be collected. MS, MSD, equipment (field) blank, trip blank and field trip blank samples will not be collected.

3.2.9 Laboratory Reporting and Data Validation

The laboratory will generate NYSDEC ASP Category B data deliverable packages of the investigative analytical data. A Data Usability Summary Report (DUSR) of the analytical data developed during this investigation will be prepared to confirm that it is valid and usable for subsequent decision making purposes. The DUSR will be completed by an independent data validator.

3.2.10 Survey

A horizontal survey will be completed to locate the RI sampling points and other pertinent Site features.

The locations and features will be amended to the Figure 2 Remedial Investigation Plan.

At the time the monitoring wells are sampled, depth to groundwater measurements will be recorded for the purpose of determining the direction of groundwater movement across the site. For the purpose of determining the direction of groundwater movement, the vertical elevations of the top of the well casings will be established utilizing a project benchmark. The groundwater elevations will be used to construct a groundwater contour map for inclusion in the RI Report.

3.2.11 Wetland Delineation

The Site and its surroundings are located in an urban setting. No suspected wetlands were observed on the Site during the past investigations. A review of National Wetlands Inventory and DEC regulated wetlands mapping did not identify wetlands on or near the Site. As such, a wetlands delineation will not be performed as a function of this RI.

3.2.12 Fish and Wildlife Impact Analysis

Due to its location in a densely urbanized area within the City of Schenectady and because nearly the entirety of the Site is improved with buildings, asphalt, concrete and gravel, a Fish and Wildlife Resources Impact Analysis (FWRIA) will not be completed.

3.2.13 Well Search

A well search will be conducted in accordance with DER-10-3.7.2(b)7. The well search will include completing and documenting a file search using available NYSDEC, New York State Department of Health (NYSDOH), Schenectady County Department of Health, and local municipal records.

3.2.14 Qualitative Human Health Exposure Assessment

A qualitative human health exposure assessment of the Site will be completed in general accordance with Appendix 3B of DER-10. At a minimum, the exposure assessment will evaluate the five (5) elements associated with exposure pathways. The elements include the following.

1. A description of the contaminant source(s) including the location of the contaminant release to the environment or if the original source is unknown, the contaminated environmental medium at the point of exposure.

2. An explanation of the contaminant release and transport mechanisms to the exposed population.

3. Identification of all potential exposure point(s) where actual or potential human contact with a contaminated medium may occur. Potential exposure routes include surface soil, fill, subsurface soil, groundwater and soil vapor.

4. Description(s) of the route(s) of exposure (i.e., ingestion, inhalation, dermal absorption).

5. A characterization of the receptor populations who may be exposed to contaminants at a point of exposure.

3.3 Project Standards, Criteria and Guidance

The RI will include: 1) the collection of fill and native soil samples for laboratory analysis for TCL VOCs, SVOCs, pesticides and PCBs and TAL metals (including mercury and hexavalent chromium) and cyanide; 2) the collection and analysis of groundwater samples for TCL VOCs, SVOCs, pesticides and PCBs and TAL metals (including mercury and hexavalent chromium) and cyanide and; 3) the collection of soil vapor samples for analyses for the TO-15 list of total volatile organic constituents. Per the NYSDEC's request for Sites in the BCP, representative surface soil and groundwater samples will also be analyzed for emerging contaminants 1,4-dioxane and PFAS. The list of substances comprising PFAS are presented in Table 2B in the QAPP in Appendix B.

Fill and soil sampling analytical results will be compared to SCOs for Unrestricted Use Sites, Restricted Residential Use Sites, and if appropriate, Protection of Groundwater promulgated at DEC 6 NYCRR Part 375 Environmental Remediation Programs. As NYSDEC has not established a regulatory standard or guidance value for PFAS these chemical constituents will not be compared to regulatory values.

Groundwater sampling analytical results will be compared to groundwater standards and guidance values promulgated in the DEC Division of Water Technical and Operational Guidance Series (TOGS 1.1.1) and addendums. 1,4-Dioxane will be compared to the New York State generic Maximum Contaminant Level (MCL) of 50 parts per billion (ppb) for unspecified organic contaminants. NYSDEC has not established a regulatory standard or guidance value for perfluorooctanoic acid (PFOA) or perfluoroctane sulfonic acid (PFOS), so the PFOA and PFOS chemical constituents of the PFAS list will be compared to the November 2016 USEPA PFOA and PFOS Drinking Water Health Advisory of 70 part per trillion (ppt).

Soil vapor sampling analytical results will be compared to comparison tables contained in the DOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006) and addendums.

3.4 Investigation Derived Wastes

Investigation derived wastes from the RI may include drill cuttings from the test borings, monitoring well development and purge water, decontamination water from manual tool cleaning, water that accumulates in the decontamination pad, and disposable items such as nitrile gloves, plastic, wipes, etc.

Drill cuttings from borings not converted to monitoring wells will be drummed unless they can be returned to their origins per the conditions outlined in DER-10-3.3(e). Any drummed drill cuttings will be labeled and staged at a secure location within the Site pending off-site disposal. The contents of the drums will be characterized and profiled for off-site disposal.

Investigation generated water, including well development and sampling/purge water, will be collected and containerized until it can be disposed of or discharged in accordance with DER-10-3.3(e)5.

Decontamination water from manual tool cleaning and the decontamination pad will be placed in DOT 17H approved 55-gallon open top steel drums, labeled and staged at a secure location within the Site pending off-site disposal. The contents of the drums will be characterized and profiled for off-site disposal.

Disposable items such as nitrile gloves, plastic, wipes, etc. will be disposed of off-site as solid waste.

3.5 Subcontractors

Subcontractors will be retained to aid in the completion of the RI. These include a drilling subcontractor for completion of the test borings and installation of monitoring wells, an environmental laboratory for laboratory analysis of the media samples, and a data validation company to provide independent third party validation of the laboratory data. The following identifies subcontractors that are anticipated to be selected to perform the work.

-The drilling will be performed by NYEG Drilling LLC of Brewerton, New York.

-The laboratory analyses of media samples will be performed by Alpha Analytical of Westborough, Massachusetts. Alpha Analytical is certified by the NYSDOH Environmental Laboratory Approval Program to perform the specific analyses requested.

-Data validation of the laboratory data will be performed by Environmental Data Services, Inc. of Virginia Beach, Virginia.

The NYSDEC Project Manager will be informed if there is a substitution of any of the above listed subcontractors.

TABLE 1: ANALYTICAL SAMPLING PROGRAM

Media(1)	Depth Interval(2)	Proposed Analysis(3)	Sampling Method	Rationale
Surface Soil	0-2 inches bgs (0-6 inches bgs for VOCs, 1,4-Dioxane and PFAS)	TCL VOCs, SVOCs, Pesticides and PCBs, TAL Metals (Including Mercury/Hex. Cr), Cyanide, 1,4-Dioxane and the List of 21 PFAS(4).	Field decontaminated hand auger, shovel, pick-ax, trowel, sampler barrel and/or other field sampling equipment. New, nitrile gloves to be worn at each sampling location.	To evaluate the environmental quality of surface soil across the Site to aid in the selection of a remedy that will be protective of human health and the environment.
Subsurface Fill and Native Soil (Test Borings and Hand Augers)	Samples will be representative of fill and native soil.	TCL VOCs, SVOCs, Pesticides and PCBs, TAL Metals (Including Mercury and Hexavalent Chromium) and Cyanide.	Obtain samples from the driller provided sampling barrel utilizing new clean nitrile gloves.	To characterize the Site's subsurface conditions and environmental quality to formulate an appropriate remedial action.
Groundwater (Monitoring Wells)	One (1) groundwater sample from each newly installed monitoring well and one groundwater sample from four (4) existing monitoring wells.	TCL VOCs, SVOCs, Pesticides and PCBs, TAL Metals (Including Mercury/Hex. Cr), Cyanide, 1,4-Dioxane and the List of 21 PFAS(4).	Develop each well per FSP in Appendix A. Purge and collect groundwater samples using low-flow techniques per FSP in Appendix A.	To characterize the environmental quality of the Site's groundwater and formulate an appropriate remedial action.
Soil Vapor	Five (5) feet bgs	USEPA Method TO-15	Collect samples employing new, perforated sampling points and tubing.	To evaluate the potential presence of environmentally impacted soil vapor in the footprint of the proposed building.

(1) QA/QC samples will be prepared for each media type at a ratio of one (1) set of QA/QC samples per each 20 media samples. The QA/QC samples will consist of a duplicate (replicate) sample, equipment (field) blank sample, MS sample and MSD sample.
(2) Soil samples will be collected from discrete, non-homogenized sample locations.
(3) TCL VOCs by USEPA Method 8260, TCL SVOCs by USEPA Method 8270, TCL Pesticides by USEPA Method 8081, TCL PCBs by USEPA Method 8082, TAL Metals (including Mercury) by USEPA Method 6010/7470A, Hexavalent Chromium by USEPA Method 7196, Cyanide by USEPA Method 335.2, 1,4-Dioxane by USEPA Method 8270 (SIM), PFAS by USEPA Method 537(M)-Isotope Dilution.
(4) The PFAS list is included in Table 2B of the QAPP.

4.0 SUPPLEMENTAL PLANS

4.1 Field Sampling Plan

The field activities for this project will include collection and laboratory analysis of subsurface fill and native soil, groundwater and soil vapor samples. The procedures relative to implementation of these field activities are presented in the FSP in Appendix A, which also conforms to the QAPP presented in Appendix B. The FSP describes the various methods and techniques to be followed during the completion of the sampling activities, instrument operation and calibration, and chain of custody procedures.

4.2 Quality Assurance/ Quality Control Plan

The QAPP describes the quality assurance and quality control procedures to be followed from the time media samples are collected to the time they are analyzed by the environmental analytical laboratory and evaluated by a third party according to USEPA and NYSDEC DUSR guidelines. The QAPP is presented in Appendix B of this RIWP.

The QAPP will be followed by field personnel during the RI activities and media sampling events. It will also be used by the project management team and Quality Assurance Officer to assure the data collected and generated is representative and accurate. The laboratory results will be reported with NYSDEC ASP Category B deliverables, which will be subjected to EPA and NYSDEC's DUSR guidelines to determine if the data is valid and usable.

4.3 Health and Safety Plan

A Site-specific Health and Safety Plan (HASP) has been prepared for this project to address C.T. Male's site worker health and safety hazards. The HASP is presented in Appendix C. Subcontractors will be required to develop their own HASP for work they will perform. A Community Air Monitoring Plan (CAMP) will be used during the RI field activities in accordance with the New York State Department of Health Generic CAMP, which is included in Appendix C of the HASP. The CAMP will be implemented during all ground intrusive investigation activities.

4.4 Citizen Participation (CP) Plan

A project-specific Citizen Participation Plan (CP Plan) has been developed as a standalone document in general accordance with NYSDEC DER-10: Technical Guidance for Site Investigation and Remediation and NYSDEC DER-23: Citizen Participation Handbook for Remedial Programs. The objective of the plan is to disseminate information to the public regarding the RI and other activities at the Site and to involve the public in the decision making process. This is accomplished by keeping the public informed of the investigation through direct mailings, email, public notice in local newspapers and other publications, and by having project documents available for review at publicly accessible repository locations. Although the CP Plan is a standalone document available for review in the document repositories, it also should be considered an integral part of the RIWP.

5.0 REPORTING AND SCHEDULE

5.1 Reporting

Upon completion of field activities and receipt and independent validation of the analytical laboratory data, a Draft RI Report will be prepared. The RI Report will summarize and discuss the investigations completed and summarize any DEC-approved deviations to the work plan. The report will present the investigations at the Site, analytical results of samples collected and analyzed, and interpretations of the data. Based on the intent to remediate the Site to Track 1 (Unrestricted Use) cleanup levels, a Draft RAWP may be prepared for review by NYSDEC in lieu of a Draft Alternative Analysis Report (AAR). The DEC Project Manager will be contacted to discuss remedial action objectives and remedial alternatives prior to submitting the RAWP.

5.2 Schedule

The proposed project schedule identifying major project tasks from approval of the RIWP to NYSDEC's Significant Threat Site determination and submission of the Draft RAWP for public comment is included in Appendix D.

6.0 SUBMITTALS

Written communications will be transmitted primarily by email and may also be transmitted by United States Postal Service, private courier, or hand delivered to the following individuals. Final documents, as they become available, will also be submitted to the following individuals:

- Joshua Haugh
  NYS Department of Environmental Conservation
  Division of Environmental Remediation
  1130 North Westcott Road
  Schenectady, NY 12306
  joshua.haugh@dec.ny.gov

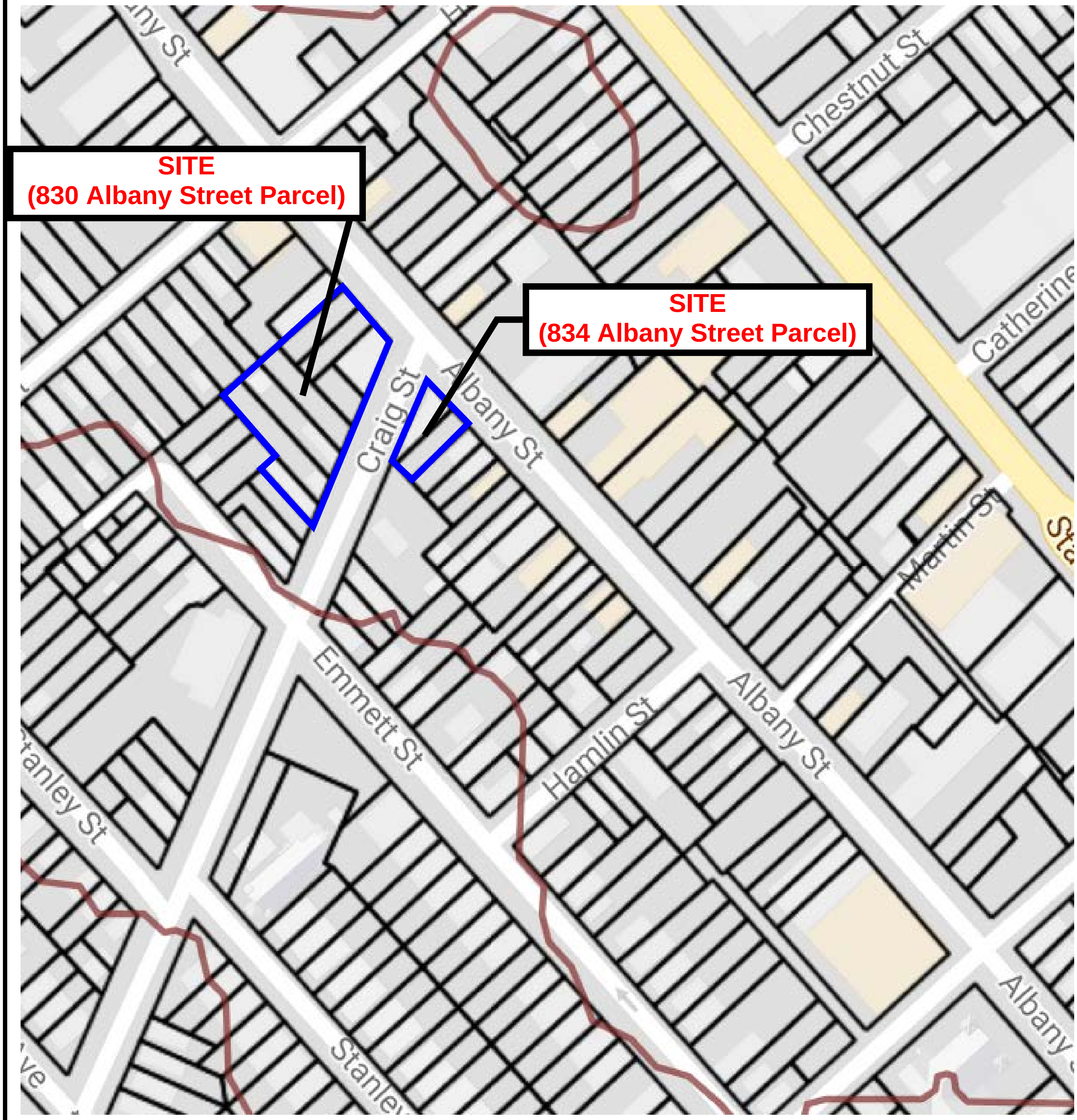
- Sarita Wagh, Project Manager
  NYS Department of Health
  Bureau of Environmental Exposure Investigation
  Empire State Plaza
  Corning Tower, Room 1787
  Albany, NY 12237
  BEEI@health.ny.gov

- Stephen Rephser, Esq.
  NYS Department of Environmental Conservation
  Office of General Counsel
  1130 North Westcott Road
  Schenectady, NY 12306
  stephen.repsher@dec.ny.gov

- Jennica Huff
  Hamilton Hill II – Target Area 1 Limited Partnership
  90 State Street, Suite 602
  Albany, NY 12207
  JPetrik-Huff@tcbinc.org

K:\Projects\166334\Env\Target Area 1 Remedial Investigation 2018\RIWP\5 FINAL NYSDEC Approved RIWP\R RIWP HHII-TA1 830 and 834 Albany Street FINAL.docx

FIGURES



MAP REFERENCE
USGS 7.5 Minute Topographical Map
Schenectady, New York Quadrangle
Year 2013

N

C.T.MALE ASSOCIATES
ENGINEERING, SURVEYING, ARCHITECTURE & LANDSCAPE ARCHITECTURE, D.P.C.

50 CENTURY HILL DRIVE
LATHAM, NY 12110

FIGURE 1: SITE LOCATION MAP
HAMILTON HILL II - TARGET AREA 1 SITE

CITY OF SCHENECTADY | **SCHENECTADY COUNTY, NY**

SCALE: NOT TO SCALE

DRAFTER: SB

PROJECT No: 16.6334

The locations and features depicted on this map are approximate and do not represent an actual survey.

XREFS: NONE

PROJECT NUMBER: 16.6334

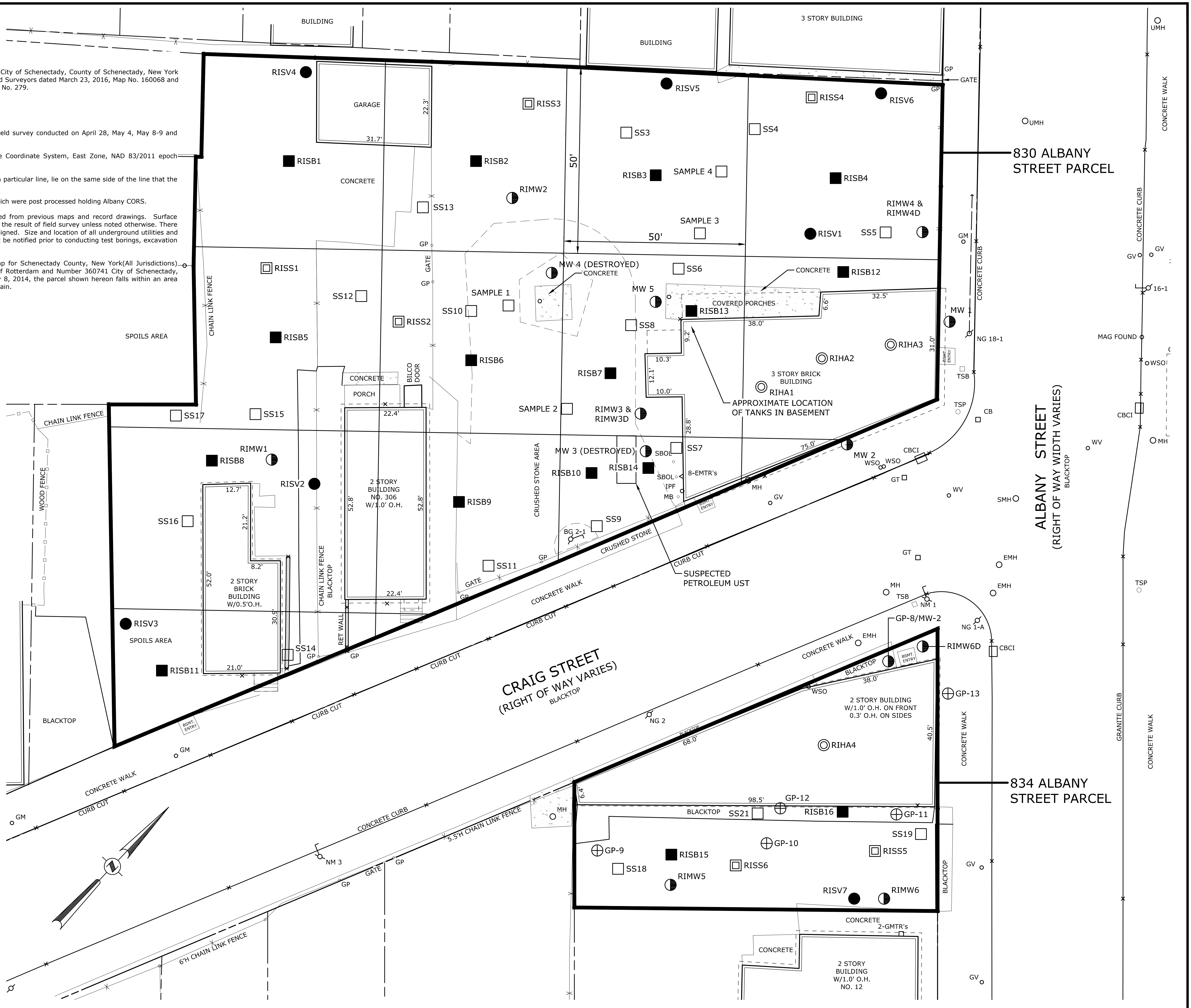
CAD DWG. FILE NAME: FIGURE 2-REV 1.dwg

MAP REFERENCES:

1. "Map Showing Lot Line Adjustment of No. 310 Craig Street No. 807 Emmett Street" City of Schenectady, County of Schenectady, New York State of New York prepared by Hershberg & Hershberg, Consulting Engineers and Land Surveyors dated March 23, 2016, Map No. 160068 and filed in the Schenectady County Clerk's Office on December 2, 2016 in Cabinet N, Map No. 279.

MAP NOTES:

1. Boundary and topographic information shown hereon was compiled from an actual field survey conducted on April 28, May 4, May 8-9 and May 24, 2017 and June 15, 2017.
2. North orientation and bearings are Grid North based on the New York State Plane Coordinate System, East Zone, NAD 83/2011 epoch 2010.00 obtained from GPS observations.
3. Objects shown on this drawing with a distance indicating how far that object is from a particular line, lie on the same side of the line that the offset distance is written.
4. Vertical datum shown hereon is NAVD 88 and was obtained from GPS observations which were post processed holding Albany CORS.
5. Underground facilities, structures, and utilities have been plotted from data obtained from previous maps and record drawings. Surface features such as catch basin rims, manhole covers, water valves, gas valves, etc. are the result of field survey unless noted otherwise. There may be other underground utilities, the existence of which is not known to the undersigned. Size and location of all underground utilities and structures must be verified by the appropriate authorities. Dig Safely New York must be notified prior to conducting test borings, excavation and construction.
6. Per map entitled National Flood Insurance Program, FIRM Flood Insurance Rate Map for Schenectady County, New York(All Jurisdictions) contains Community Number 360739, Town of Niskayuna, Number 360740, Town of Rotterdam and Number 360741 City of Schenectady, Panel 170 of 257, Map Suffix: D, Map Number 36093C0170D, effective date January 8, 2014, the parcel shown hereon falls within an area designated as Zone X areas determined to be outside the 0.2% annual chance floodplain.



LEGEND

□ CB	CATCH BASIN
CBCI	CATCH BASIN CURB INLET
◦ CBOL	CONCRETE BOLLARD
○ DMH	DRAINAGE MANHOLE
○ EMH	ELECTRIC MANHOLE
△ EMTR	ELECTRIC METER
○ GM	GAS MARKER
□ GMTR	GAS METER
□ GT	GAS TEST
○ GV	GAS VALVE
○ GP	GATE POST
HYD	HYDRANT
○ IPF	IRON PIPE FOUND
○ IRF	IRON ROD FOUND
○ MB	MAIL BOX
◦ MFP	METAL FENCE POST
○ SMH	SANITARY MANHOLE
◦ SBOL	STEEL BOLLARD
○ TMH	TELEPHONE MANHOLE
□ TSB	TRAFFIC SIGNAL BOX
○ TSP	TRAFFIC SIGNAL POLE
○ MH	UTILITY MANHOLE
○ UMH	UNKNOWN UTILITY MANHOLE
	UTILITY POLE
	UTILITY POLE W/LIGHT
○ WSO	WATER SHUT-OFF
○ WV	WATER VALVE
⊕ GP-10	EXISTING GEOPROBE (APPROXIMATE LOCATION)
◐ MW1/RIMW1	EXISTING AND PROPOSED MONITORING WELL LOCATION
□ SS3	EXISTING SHALLOW SOIL SAMPLE LOCATION
● RISV1	PROPOSED SOIL VAPOR SAMPLE LOCATION
◎ RIHA1	PROPOSED HAND AUGER LOCATION
■ RISB1	PROPOSED SUBSURFACE SOIL SAMPLE LOCATION
▣ RISS1	PROPOSED SURFACE SOIL LOCATION

BAR SCALE

20 0 10 20 40

1 inch = 20 ft.

DATE		REVISIONS RECORD/DESCRIPTION	DRAFTER	CHECK	APPR.
2/21/19	1	SAMPLE POINT REVISIONS AND ADDITIONS	GLB		
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				

UNAUTHORIZED ALTERATION OR ADDITION TO THIS DOCUMENT IS A VIOLATION OF THE NEW YORK STATE EDUCATION LAW.

APPROVED: _____
DRAFTED : GLB
CHECKED : JAM
PROJ. NO : 16.6334
SCALE : 1" = 20'
DATE : DEC. 11, 2018

FIGURE 2 REMEDIAL INVESTIGATION PLAN
HAMILTON HILL II - TARGET AREA 1 SITE

CITY OF SCHENECTADY

SCHENECTADY COUNTY, NEW YORK

C.T. MALE ASSOCIATES

Engineering, Surveying, Architecture & Landscape Architecture, D.P.C.

50 CENTURY HILL DRIVE, LATHAM, NY 12110
518.786.7400 * FAX 518.786.7299

SHEET 1 OF 1
DWG. NO: 18-578

CAD DWG. FILE NAME: K:\Projects\177266\Survey\Drawings and Maps\FIGURE 2-REV 1.dwg

APPENDIX A

FIELD SAMPLING PLAN

December 2018
Revised February 2019

Field Sampling Plan

Hamilton Hill II – Target Area 1 Site
830 & 834 Albany Street
City of Schenectady
Schenectady County, New York
BCP Site #C447052

Prepared for:

HAMILTON HILL II LIMITED PARTNERSHIP
90 State Street
Albany, New York 12207

Prepared by:

C.T. MALE ASSOCIATES
50 Century Hill Drive
Latham, New York 12110
(518) 786-7400
FAX (518) 786-7299

C.T. Male Project No: 16.6334

FIELD SAMPLING PLAN
HAMILTON HILL II – TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY, NEW YORK

TABLE OF CONTENTS

Page

ATTACHMENTS

ATTACHMENTS (CONT'D)

SOP #11: Chain of Custody Procedures

SOP #12: Domestic Transport of Samples to Laboratories in the USA

SOP #13: Soil Vapor Sampling

SOP #14: Collection of Quality Control Samples

SOP #15: Sampling and Disposal of Investigative Derived Waste

1.0 INTRODUCTION

This document is the Field Sampling Plan (FSP) for the Remedial Investigation (RI) to be conducted at the Hamilton Hill II – Target Area 1 Brownfield Cleanup Program (BCP) Site (C447052) located at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York (the "Site"). It has been developed in accordance with the RI Work Plan (RIWP) as prepared by C.T. Male Associates Engineering, Surveying, Architecture, Landscape Architecture & Geology, D.P.C. (C.T. Male). A description of the property, background information, objectives, and the proposed scope of work, are presented in the referenced RIWP.

This FSP is a supplement to the RIWP in that it presents the standard field sampling and data gathering procedures to be followed during implementation of the field activity portion of the scope of work. This plan addresses sampling locations and frequencies, drilling methods including advancement of soil borings and installation of monitoring wells and soil vapor probes, decontamination procedures, various media sampling procedures, field screening and testing procedures, field instrumentation operating procedures, field measurements, sample handling and chain of custody procedures, and water level measurement procedures. The applicable portions of the RIWP that coincide with the FSP will be provided to, and followed by the field team. This FSP is intended to be applicable to field sampling activities conducted by C.T. Male and its subcontractors.

Included in this FSP are forms that are an integral part of the Quality Assurance Project Plan (QAPP). The field sampling and data gathering procedures presented in this FSP are incorporated into the QAPP by reference. The FSP and the QAPP document the laboratory quality assurance/quality control procedures to be followed during analysis of samples collected in the field so that valid data of a known quality is generated.

The FSP has been prepared, in part, in general accordance with the following New York State Department of Environmental Conservation (NYSDEC) and United States Environmental Protection Agency (USEPA) guidance documents:

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

- 6 NYCRR Part 375 Environmental Remediation Programs Subparts 375-1 to 375-4 and 375-6, Effective December 14, 2006.
- NYSDEC, Department of Water, Technical and Operational Guidance Series (TOGS): TOGS 1.1.1 Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, June 1998, and errata and addendum sheets.
- New York State Department of Health (NYSDOH) regulations and guidelines.
- A Compendium of Superfund Field Operations Methods, EPA/540/P-87/001, USEPA, December 1987, revised 2005.

2.0 MEDIA SAMPLING AND OVERVIEW OF FIELD ACTIVITIES

2.1 Media Sampling

Based on the RIWP, sampling may include volatile organic vapor screening, organoleptic media assessment, laboratory analyses, and for geologic and hydrogeologic characterization of the project Site. The environmental media that may be sampled includes:

- Fill/Soil,
- Groundwater, and
- Soil Vapor.

2.2 Overview of Field Activities

The potential field activities are summarized in this FSP and details of each activity are provided within the referenced standard operating procedures (SOPs), which are included in Attachment A.

Field Report Forms applicable to their corresponding field activity (i.e., test boring log, monitoring well construction log, water level record, etc.) are referenced in their respective SOPs.

3.0 SITE INVESTIGATION OVERVIEW

3.1 General

The proposed RI includes: collection of surface soil samples for visual and/or olfactory evidence of contamination and laboratory analyses; advancement of test borings to aid in the collection of fill/soil samples for visual and/or olfactory evidence of contamination and laboratory analysis, for installation of monitoring wells and soil vapor probes, and characterization of the Site's subsurface; collection and laboratory analysis of groundwater samples from monitoring wells; collection of soil vapor samples for laboratory analyses; collection of water levels; and sampling of investigative derived waste for disposal.

3.2 Observation of Drilling Operations and Monitoring Well Installations

Drilling, monitoring well installation and other associated field work involved in the investigations to be performed by C.T. Male and their subcontractors will be observed by full-time, on-site, C.T. Male representatives. These representatives will be responsible for the collection of fill/soil samples, soil classification, field screening of fill/soil samples, recording of drilling and sampling data, recording of groundwater data, deciding on the final drilling depths and monitoring well screened intervals (with input from the project manager), recording the monitoring well construction procedures, and monitoring the decontamination procedures. Field reports will be prepared that document the daily activities and their conformance to the work plan in accordance with the SOP in Attachment A entitled SOP #1: Note Taking and Field Logs.

The project manager will be kept informed of the progress of work and any problems encountered during the investigations so appropriate corrective action can be implemented in consultation with Hamilton Hill II Limited Partnership and NYSDEC.

3.3 Drilling and Sampling

There are several different drilling techniques that can be utilized to aid in the collection of fill/soil samples and for installation of monitoring wells and soil vapor probes. These include direct-push, hollow stem auger and rotosonic and air rotary drilling techniques. The drilling technique to be used for the investigation is outlined in the RIWP. C.T. Male personnel will observe the drilling subcontractor and the drilling subcontractor will follow their SOPs for the drilling technique(s) specified in the work plan.

3.3.1 Soil Classification

Soils collected during drilling activities will be visually classified in the field using the Unified Soil Classification System in general accordance with ASTM D-2488, Standard Practice for Description and Identification of Soils. The soil description may include matrix and clast descriptions, moisture content, color, appearance, odor, behavior of the material and other pertinent observations. This information will be recorded on a subsurface exploration log form along with the boring identification and elevation, date started and completed, sampling intervals, standard penetration values (if not employing direct-push drilling methods), length of recovered sample and depth of first groundwater encountered. During the drilling, a photoionization detector (PID) meter will be used to monitor the volatile organic vapors exiting the borehole and soil cuttings, and of all recovered subsurface samples. These visual observations and field measurements will be recorded in accordance with the SOPs in Attachment A entitled SOP #2: Drilling and Associated Sampling Methods, SOP #3: Organic Vapor and Air Monitoring, and SOP #4: Surface and Subsurface Soil Sampling.

3.3.2 Borehole Abandonment and Drill Cuttings

During drilling activities, drill cuttings will need to be properly managed. Drill cuttings from borings that will not be converted to a monitoring well(s) meeting the conditions listed in NYSDEC DER-10, section 3.3(e), will be placed within the borehole from which they were generated. As per DER-10, drill cuttings and soil that are not used to backfill a borehole will be transferred to labeled DOT 17H approved 55-gallon open top steel drums which will be staged at a secure location within the Site pending off-site disposal. The contents of the drums will be subsequently characterized and profiled for off-site disposal.

3.4 Monitoring Well Installation in the Overburden

The installation of monitoring wells in the overburden groundwater may be used to identify hydrogeologic characteristics, groundwater constituents, contaminants of concern, contaminant plume transport, and the hydraulic relationship between the Site and localized groundwater flow. The SOP for this field activity is included in Attachment A as SOP #5: Monitoring Well Installation.

Monitoring wells will be installed within select boreholes that are typically completed utilizing direct-push and hollow stem auger drilling methods. For the direct-push boreholes, typically one (1)-inch diameter monitoring wells with slotted screens will be installed in the open boreholes. For the hollow stem auger boreholes, typically two (2)-inch diameter monitoring wells with slotted screens will be installed within the flush hollow stem augers or casing in accordance with standard practices. Monitoring well depths, and screen lengths and depths will be calculated by the environmental scientist/geologist by maintaining accurate measurements of screen and casing placed in the borehole. C.T. Male personnel will complete the Monitoring Well Construction Log forms for the monitoring wells in accordance with the SOP in Attachment A entitled SOP #5: Monitoring Well Installation.

3.5 Monitoring Well Development

Monitoring wells will be developed by pumping/bailing in order to remove any accumulated fine sediment within the well and to establish a hydraulic connection with the surrounding aquifer. Wells will be developed at an appropriate time interval post-installation using pumping/bailing techniques. Monitoring of temperature, specific conductivity, pH, and turbidity for defining stabilization will be completed. The SOP for this field activity is included in Attachment A as SOP #6: Monitoring Well Development.

3.6 Decontamination of Drilling and Sampling/Gauging Equipment

Drilling equipment including casing, augers, rods, plugs, samplers, tools, drill unit and any piece of equipment that can come in contact with the formation will be cleaned with a high temperature/high pressure steam cleaner prior to the start of work and between each boring to prevent cross-contamination between borings. The equipment will also be cleaned using the same procedure at completion of the work to prevent any contamination from leaving the Site. The SOP for this field activity is included in Attachment A as SOP #7: Equipment Decontamination Procedures.

4.0 GROUNDWATER SAMPLING PROCEDURES

4.1 Groundwater Sampling

During groundwater sampling, acceptable techniques and protocol during the collection and transportation of groundwater samples are required to minimize the potential for sample variation from well to well. Quality control measures will be instituted as discussed in this document and the QAPP as a check on the procedures being utilized so that the quality of the data can be assessed. The groundwater samples will be analyzed in the laboratory by standard methods following the QA/QC procedures outlined in the QAPP.

Periodic monitoring/sampling events may be conducted. The SOP for this field activity is included in Attachment A as SOP #8: Groundwater Sampling.

4.2 Water level Measurements, Immiscible Layers, Total Well Depth in Well

Prior to sampling, static water heights will be measured using a water level indicator to determine the standing water column height within the well. Water levels will be collected from all wells that are slated for sampling prior to initiating the purging/water sampling. The water column height and depth of the well are used to calculate the well water volume. Non-vented well caps will be removed for a period of 10 minutes to allow the water column to reach static conditions prior to taking the water level measurements.

Any light non-aqueous phase liquid (LNAPL) level and/or dense non-aqueous phase liquid (DNAPL) level, if encountered, will also be measured utilizing LNAPL and DNAPL specific water level meters. The SOP for obtaining water, LNAPL and DNAPL levels are included in the SOPs in Attachment A as SOP #9: Measuring Static Water Level, Immiscible Layers (DNAPL and LNAPL), and Total Well Depth in Water.

4.3 Well Purging Procedures

The wells will be purged employing pumping techniques utilizing a peristaltic pump with new factory sealed tubing that will be dedicated to each well. The wells will be purged in accordance with the low flow purging/sampling methodology in Section

5.6.2 of SOP #8: Groundwater Sampling in Attachment A.

Purge water from the monitoring wells will be placed in DOT approved 55-gallon drums, labeled and stored in a secure location within the Site until it can be disposed of or discharged in accordance with DER-10-3.3(e)5. The laboratory analyses results of the soil and groundwater samples will be used to profile the waste and to determine the proper method of treatment or disposal for the material.

4.4 Well Stabilization

Well stabilization is conducted to verify the groundwater sample is representative of aquifer conditions. A well is considered stabilized after the groundwater stabilization parameter measurements are within acceptable limits for three (3) consecutive readings. The SOP for this field activity is included in Attachment A as SOP #8: Groundwater Sampling.

4.5 Sample Collection

Prior to sample collection, the wells will have achieved water quality parameter stabilization. The SOP for this field activity is included in Attachment A as SOP#8: Groundwater Sampling.

4.5.1 Low Flow Sampling

Low flow sampling is a method of collecting samples from a well that does not require purging volumes of water from the well and relies on natural flow of formation water through the well. Using this method, the water flowing into and through the well is representative of the groundwater within the formation surrounding the screen and this representative groundwater sample can be obtained by slowly pumping.

Low-flow sampling methods emphasize minimal stress to the groundwater by low water-level drawdown and low pumping rates in order to collect samples with minimal alterations to water chemistry (U.S. Environmental Protection Agency [EPA], 2002; ASTM D6771-02). Low-flow sampling is typically conducted using positive displacement pumps, submersible pumps, or peristaltic pumps. Commonly used low-flow pumps include the QED Sample Pro® bladder pump, Geotech® bladder pumps, Grundfos Redi-Flo 2® submersible pump, and the Geotech Geopump™ Series II peristaltic pump. The use of low flow sampling and the type of pump to be used will be specified in the RIWP. Pumps that are to be used on-site will be reviewed prior to use to ensure they would not bias the PFAS sampling due to their construction and parts. The SOP for this field activity is included in Attachment A as SOP #8: Groundwater Sampling (Section 5.6.2).

4.5.2 Field Analyses

Groundwater field analyses will include pH, temperature, specific conductivity and turbidity. The field analyses will be measured immediately upon collection of each sample since the values of these parameters can change with time.

The pH, temperature and specific conductivity of a sample are measured with a portable unit capable of measuring all three (3) parameters concurrently. The SOP for this field activity is included in Attachment A as SOP #10: Field Water Quality Measurements and Calibration. The portable unit automatically adjusts to compensate for the temperature of the sample. The turbidity of a sample is measured with a separate portable unit. The pH, temperature, specific conductivity and turbidity will be recorded on a Groundwater Services Field Log. These units will be calibrated to known standards prior to the start of field activities every day. Measurement and operating procedures for these field analyses are presented in Section 7.0 of this FSP.

4.5.3 Analytical Groundwater Sampling

The groundwater samples will be subjected to laboratory analysis to assist in characterizing the environmental quality of the Site. The samples will be transferred from the sampling equipment directly into the designated sampling containers. The sampling containers for volatile organics analyses will be filled first to minimize volatilization of the sample. The laboratory analytical method, container type, sample holding times, and preservation of the samples are outlined in the QAPP and the RIWP. The SOPs for this field activity are included in Attachment A as SOP #8: Groundwater Sampling, SOP #11: Chain of Custody Procedures and SOP #12: Domestic Transport of Samples to Laboratories in the USA.

5.0 SOIL SAMPLING PROCEDURES

5.1 Soil Sampling

Soil sampling will be completed as outlined in the RIWP. Surface soil samples will be collected using a decontaminated hand auger, shovel, pick-ax, trowel and/or other field sampling equipment. Subsurface soil samples will be collected using a spilt spoon sampler during conventional hollow stem auger drilling and/or a macro-core sampler during direct-push drilling. The collected soils will be logged in accordance with ASTM D2488 (visual-manual method) and screened for signs of obvious environmental impacts (*e.g.*, staining, sheen, odor, discoloration, or the presence of headspace as measured by a photoionization detector). The soil sample collection procedures will follow the RIWP and QAPP. The SOP for this field activity is included in Attachment A as SOP #4: Surface and Subsurface Soil Sampling.

5.2 Analytical Soil Sampling

The soil samples will be subjected to laboratory analysis to assist in further characterizing the environmental quality of the Site. The samples will be extracted from the sampling equipment in a timely fashion such that the sample has limited exposure to the outside air, thus reducing the chance for volatilization. The sampling containers for volatile organics analyses will be filled first to minimize volatilization of the sample. The laboratory analytical method, container type, sample holding times, and preservation of the samples are outlined in the QAPP and the RIWP. The SOP for this field activity is included in Attachment A as SOP #4: Surface and Subsurface Soil Sampling.

6.0 SOIL VAPOR ASSESSMENT

A soil vapor assessment will be conducted within open areas of the Site where the proposed building will be located and will be conducted in general accordance with the DOH Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006). The SOP for this field activity is included in Attachment A as SOP #13: Soil Vapor Sampling.

The samples will be collected at a depth of no less than five (5) feet below the ground surface. Should groundwater be encountered at a depth of less than six (6) feet below the ground surface, the DEC and DOH Project Managers will be contacted for guidance. All attempts will be made to collect the samples concurrently.

6.1 Sample Point Installation

The following procedures will be employed for installation of the subsurface sampling point.

- Utilize direct-push (Geoprobe) or hollow stem auger drilling methods to advance a boring to the desired sampling depth. All equipment coming in contact with Site soils during advancement of the borings will be decontaminated prior to the commencement of the borings and between each boring in accordance with Section 6.3.

- Insert the sampling point and tubing to the desired sampling depth within the boring.

- Backfill the borehole with an inert, porous media such as silica sand to create a soil vapor sampling zone of approximately two (2) to three (3) vertical feet.

- Backfill the remainder of the boring with a bentonite/cement mixture having a 20:1 ratio. This will provide a seal so that outside ambient air will not infiltrate into the sampling zone.

Note: If direct-push refusal is encountered at a depth less than four (4) to five (5) feet bgs, another attempt will be made within five (5) feet of the original location. The distance and direction of the new boring from the original boring location will be noted in the daily field notes. If four (4) unsuccessful attempts are made, the location where the deepest depth was achieved will be utilized for soil vapor sampling.

Note: No soil vapor sample will be collected from below grade locations where groundwater is present and saturated soil conditions prevail. Adjustments should be made in the target depth below grade to assure that the sample depth is one (1) foot above the saturated soil condition or surface of the groundwater table.

To ensure that ambient air does not enter the annulus, thus affecting the analytical data, a tracer gas (i.e. helium) will be applied within an enclosed structure at the ground surface above the top of the sealed annulus. The tracer gas will be a constituent that will be analyzed for in the field using a portable instrument capable of detecting the tracer gas. The detector will be attached to the end-portion of the tubing that will eventually be attached to the vacuum canister prior to the commencement of sampling. The helium detector will be utilized prior to the start of sampling and at the conclusion of sampling to verify that ambient air is not infiltrating the probe point annulus. The soil vapor probe will be considered adequately sealed if less than 10% tracer (helium) gas is detected.

6.2 Sample Collection and Laboratory Analysis

Prior to the commencement of sampling, two (2) to three (3) volumes of air will be purged from the sampling apparatus. Once the tubing is connected to the vacuum canister, the laboratory preset flow regulator will be opened for a period of two (2) hours for collection of the soil gas at a rate that will not exceed 0.2 liters per minute. After the two-hour time period is up, close the flow regulator and disconnect the tubing from the Summa canister. The samples will be analyzed for total volatile organic constituents per EPA Method TO-15.

6.3 Decontamination

Drilling equipment that comes into contact with the Site's soils will be decontaminated prior to advancement of the soil gas sampling borings and between each boring. Drilling equipment includes casing, augers, rollers, plugs and extension rods. The decontamination procedure should include the following:

- Physically remove (e.g., brush) any soil adhered to the equipment.
- Scrub/wash the items with non-phosphate detergent and tap water.
- Rinse the item using tap water.
- Air-dry the item where practical.
- Wrap the item in clean aluminum foil (or plastic for larger items) if not immediately re-used.
- Document cleaning activities in the daily field notes.

7.0 QUALITY CONTROL

7.1 Field Quality Control

Field Quality Control samples may include Equipment Blanks, Duplicates, Field Blanks, Laboratory Blanks and Matrix Spike/Matrix Spike Duplicates (MS/MSD). The types of field quality control samples to be collected and the sampling method and rationale are detailed in the QAPP. The SOP for this field activity is included in Attachment A as SOP #14: Collection of Quality Control Samples.

8.0 FIELD INSTRUMENTATION OPERATING PROCEDURES

8.1 General

The field instruments that may be utilized during implementation of the RI are: Photoionization Detector (PID) or Flame Ionization Detector (FID) for air monitoring of total VOCs in ambient air; PID or FID for headspace analysis of soil samples for total VOCs; and a temperature/pH/specific conductivity and turbidity meter for field analysis of groundwater samples. The field instruments used will be calibrated and operated in accordance with the manufacturers' instructions and the procedures identified in the SOP in Attachment a, entitled SOP #10: Field Quality Measurements and Calibration.

8.2 Photoionization and Flame Ionization Detector

A PID meter and data logger with a 10.6 eV lamp will be utilized to measure total VOCs. Although not anticipated, if the ionization potential of any compound being measured is expected to be greater than 11.7eV, a FID meter may be utilized in place of the PID meter. The instrument is calibrated at the factory upon purchase and annually thereafter using certified service shops who utilize standards of benzene and isobutylene. Prior to use in the field, the instrument will be calibrated in accordance with the manufacturer's instructions using a disposable cylinder containing isobutylene obtained from a reputable supplier. The calibration value varies by the manufacturer, however, 100 parts per million (ppm) is commonly utilized. During use, the PID or FID meter will be calibrated at least once every 8 hours. The calibration procedure is contained in the PID or FID meter User's Manual.

Care will be taken when handling and using the PID or FID meter to prevent any debris from entering the sample line which will affect the instrument's operation. If this occurs, the field personnel will clean the unit or replace it with a functional PID or FID meter.

8.3 Air Monitoring for Potential Contaminant Exposure

Air monitoring for potential exposure to airborne contaminants is typically conducted using a PID, FID, Combustible Gas Indicator (CGI) (measuring oxygen level and explosive atmosphere), MultiRae Plus meter (measuring oxygen level, explosive atmosphere, PID, and hydrogen sulfide), or dust/aerosol meter. The SOP for this field activity is included in Attachment A as SOP #3: Organic Vapor Monitoring and Air Monitoring.

8.4 Temperature, PH and Specific Conductivity

The instrument used to measure temperature, pH and specific conductivity will be equipped with automatic temperature control for accurate adjustment to the temperatures of the samples and calibration standards. Prior to collecting the pH and specific conductivity readings, the instrument will be calibrated prior to use each day to ensure accuracy. The standard operating procedure for this field activity is included in Attachment A as SOP #10: Field Water Quality Measurements and Calibration.

9.0 SAMPLE HANDLING AND CHAIN OF CUSTODY PROCEDURES

The purpose of this procedure is to describe how to properly handle the sampling containers and how to document information on a Chain-of-Custody (COC) form. A COC is a legally binding document that includes sample identification and laboratory analyses required, and documents possession of samples from the time they are obtained until they arrive at the laboratory. The SOP for this field activity is included in Attachment A as SOP #11: Chain of Custody Procedures.

10.0 WATER LEVEL MEASUREMENT PROCEDURES

Water levels will be measured in the monitoring wells using a water level indicator probe. The water levels will be measured from the surveyed reference point to the nearest 0.01 foot. Water levels will be measured progressively from upgradient monitoring wells to downgradient monitoring wells, attempting to measure water levels from the well with the lowest concentration of target compounds to the well with the highest concentration of target compounds.

To avoid possible cross contamination of the wells, the water level indicator will be decontaminated prior to and following the water measurement at each individual well. The water level indicator will be decontaminated by rinsing it with potable water, vigorously scrubbing with a brush and laboratory-grade standard detergent (e.g., Alconox® or Liquinox®) and potable water, then rinsing it in accordance with the SOP included in Attachment A as SOP #7: Equipment Decontamination Procedures.

The procedure for measuring the static water level and the total well depth in a groundwater well is included in Attachment A as SOP #9: Measuring Static Water Level, Immiscible Layers (DNAPL and LNAPL), and Total Well Depth in Water.

11.0 INVESTIGATIVE DERIVED WASTE, STORAGE, SAMPLING AND DISPOSAL

Investigative Derived Waste (IDW) will be containerized in appropriately sized compatible containers, properly stored, profiled and ultimately transported to a disposal facility permitted to accept the waste in accordance with NYSDEC DER-10 procedures and this FSP. The SOP for this field activity is included in Attachment A as SOP #15: Sampling and Disposal of Investigative Derived Waste.

ATTACHMENT A

STANDARD OPERATING PROCEDURES

C.T. MALE ASSOCIATES ENGINEERING,
SURVEYING, ARCHITECTURE &
LANDSCAPE ARCHITECTURE, D.P.C

STANDARD OPERATING PROCEDURE
#1

NOTE TAKING and FIELD LOGS

Revision 2

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: NOTE TAKING AND FIELD LOGS

1.0 PURPOSE

This standard operating procedure (SOP) provides programmatic criteria for the content of field logs.

2.0 SCOPE

This procedure applies to all C.T. Male Associates field personnel engaged in note taking and data collection to be recorded on Environmental Services Field Logs.

3.0 GENERAL

An essential part of any environmental field project is proper documentation. The primary documentation used to record site data are Environmental Services Field Logs, which describe the history of field activities and summarize field measurements. This is necessary to demonstrate that the data are representative and have been obtained according to required procedures. The field logs may be used as evidence in legal proceedings to defend procedures and techniques employed during site investigations and remedial actions. Therefore, it is important that documentation be factual, complete, accurate, consistent, and clear.

4.0 DOCUMENT SOURCES

Field documents consist of the following hardcopy, printed on standard paper and placed in a non-waterproof resistant folder or aluminum clipboard, or electronic types:

- Environmental Services Field Logs.
- Soil Boring Logs.
- Test Pit Log Sheets.
- Organic Vapor Headspace Analysis Logs.
- Monitoring Well Construction Logs.
- Groundwater Services Field Log.
- Monitoring Well Water Level Logs.

- Monitoring Well Purging Logs.
- Monitoring Well Development Logs.
- Photographs and Photographic Logs.
- Laboratory Chain of Custody Forms.
- Shipping Waybill and Manifest Documents.
- Other field activity and/or field data documentation.

5.0 RESPONSIBILITIES

5.1 Project Manager

Field sampling personnel, in conjunction with the Project Manager are responsible for overall compliance with this technical procedure. The Project Manager, or designee, is responsible for verifying that the data entries made on the field logs comply with this technical procedure. The Project Manager will also provide copies of Environmental Services Field Logs to the Quality Assurance Officer for general review.

5.2 Site Personnel

All site personnel who make field log entries are required to read this procedure before engaging in this activity. The Project Manager, or designee, will inform personnel who will be responsible for field log entries, care, and maintenance.

6.0 PROCEDURE

6.1 Environmental Services Field Logs

Field logs will contain lined, consecutively numbered pages. Record the following information on the front page of Field Logs:

- Date.
- Time On-Site/Time Off-Site.
- Project name.

- C.T. Male Associates project number.
- Purpose (i.e., completion of test borings/soil sampling, etc.).
- Weather conditions.
- Personnel present at the site and site visitors.

Entry of field activities, events, data, and other relevant project task information will be documented daily (at minimum) throughout the course of field activities. The following minimum requirements must be followed when entering daily activities on the Field Logs:

- The field activity and date must be recorded at the top of each page.
- The top page corner of each page will be consecutively numbered.
- Entries on the field logs should be preceded with the time written in military units. The time should be recorded frequently and at the point of events or measurements that are representative of the activity being logged.
- Changes must be made with a single, strike-out line through the deletion. Changes must be initialed and dated. Scribbling or blotting out deletions is unacceptable.
- Entries should be made in waterproof ink unless inclement weather prevents pens from working. Except on site where samples are being collected for PFAS, then a non-waterproof pen will be used.
- Entries must be written clearly and legibly enough so that any reviewer can read and understand the entry.
- The bottom of each page should be signed and dated by the author.

Events and observations that should be recorded should include, but are not limited to, the following:

- The field activities/tasks with date and time.

- The location(s) and field conditions in which the field task will be conducted.
- The names and organization(s) of field task staff and/or visitors, including C.T. Male Associates' personnel, subcontractors, clients, and regulators.
- Site conditions (upon arrival and departure) and changes in site conditions.
- Current weather and changing weather conditions that might impact field activities.
- Relevant field observations, major task decisions, comments, or other valuable information will be documented throughout the course of site activities. Entries will be as specific and detailed as possible and practical.
- If field datasheets, soil boring log sheets, photographs, sample location coordinates, or other documentation types are specified by a procedure, the information need not be duplicated, but the relevant documentation type and/or forms must be referenced in the Field Logs and attached to the Field Logs, if applicable.
- Documentation of field instrument calibration or reference to appropriate field calibration sheets.
- Field map sketches will be drawn with an approximate North arrow and, if possible, approximate scale. Boring or sample locations with measurements (swing ties) to at least two fixed objects to locate points for mapping.
- Changes and/or deviations from task protocols (such as sampling procedures) outlined in governing planning documents.
- Reason(s) for noted deviations, and whom the deviation was discussed with and authorized by.
- Problems, downtime, or delays and the reasons for the problem or delay.
- Upgrade or downgrade of personal protective equipment.

- Equipment make, model, and property numbers or serial numbers used at the site.
- Health and safety monitoring equipment, including calibration procedures and results and actual and background readings.
- Start and end times of sampling.
- Sampling steady-state parameters.
- Decontamination times and methods.
- Type, amount, and disposal methods used for investigation/remedial action derived wastes.

When samples are collected, the following should be recorded on the log sheets or laboratory Chain of Custody form:

- Sample location and depth.
- Sample identification number.
- Sample date and time.
- Sample methodology.
- Sample type and media.
- Field sampler initials.
- Sample analyses requested.
- Sample preservation type.
- Quality control sample numbers and types.
- Chain-of-custody number.
- Name of individual to whom the samples are relinquished.

- Laboratory service provider in which samples are to be relinquished.
- Shipping Service(s) or method(s) used for sample delivery.
- Date and time of shipment.
- Shipping Waybill or manifest number.

6.2 Field Datasheets and Forms

Other data documentation types (including Soil Boring/Test Pit Log Sheets, Photographic Logs, Laboratory Chain of Custody Forms, Shipping Waybill and Manifest Documents, and similar documents) are part of the field records. Generally, the use of these documentation types are task-specific and when used should be attached and referenced within the field logs. However, specific data entered on these types of documents will not typically be documented verbatim on the field logs, so document handling and archiving must be performed in the same manner as the field logs.

6.3 Electronic Data Documents

Electronic data documents may consist of photographs; GPS and survey coordinate data, field instrument data, and other electronic data files. Field instruments and tools such as digital cameras, GPS units, water-quality meters, photoionization detectors (PIDs), pressure-transducers, dust monitors and hand-held computers store data in electronic formats that can be later downloaded and stored electronically for future reference. Take care when retrieving, storing, and managing these electronic data. The Project Manager or designee will be consulted for electronic data management instruction before using unfamiliar electronic instrument or tool requiring electronic data retrieval and storage. At minimum, Electronic Data Documents will be managed as suggested below:

- Download electronic data without manipulation. Downloaded data should be in a format that can be reviewed by others that may not have the equipment specific software used to download it.
- After collection, retrieve (download) electronic data from the field instrument daily or as determined necessary by the Project Manager.

- After successful electronic data document retrieval, store electronic data files at a digital location specifically reserved for that data document type. The data storage device must be reliable and secure. The data will be stored at a location that can be readily accessed by multiple team members (that is, network project server or file transfer protocol [FTP] site).

- Back up electronic data documents in the event of data loss. Backup formats may include, but are not limited to, CDs, DVDs and external hard drives. Whatever data backup format is used, the data backup must be managed for retrieval by the Project Manager and other responsible team members, if necessary.

- Name data files appropriately to easily identify the content and date of collection or download.

- If possible, include the following identifying information in data files:
  - Company name (C.T. Male Associates).
  - Client and project name.
  - Investigation area name.
  - Date and time.
  - Project number.
  - Location(s) of data collection.
  - Other information unique to the kind of data collected.

- Delete data from electronic instrument once successful download is confirmed. This is especially important if equipment is rented, so project data is not available to others not involved with the project.

7.0 Document Control

At the conclusion of a task or when field logs, datasheets, and/or electronic data documents have been completed, they will be submitted for records retention. Project files will be maintained by the Project Manager or designee. Documents will be kept in the project files and C.T. Male Associates electronic project directory. Project personnel may keep their own duplicate files; however, original documents will be placed in the official project file and scanned into the electronic project directory. Field logs of boring, sampling, and well installation activities will be maintained by the field sampling personnel and submitted to the project manager after the field effort.

8.0 Attachments

The following field forms are attached for reference:

- Environmental Services Field Log.
- Subsurface Exploration Log
- Geoprobe Subsurface Exploration Log.
- Test Pit Log Sheets.
- Organic Vapor Headspace Analysis Logs.
- Monitoring Well Construction Logs.
- Groundwater Services Field Log.
- Monitoring Well Water Level Logs.
- Monitoring Well Purging Logs.
- Monitoring Well Development Logs.

C.T. MALE ASSOCIATES ENGINEERING,
SURVEYING, ARCHITECTURE &
LANDSCAPE ARCHITECTURE, D.P.C

STANDARD OPERATING PROCEDURE
#2

DRLLING and ASSOCIATED SAMPLING METHODS

Revision 2

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: DRILLING and ASSOCIATED SAMPLING METHODS

1.0 PURPOSE

This standard operating procedure (SOP) provides guidance for selecting and implementing the proper drilling methods for collecting subsurface soil and groundwater samples and for installing groundwater monitoring wells using hollow stem auger (HSA) and/or direct push system (DPS) drilling methods.

2.0 SCOPE

This SOP applies to all C.T. Male Associates personnel and sub consultants engaged in drilling activities. This SOP focuses on the commonly used drilling tasks and applications and should be used in conjunction with other project SOPs, including the following:

- SOP: Note Taking and Field Logs.
- SOP: Organic Vapor Monitoring and Air Monitoring.
- SOP: Surface and Subsurface Soil Sampling.
- SOP: Equipment Decontamination Procedures.

Should field tasks and procedures be added to a project that is not included in this SOP, they will be defined in the project-specific Health and Safety Plan (HASP), before implementation. Changes to field procedures and/or equipment will be documented on the Environmental Services Field Logs and Subsurface Exploration Logs.

3.0 GENERAL

Selecting the proper drilling equipment for environmental and geotechnical sampling and monitoring well installation is a part of field investigations. This SOP describes hollow stem auger and direct push drilling methods generally used for subsurface soil sampling and groundwater monitoring well installation and the commonly used tools for these techniques.

In addition to selecting the proper type of drilling technology, drilling activities should conform to State regulations and be supervised by an experienced geologist or environmental scientist. Either the drilling contractor or C.T. Male Associates will obtain permits, applications, and other documents required by state and local authorities and the client. In addition, the following general guidelines should be considered during planning and implementation of drilling investigations:

- Review background information for the investigation area. This includes identifying and understanding the type(s) of contaminant(s) released, the manner of release, and the affected media.

- Select the proper drilling technology and drill rig.

- Determine the inside diameter of the soil borehole needed to accomplish the drilling objectives and provide adequate sample volume.

- Before mobilization to each boring location, determine that the location is free of subsurface or overhead utilities. The drilling contractor will be responsible for obtaining utility clearance prior to mobilizing to the project site.

- Take appropriate precautions during drilling to avoid introducing contaminants into the borehole.

- Drill boreholes in areas of no or low anticipated contamination by first progressing toward areas of increasing contamination. Under ideal conditions, upgradient areas without contamination should be drilled first.

- When drilling boreholes through more than one water-bearing zone or aquifer, take measures to prevent cross-connection or cross-contamination of the zones or aquifers, such as using telescoped casing.

- Before mobilization to each boring location, decontaminate the drill rig and drilling equipment placed into the borehole by steam cleaning, using high-pressure hot water, or similar methods according to SOP Equipment Decontamination Procedures. The drill rig must not leak any fluids that may enter the borehole, contaminate equipment placed in the borehole, or impact lands and waters of the State.

- Avoid using drilling mud, synthetic drilling fluids, or petroleum- or metal-based pipe joint compounds and other potential contaminants unless necessary. To reduce the cross contamination for PFAS, avoid using tubing, liners, pumps, valves and wiring with polytetrafluoroethylene (PTFE), Vitron, Niskin, GoFlo, or ethylene tetrafluoroethylene, Teflon check balls, o-rings, compression fittings, and impellers. If their use is necessary, drilling fluids must not introduce or mask contaminants. Provide safety data sheets (SDS) for drilling fluids proposed for downhole use before field work and describe procedures for containment and disposal of fluid in the remedial action work plan. If it is necessary to add drilling mud to the borehole during drilling to stabilize the hole or control down-hole fluid losses, use only high-yield sodium bentonite clay free of organic polymer additives.

- If it is necessary to add water to the borehole during drilling to control flowing and heaving soils, use only potable water from a documented clean source. If drilling to potentially sample for PFAS, the drilling water will need to be filtered to ensure the source water if PFAS free. Refer to the site specific work plan. Potable or filtered water volume added to a borehole must be developed from the well. If potable or filtered water is added to the borehole, an equal volume of water must be developed from the borehole in addition to the standard well development volume.

- To the extent practical, restore the site to its pre-investigation conditions. Record information pertinent to documenting the above requirements on the Environmental Services Field Logs.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager is responsible for providing adequate resources and ensuring that field staff have adequate experience and training for project-specific implementation of the health, safety, and environment (HS&E) management process and project SOPs. The Project Manager and Health & Safety Officer cooperatively have overall HS&E program responsibility; however, specific tasks may be delegated to other project staff. The Project Manager retains ultimate HS&E responsibility for the project. The Project

Manager will solicit the appropriate technical expertise to adequately identify the drilling and sampling technology for the job given the current understanding of the site lithology.

4.2 Health & Safety Officer

The Health & Safety Officer is responsible for site-specific HS&E and overall compliance with project HS&E requirements. The Health & Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE for the project, lists the requirements in the project-specific HASP, coordinates with the Field Team Leader to complete the PPE program, and conducts project audits on the effectiveness of the HS&E program.

4.3 Site Specific Health and Safety Officer

The role of Site Specific Health and Safety Officer is designated to the Field Team Leader by the Project Manager and/or Health & Safety Officer, to assist in implementing the project-specific HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the HS&E program, implements the PPE requirements described in the project-specific HASP, and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Team Leader

The Field Team Leader, in conjunction with the Project Manager and Health & Safety Officer, is responsible for overall compliance with this SOP. The Field Team Leader is responsible for following these procedures or delegating drilling tasks to field personnel. The Field Team Leader should document that subcontractors comply with this SOP.

4.5 Field Geologist/Environmental Scientist

The Field Geologist/Environmental Scientist supervises the drilling and collection of lithologic samples, and records field data as described in this SOP, the project-specific HASP, and the SOP for Note Taking and Field Logs.

5.0 DRILLING OVERVIEW OF METHODS

5.1 Hollow Stem Auger Drilling

Hollow stem auger drilling is a form of rotating auger drilling, consisting of continuous-casing, segmented auger sections with screw-flights that are rotated into the subsurface under downward pressure. The auger section is typically equipped with a drill bit and cutting teeth. Drill cuttings are brought to the surface by a conveyor action created by the rotating screw flights and drill bit. The auger sections maintain borehole stability even in unconsolidated material.

Continuous (every two feet) or nominal (every five feet) soil samples will be collected in general accordance with the procedures of ASTM D-1586, Standard Method for Penetration Test and Split Barrel Sampling of Soils. A standard split barrel sampler, which is 24-inches long and 2-inches in diameter, will be used for sampling.

Generally, hollow stem auger drilling is limited to depths less than 100 feet where lithology is unconsolidated. Multiple auger sections are connected in series to create a "drill string" with clamping pins or threaded bolts. Hollow stem auger drilling usually requires a larger drill rig than is used with direct push system drilling, and the entire rig can stand between 20 and 40 feet high, requiring high overhead clearance. At sites where groundwater is relatively shallow (less than 50 feet) and direct push system drilling is not feasible because of lithology (cobbles and boulders, glacial till, etc. are present), or where a larger diameter boring is required, it is common to use hollow stem auger drilling.

In situ soils may be sampled through the center of the hollow stem auger drill stem. An advantage of hollow stem auger drilling is that the auger sections can be left in place to hold the borehole open and prevent borehole collapse. Hollow stem augers are specified by the internal diameter of the hollow stem, not by the size of the hole they drill. Augers with a minimum inner diameter of 4 inches will be required to install a 2-inch monitoring well, to create adequate annular space between the auger casing and well casing to construct well filter sand pack and bentonite seal. It is preferable to use a larger inner-diameter auger (6 inches) to install a 2-inch monitoring well; however, the benefits should be weighed against the additional investigation-derived waste volumes that will be generated and the cost. If a 4-inch diameter monitoring well is required, the inner auger diameter must be 6 to 8 inches.

Boreholes should be advanced using pre-cleaned and decontaminated augers and sampling equipment, according to SOP for Surface and Subsurface Soil Sampling. Boreholes that are not converted to wells should be abandoned by returning non-impacted soil cuttings to the borehole and filling remaining borehole space with a grout/bentonite mixture having an approximate ratio of 20:1.

5.2 Flush Joint Casing Drilling

Drilling with flush joint casing is similar to auger drilling and is most often advanced with the same drill rig. Typical casing diameters are 4, 6 and 8 inches, but can vary. Casing lengths are typically 5 and 10 feet. Casing sections are joined with flush thread fittings. The casing sections can be spun into the ground while applying downward pressure on the drill string while adding water to the casing to flush the drill cuttings Casing sections can also be advanced into the ground with either a 140 lbs. or 300 lbs. hammer with a casing drive head connected to the top of the drill string. A roller bit and water are then used to remove and flush soils from the casing.

Soil samples are collected in the same manner as when using auger casing. Installation of monitoring wells is essentially the same a using auger casing. Four- inch diameter casing is typically used for installing two-inch diameter monitoring wells, and six-inch casing when installing four-inch diameter wells.

Flush joint casing is also used to seal off the overburden soils when advancing the borehole into bedrock with a rock core barrel or roller bit.

Boreholes should be advanced using pre-cleaned and decontaminated augers and sampling equipment, according to the SOP for Surface and Subsurface Soil Sampling. Boreholes that are not converted to wells should be abandoned by returning non-impacted soil cuttings to the borehole and filling remaining borehole space with a grout/bentonite mixture having an approximate ratio of 20:1.

5.3 Direct Push System Drilling

Direct push system technologies involve a category of drilling equipment that hydraulically pushes or drives small-diameter, hollow steel rods into the subsurface without rotating the drill rods. Some drill rigs may be “combo rigs,” capable of conducting both direct push and rotating hollow stem auger drilling operations. Direct push system drilling uses a combination of a hydraulically powered percussion hammer, a downward hydraulic push, and the weight of the vehicle on which the system is mounted to drive rods into the subsurface. Direct push system methods push a continuous tube sampler into the subsurface by laterally displacing soil to make a path for the sampler, so no cuttings are generated. Direct push system drilling is commonly used for shallow applications (less than 50 feet); however, depending on the lithologic conditions, it may be used as deep as 120 feet.

Direct push system technology is typically limited to unconsolidated formations that are relatively free of cobbles or boulders or dense glacial till. Refusal may occur if there are too many cobbles, boulders, or other consolidated formation materials. However, since direct push system drilling is relatively fast, drilling refusal at a desired location due to cobbles may be mitigated by abandoning the hole and relocating to an adjacent location.

Direct push system boreholes generally cannot be sampled deeper than the water table because unconsolidated materials cave in once the drive rods are removed. However, caving may be mitigated by advancing casing with an inner drill rod used for sampling, allowing for sampling and well installation below the water table.

Outside diameters of samplers and boring tools generally range from 0.75 to 3.5 inches. If installation of monitoring wells is planned, the inside diameter of the boring should typically ranges from 1.5 to 3.5 inches (for 1- to 2-inch diameter wells).

Direct push system technologies provide the following advantages over conventional drilling methods:

- Minimal ground disturbance, with a small-diameter boring that is easy to abandon.

- No cuttings, which eliminates the need for handling, containerizing, sampling, and disposing of potentially contaminated investigation-derived waste (unless samples are brought to the surface).
- Relatively faster boring advancement as compared to hollow stem auger drilling.
- Relatively faster monitoring well installation as compared to hollow stem auger drilling if small-diameter wells (0.75 to 1.25 inches in diameter).

Boreholes should be completed using pre-cleaned and decontaminated drive points, rods, and sampling equipment according to SOP for Surface and Subsurface Soil Sampling. Boreholes that are not converted to wells should be abandoned by returning non-impacted soil cuttings to the borehole and filling remaining borehole space with a grout/bentonite mixture having an approximate ratio of 20:1.

5.4 Rotosonic Drilling

Sonic drilling advances a borehole using resonant high frequency vibrations to fluidize the formation at the drill bit. Vibrations created in the sonic head at the top of the drill string move rapidly up and down the drill string with intense vibration at the drill bit; resonant frequencies of 50 to 200 Hertz. Sonic drilling could be used for continuous collection of soil samples and advancement into bedrock.

The installation of monitoring wells with a Rotosonic borehole is essentially the same as when employing either hollow stem augers or flush joint casing.

Boreholes should be advanced using pre-cleaned and decontaminated augers and sampling equipment, according to SOP for Surface and Subsurface Soil Sampling. Boreholes that are not converted to wells should be abandoned by returning non-impacted soil cuttings to the borehole and filling remaining borehole space with a grout/bentonite mixture having an approximate ratio of 20:1.

6.0 DRILLING AND SAMPLING PROCEDURES

6.1 Drilling Contractor Responsibilities

Working around drill rigs can be dangerous. As a result, increased consciousness and vigilant observation of drilling activities are necessary to reduce the risk of injury to workers involved with drilling. Safe work requires that good communication is maintained between the driller/helper and the Field Geologist/Environmental Scientist during drilling activities. Encourage the driller to notify the Field Geologist/Environmental Scientist routinely of the depth(s) at which changes in drilling rates become evident and immediately of other drilling observations that may indicate subsurface obstructions or utilities. The SOP for utilizing the machinery to drill the borehole(s) or well(s) onsite will be conducted by the drilling subcontractor, following their SOP.

At a minimum, the following activities should be conducted as part of the drilling program:

- Conduct a kickoff meeting prior to drilling. Describe tasks to be conducted and a tentative schedule. As the drilling progresses, discuss the remaining tasks and revised schedule with the drill crew daily. Communicate progress and issues with the Project Manager.

- Hold a health and safety tailgate meeting prior to the commencement of drilling activities, each day.

- Wear proper PPE at all times.

- Conduct air monitoring as specified in the project-specific HASP and according to SOP Organic Vapor Monitoring and Air Monitoring.

- Visit the site and drilling locations with the driller to identify potential site hazards and obstacles before mobilization and setup.

- Document that the drilling contractor has obtained underground and overhead utility clearance. Require driller to maintain proper clearance with aboveground utilities and obstructions.

- Set up proper traffic controls if working in an area where there are traffic hazards.

- Establish exclusion and decontamination zone using barriers, flagging tape, or other methods to prevent unauthorized access to the drilling location according to the site-specific HASP.

- Inspect the drill rig for leaking lines or other hazards and have the driller test safety switches and demonstrate that they work. No fluids should leak from the drill rig.

- Document that personnel working around the drill rig are trained and instructed, familiar with drill rig operation, and understand the task to be performed.

- Identify the locations of the fire extinguisher(s) and first aid kit(s), and verify that they are readily available for use.

- Maintain good housekeeping on and around the drill rig.

- Establish a staging area for storing investigation-derived waste and decontaminating augers and sampling equipment.

- Establish a core logging and sample collection area at a safe location within sight of the drill rig.

- Place sampling equipment and soil recovered from the subsurface on plastic sheeting or similar dedicated material to avoid potentially contaminating the ground surface.

- Log downtime that occurs because of drilling contractor equipment failure, weather, site access, or other issues, on the Environmental Services Field Log and/or Subsurface Exploration Log.

7.0 HEAVING AND FLOWING SOILS

Heaving and flowing soils within the saturated zone may complicate drilling procedures. When encountered, use appropriate drilling techniques to minimize potential impacts; these include using drilling fluids or a drill-stem plug. Minimize the use of drilling fluids if possible. However, when necessary, it is permissible to add potable water from a documented, clean source, or when sampling for PFAS the use of filtered water to the borehole to control heaving and flowing soils as long as identification of the saturated zones during drilling is not compromised and the drilling fluid can be removed during development so that representative water levels can be obtained. Drilling fluid volume added to a borehole must be developed from the well. If potable or filtered water is added to the borehole, develop an equal volume of water from the borehole, in addition to the standard well development volume. If a drill-stem plug is used, slowly release the plug from the end of the drill-string while at total borehole depth.

8.0 RECORDS

Record field activities and soil boring field data on the Environmental Services Field Logs and Subsurface Exploration Logs.

9.0 DEFINITIONS

- Auger section: A segment of hollow auger outer casing with helices (flights) welded around the exterior that conveys soil cuttings from the drill bit to the surface when rotated.
- Borehole: The downward hole in the subsurface lithology created by drilling activities.
- Combo drill rig: Drill rigs capable of conducting both direct push system and rotating hollow stem auger drilling operations.
- Cutting shoe: The cutting end of a direct push system drill string.
- Direct Push System (DPS): A drilling technology that hydraulically pushes or drives small diameter, hollow steel rods into the subsurface without rotating the drill rods.
- Down time: Non-productive time on the part of the drilling contractor or their subcontractors related to scheduling, breakdown, or other operational delays.
- Drill bit: The cutting end of a drill string that typically has cutting teeth.

- Drill string: Multiple auger or casing sections connected in series with a drill bit or cutting shoe connected at the driving end of the drill string.

- Flush Joint Casing: Lengths (usually 5 to 10 ft, casing diameters can be 4, 6 and 8 inches) of steel tubing provided with a box thread at one end and a matching pin thread on the opposite end. Coupled, the lengths form a continuous tube having uniform inside and outside diameters throughout its entire length.

- Heaving or Flowing Soils: Loose medium- and fined-grained soils in a confined, water bearing zone or aquifer that tend to rise up into the drill stem when the unit confining the aquifer is breached by the drill bit. This happens because the water in the aquifer has a pressure head great enough to cause upward flow into the drill stem with enough velocity to overcome the weight of the sand, creating a quicksand condition and carrying sand into the drill stem. Usually associated with hollow stem auger drilling.

- Hollow Stem Auger (HSA): A form of rotating auger, consisting of continuous-casing, segmented auger sections with helices (screw-flights) that are rotated into the subsurface under downward pressure.

- Investigation-derived waste (IDW): Contaminated waste generated during investigation and/or remedial activities, including wash water, purge water, personal protective equipment, sampling tools and supplies, and soil cuttings.

- Photoionization detector (PID): A detection tool that measures organic vapor concentrations in air using the photoionization potential of the contaminant.

- Probe drive string: The outer casing and drive string used during direct push system drilling.

- Sample shoe: A retaining device, typically made of polyethylene, that allows soils to enter a sampler but does not allow them to exit through the end of the sampler.

- Solid-point drive point: A solid point placed within the open, hollow end of a direct push system cutting shoe so that soil may not push up and into the probe drive string.

- Split- spoon sampler: A soil coring device that consists of a length of carbon or stainless steel tubing split longitudinally and equipped with a sample shoe and a drive head.

- Standard Penetration Test (SPT): A soil test used to evaluate the relative density of unconsolidated soil by counting the number of times a weighted hammer (typically 140 pounds) is repeatedly raised and dropped over a 30-inch height for every 6 inches of soil penetration.

- Unconsolidated formation: A subsurface soil formation that is unstable or loose with a low ability to remain cohesive without retainment. Soils that easily slough or erode back into an open borehole without an outer casing to keep the borehole open.

C.T. MALE ASSOCIATES ENGINEERING,
SURVEYING, ARCHITECTURE &
LANDSCAPE ARCHITECTURE, D.P.C

STANDARD OPERATING PROCEDURE
#3

ORGANIC VAPOR MONITORING and AIR MONITORING

Revision 2

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: ORGANIC VAPOR MONITORING AND AIR MONITORING

1.0 PURPOSE

This standard operating procedure (SOP) provides guidance for conducting organic vapor monitoring of environmental media, and air monitoring procedures to identify volatile organic compounds (VOCs) and airborne particulates (i.e., dust) during field activities. The project-specific Health and Safety Plan (HASP), submitted under separate cover, will specify the type(s) and frequency of vapor and air monitoring requirements at each work area.

2.0 SCOPE

- This SOP applies to C.T. Male Associates' personnel engaged in organic vapor or air monitoring activities.

There are many instruments available for organic vapor and air monitoring. This SOP focuses on the project-specific instruments and applications. Monitoring requirements that are not identified in this SOP will be discussed with the Site Health & Safety Officer before starting field activities, such that proper requirements, procedures, and monitoring instruments are identified. Should instrumentation or procedures be added to a project task that is not included in this SOP, they will be incorporated into the project-specific HASP and documented on the Environmental Services Field Log.

3.0 GENERAL

Organic vapor monitoring and air monitoring serve two primary functions:

1. To evaluate organic vapor concentrations in site media to assist site characterization.

2. To monitor potential airborne chemical contaminant exposures to C.T. Male Associates site workers and the surrounding community.

The use of field instrumentation for volatile organic compounds (VOCs) at field sites allows on-site analytical screening of air, water, sediment, and soils. Screening results can also be used to anticipate potential petroleum and other VOC contamination and select locations for sample collection for laboratory analysis. In addition to monitoring for VOCs during sample collection, air monitoring for VOCs and airborne particulates may be necessary to identify potentially hazardous atmospheres encountered during field activities which may affect site personnel and/or the surrounding community.

Air screening measurements can be used to evaluate the exposure risk and be used as a basis for setting health and safety levels of protection. Instrument calibration and air monitoring should be conducted according to, and at the frequency specified in, the approved project-specific HASP. Air monitoring instruments will be calibrated daily and/or as specified by the instrument manufacturer, before obtaining measurements. Air monitoring results compared to specifications in the project-specific HASP provide documentation that overexposure has not occurred, compliance with standards has been achieved, and most importantly, the real-time determination of whether engineering controls or personal protective equipment (PPE) are needed to control exposure.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager is responsible for providing adequate resources, and verifying that field staff has adequate experience and training for project-specific implementation of the health, safety, and environment (HS&E) management process and project SOPs. The Project Manager is also responsible for identifying the need for organic vapor monitoring or the potential for hazardous atmospheres during the planning stages of the project. In addition, the Project Manager is responsible for developing or authorizing alternative monitoring requirements if notified that conditions encountered in the field have changed from those identified in the HASP.

The Project Manager and Health & Safety Officer cooperatively have overall HS&E program responsibility; however, specific tasks may be delegated to other project staff. The Project Manager retains ultimate HS&E responsibility for the project.

4.2 Health & Safety Officer

The Health & Safety Officer is responsible for verifying that organic vapor and air monitoring is conducted according to the project-specific HASP. The Health & Safety Officer and a designated Field Sampling Leader supervise the collection and documentation of field data generated, and verifies that the equipment used by the field sampling personnel is calibrated at the appropriate frequency and maintained correctly.

4.3 Site Health and Safety Officer

The role of Site Health and Safety Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Site Health and Safety Office /Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Sampling Leader

The Field Sampling Leader, in conjunction with the Health & Safety Officer, is responsible for overall compliance with this technical procedure. The Field Sampling Leader is responsible for following these procedures or delegating tasks to team members to perform vapor and air monitoring tasks.

5.0 PROCEDURES

Many instruments are available for organic vapor monitoring, as well as monitoring of airborne dust. Because it is beyond the scope of this SOP to describe available alternatives, this SOP will focus on conducting air monitoring and headspace soil vapor monitoring using the following commonly used equipment types:

- Photoionization detector (PID)
- Flame Ionization detector (FID)
- Combustible gas indicator (CGI) and oxygen level indicator
- Combination Meters and Multi –gas meters (such as PID, CGI, oxygen, and hydrogen sulfide)
- Dust monitor

The organic vapor and air monitoring instruments expected to be used include the following:

- MiniRae 2000 or 3000 PID
- Photovac Micro FID
- Thermo Scientific TVA 1000A FID/PID
- MultiRae Plus Multi-gas meter
- RKI Eagle 6
- DustTrak™ II Aerosol Monitor (Model 8530).

The MiniRae 3000 PID is the commonly used instruments for organic vapor monitoring. The DustTrak™ II Aerosol Monitor is a direct-reading, aerosol monitor designed to provide real-time measurement of airborne dust and particulate concentrations.

5.1 Equipment Calibration

To ensure that field air monitoring equipment will be calibrated and remain operable in the field, calibrate field air monitoring equipment daily, or per the manufacturer's recommendation, before use. Other project-specific requirements may require calibration of air monitoring equipment at a greater frequency. Calibrate field air monitoring equipment on site and document that calibration standards used meet the minimum requirements for source and purity recommended by the instrument manufacturer. PIDs and FIDs are typically calibrated with a 100 parts per million (ppm) isobutylene calibration gas. The PID or FID must be capable of ionizing the expected contaminants of concern. Calibrate field air monitoring equipment within calibration acceptance criteria and within the instruments operational limits (zero calibration for the dust monitor equipment). If instrument readings appear to be irregular or drifting, recalibrate instruments before collecting additional data. Flag apparent instrument drift or erratic instrument readings on Environmental Services Field Logs (see SOP Note Taking and Field Logs). If the instrument cannot be recalibrated, take the instrument out of service and replace it with a different unit that is capable of being calibrated and used with reliability.

Before starting air monitoring, document the following calibration information on the Environmental Services Field Log and Organic Vapor Headspace Analysis Log:

- Calibration Date and Time.

- Instrument Type, Name, Serial Number, and Owner.

- Lamp Type (PID only).
- Calibration gas type, canister lot number, and expiration date.
- Zero gas calibration reading, if used.
- Calibration gas (span gas) reading.
- Zero filter calibration reading (dust monitor).
- Ambient weather condition (for example, temperature and wind direction).
- Operator's initials.
- Other notes and comments.

5.2 Organic Vapor Monitoring with a Photoionization Detector

The following procedures are specific to the MiniRae 3000 PID instrument; however, they are generally applicable to other manufacturer's instruments, and the precautions to consider are the same. Manufacturer specific manuals should be reviewed and understood before instrument use.

The MiniRAE 3000 PID is a portable, non-specific vapor/gas detector employing the principle of photoionization to detect a wide variety of VOCs. Use a PID during intrusive activities (i.e., test borings, soil excavation, etc.) where there is a potential for the presence of petroleum or VOC contamination in accordance with the project-specific HASP.

Calibrate the PID each day, following the calibration specifications of the manufacturer and before the start of field activities. If the PID is in continuous operation, verify daily calibration with a bump test. Perform instrument calibration using isobutylene calibration gas of known concentration; 100 ppm isobutylene calibration gas is preferred.

The following provide additional details about the PID:

- The MiniRae 3000 PID is reported to operate continuously for up to 16 hours before requiring battery recharging, but charging on a daily basis is preferred.

- Elevated water vapor concentrations experienced in high humidity will foul the PID and may result in erroneous readings. If high humidity problems persist, blow-dry the sensor module or bring instrument into an air conditioned environment with reduced humidity.

- MiniRAE 3000 PID readings are relative to the calibration gas. After calibration with 100 ppm isobutylene, the MiniRAE 3000 PID will respond directly in units equivalent to isobutylene.

- Most VOCs will be detected by the MiniRAE 3000 PID. However, it cannot distinguish between isobutylene and other ionizable compounds. A reading of 10 ppm indicates ionizable compounds that are present have generated an ion current equivalent to 10 ppm of isobutylene. The reading is actually 10 ppm isobutylene equivalent units.

- The lamp window must be periodically cleaned according to the instructions in the manual provided with the instrument to maintain ionization of the volatized contaminants.

5.2.1 Organic Vapor Monitoring of Site Media

Monitoring of organic vapors in site media can help identify potentially contaminated areas to assist with site characterization. Organic vapor monitoring is typically conducted using a PID or FID for analytical screening of soil by screening soil cores, test pits, or soil headspace. The PID or FID can also be used to evaluate organic vapors inside monitoring wells and excavations.

For volatile and semi-volatile compounds, knowing the photoionization potential (PIP) is necessary in determining the appropriate instrument to use when conducting organic vapor screening. Review the QAPP and manufacturer's manual to determine that the proper instrument has been selected for the contaminate vapors of interest. A 10.6 eV lamp may be used if expected compounds have a PIP less than or equal to 10.6 eV. If an expected compound at a site has a PIP less than or equal to 11.7 electron volts (eV), it is possible to use a PID equipped with an 11.7 eV lamp. If the ionization potential is great than 11.7 eV, and FID is preferred.

Perform operation, maintenance, and calibration according to the manufacturer's specifications and this SOP. Document results of instrument calibrations on the Environmental Services Field Logs.

5.2.2 Soil Core Screening for Organic Vapors

Soil cores are typically obtained during drilling activities and should be screened for the presence of organic vapors using a PID or FID. Immediately following extraction and opening of a lithologic core sample during drilling, screen the core by slowly passing the tip of the PID or FID along the lithologic core (very close to the core, but not touching it). Record readings along the soil core in 2 foot increments and additionally target zones of high odor or staining. Record readings on the Organic Vapor Headspace Analysis Log.

5.2.3 Test Pit Soil Screening for Organic Vapors

Surface soil, newly exposed soil, soil stockpiles, and excavation surfaces can be screened for the presence of organic vapors using a PID or FID. Before screening newly exposed soil, soil stockpiles, and excavation surfaces, dig a sample test pit at least 6 inches deep into the soil using a clean, decontaminated sampling tool such as a stainless-steel spoon and/or shovel. For surface soil or other soil directly exposed to the atmosphere for greater than 1 hour, dig an at least 18-inch test pit before soil screening. Observe soil screening from freshly exposed soil. When digging, minimize the diameter of the test pit, if possible, to reduce advection of soil vapors out of the test pit. Immediately following digging, insert the sample tip of the PID or FID into the test pit, approximately 1 to 2 inches from the bottom of the test pit, taking care not to foul the sample tip with soil particulates or uptake water droplets. Use of a particulate/moisture filter is recommended. Record the maximum detector reading as the final sample concentration on the Organic Vapor Headspace Analysis Log.

5.2.4 Soil Headspace Screening for Organic Vapors

Headspace organic vapor monitoring involves the measurement of organic vapors emitted from soil samples in a sealed container. The headspace of the container is typically warmed and then tested for volatile organic vapors using a PID or FID. The results generated by this method are qualitative to semi-quantitative and are limited to organic compounds that readily volatilize. Soil can be collected for headspace screening from various sources including lithologic soil cores during drilling, soil stockpiles, or from excavations and test pits. For soil cores, soil headspace should be screened from 2-foot intervals at zones of where contamination is expected.

The following procedures may be followed when conducting soil headspace screening for organic vapors:

- Calibrate the headspace screening instrument(s) according to the manufacturer's specifications.

- Headspace screening will typically be analyzed using clean, re-sealable 1-quart Zip-loc™ (or similar) plastic bags. Bags are not to be reused.

- To begin collection of headspace screening samples, collect a small amount of soil (about the equivalent of a softball) and immediately place it inside a clean, re-sealable 1-quart Ziploc™ (or similar) plastic bag until the plastic bag is about one-third to one-half full; then immediately seal the bag completely. Larger plastic bags should not be used to prevent vapor diffusion and stratification effects that may significantly affect the sample. Samples from soil cores, excavations, or soil piles must be immediately transferred into the sample bag once the soil core is opened, or the soil sample is uncovered and exposed to the atmosphere.

- Shake the bag for 15 seconds and let it rest for at least 10 minutes but no longer than one hour. The temperature of the headspace must be warmed to at least 40 degrees Fahrenheit (°F) (5 degrees Celsius [°C]) before testing. If the soil and/or outdoor temperature is below 40°F, placing the headspace sample in a warm location at approximately room temperature (that is, indoors) may be necessary to slowly warm the sample to an acceptable temperature.

- Before testing, shake the bag for another 15 seconds to further assist volatilization.

- Insert the sample tip of the PID or FID into the bag at a point approximately one-half the headspace depth, taking care not to foul the sample tip with soil particulates or uptake water droplets. The sample bag insertion opening must be minimized to reduce the potential for vapors from escaping. The bag opening can be made with the probe tip.

- After probe insertion, record the maximum detector reading as the final sample concentration on the Organic Vapor Headspace Analysis Log. The maximum detector reading normally occurs between 2 and 5 seconds after probe insertion, but if reading is rapidly climbing, wait longer.

- If erratic instrument response occurs at high VOC concentrations or conditions of elevated headspace moisture are realized, record the instrument behavior along with the maximum detected reading(s). Under these conditions, headspace data may be discounted.

5.2.5 Screening for Organic Vapors in the Monitoring Well Casing

When conducting groundwater monitoring and/or sampling, the air inside the monitoring well casing will be screened for organic vapors using a PID. To screen for organic vapors inside or exiting the monitoring well casing, stand next to and not over the well approximately arms reach away from the well. Slowly open the well cap and immediately check for organic vapors in the well casing by positioning the tip of the PID at the top of the open well casing. Record this reading on the Groundwater Services Field Log.

5.3 Air Monitoring for Potential Contaminant Exposure

Air monitoring for potential exposure to airborne contaminants is typically conducted using a PID, FID, CGI (measuring oxygen level and explosive atmosphere), MultiRae Plus meter (measuring oxygen level, explosive atmosphere, PID, and hydrogen sulfide), or dust/aerosol meter. Air monitoring is typically conducted at one or more of the following areas for the reasons given below:

- At the source. Monitoring at this location gives a worst-case assessment of the situation. If concentrations at the source are below the action levels, then a potential exposure problem is unlikely.
- In the employee breathing zone. Monitoring should be conducted in the employees' breathing zones to determine the actual conditions that they may potentially be exposed to. Since employees doing different tasks may have different potential exposures, monitoring should be conducted for the worst case scenario for each task.
- At the perimeter. Perimeter monitoring is used to document background condition and that the surrounding community is not being adversely affected by the operations. This type of monitoring is typically warranted as a means of documenting that no off site releases occur.
- Conduct monitoring before entering a potentially hazardous area, according to requirements in the project-specific HASP.

5.3.1 Monitoring of Oxygen, Combustible, Hydrogen Sulfide Gas, and Airborne Particulates

Instruments typically used to monitor oxygen levels, combustible atmosphere, hydrogen sulfide, or airborne dust include the MultiRAE plus meter (measuring oxygen level, explosive atmosphere, PID, and hydrogen sulfide), CGI (measuring oxygen level and explosive atmosphere), or dust/aerosol meter.

Depending on the requirements in the site specific HASP; oxygen, combustible, hydrogen sulfide gas, and airborne dust measurements may be made during field activities to ensure that breathing atmospheres do not become hazardous.

Entry into any confined space or any other area where hazardous atmospheres may possibly be a concern must be conducted under direct consultation with the site specific HASP and work plan. Always consult the project PM and/or OHSM with any questions or concerns regarding instrument monitoring and work situations involving confined spaces and/or potentially hazardous atmospheres.

5.3.2 Monitoring of Oxygen Level

The oxygen level in a confined space or other area of little to no air circulation is of prime concern to anyone about to enter that space. Removal of oxygen by combustion, reduction reactions, or displacement by other gases or vapors may be a hazard. Likewise, elevated levels of combustible or toxic gases may also pose a hazard to health. Elevated levels of oxygen may also result in an explosive hazard.

MultiRAE Plus meters are commonly used to monitor oxygen levels. Perform operation, maintenance, and calibration of oxygen monitoring instruments according to the manufacturer specifications. Calibrate oxygen monitoring instruments before starting work each day. Document the calibration check on the Field Calibration Sheet.

Because some instruments do not operate properly without sufficient oxygen and others can cause explosions, the monitoring of oxygen will be the initial concern when working in an environment where there is potential for oxygen levels to be below 19.5% or greater than 23%. The normal oxygen concentration at sea level is 21%.

5.3.3 Monitoring for Explosive Atmosphere

The MultiRAE Plus meter is commonly used to monitor for a flammable and explosive atmosphere. Perform operation, maintenance, and calibration of explosive atmosphere monitoring instruments according to the manufacturer specifications. Calibrate explosive atmosphere monitoring instruments before starting work each day. Document the calibration check on the Field Calibration Sheet.

Conduct monitoring for flammable or explosive environments at the same locations as monitoring of oxygen levels. Work can proceed as normal if the air conditions are less than 10% of the LEL. If the air conditions are greater than 10% of the LEL or methane gas is less than 5% LEL, work is to stop immediately. Evacuate the site or implement engineering controls to reduce the LEL to acceptable levels.

5.3.4 Monitoring for Toxic Gases

The MultiRAE plus meter and Drager colorimetric tubes are commonly used to monitor for toxic gases. Perform operation, maintenance, and calibration of toxic gas monitoring instruments according to the manufacturer specifications and the HSP. Calibrate or inspect toxic monitoring instruments (as required) before starting work each day. Document the calibration check on the Field Calibration Sheet.

Toxic gases include organic and inorganic vapors and gases. The MultiRAE Plus meter is capable of monitoring the odorless and colorless toxic gas hydrogen sulfide, which is a common gas found at contaminated sites.

5.3.5 Monitoring of Airborne Particulates (Dust)

The instrument that should be used to measure airborne dust is the DustTrak™ II Aerosol Monitor (Model 8530). The monitor will be used during ground intrusive activities and is capable of measuring airborne particulate (dust) concentrations at the perimeter of the work area for protection of site workers and the surrounding community. . The aerosol monitor meter is typically used to monitor for airborne aerosol particles and dust. Perform operation, maintenance, and calibration of airborne dust monitoring instruments according to the manufacturer specifications and the project-specific HASP. Calibrate airborne dust monitoring instruments (as required) before starting work each day. Document the calibration check on the Environmental Services Field Log.

Non-volatile contaminants (such as metals or polychlorinated biphenyls [PCBs]) can become airborne as particulates and typically require monitoring at sites where there is a potential for dusty environments. Total dust action levels are discussed in the project-specific HASP.

6.0 RECORDS

Record PID field measurements on the Environmental Services Field Logs. Dust monitoring data is recorded electronically and is downloaded and stored in electronic format in C.T. Male Associates’ project directory.

7.0 DEFINITIONS

- Combustible Gas Indicator (CGI): used to screen for flammable and explosive vapors and gases. Often combined with an oxygen level indicator.

- Continuing calibration verification: an analytical standard run periodically to verify the calibration of an instrument.

- Flame Ionization Detector (FID): detects organic gases and vapors. Determines relative total concentration of selected organic air contaminants, which is used to specify engineering controls and PPE requirements.

- Headspace Gases: The accumulated gaseous components found above solid or liquid layers in closed vessels.

- Initial Calibration: Analysis of standard gases at a series of different specified concentrations; used to define the linearity and dynamic range of the response of an instrument to the target compounds.

- Photoionization detector (PID): Detects total concentrations of many organic and some inorganic gases and vapors. Molecules are ionized using ultraviolet radiation. A current is produced in proportion to the number of ions present.

- Photoionization Potential (PIP): The potential difference through which a bound electron must be raised to free it from the atom or molecule to which it is attached. In particular, the ionization potential is the difference between the initial state, in which the electron is bound, and the final state, in which it is at rest at an indefinite distance from the molecule.

- Volatile Organic Compounds (VOCs): Organic compounds that evaporate when exposed to air (>100 millimeters of mercury [mm Hg]).

8.0 ATTACHMENTS

Attachment 1:	MiniRae 3000 PID Specification Sheet.
Attachment 2:	DustTrak™ II Aerosol Monitor (Model 8530) Specification Sheet.

ATTACHEMNT 1

MiNiRae 3000 PID SPECIFICATION SHEET

RAE SYSTEMS
by Honeywell

MiniRAE 3000

Portable Handheld VOC Monitor

The MiniRAE 3000 is a comprehensive handheld VOC (Volatile Organic Compound) monitor that uses a third-generation patented PID technology to accurately measure more ionizable chemicals than any other device on the market. It provides full-range measurement from 0 to 15,000 ppm of VOCs.

The MiniRAE 3000 has a built-in wireless modem that allows real-time data connectivity with the ProRAE Guardian command center located up to 2 miles (3 km) away through a Bluetooth connection to a RAELink 3* portable modem or optionally via Mesh Network.

KEY FEATURES

- Third-generation patented PID technology
- VOC detection range from 0 to 15,000 ppm
- 3-second response time
- Humidity compensation with built-in humidity and temperature sensors
- Six-month datalogging
- Real-time wireless built-in – Bluetooth (and optional RAELink3 portable modem) or Mesh Network support
- Large graphic display with integrated flashlight
- Multi-language support with 10 languages encoded
- IP- 67 waterproof design

APPLICATIONS

- Oil and Gas
- HazMat
- Industrial Safety
- Civil Defense
- Environmental and Indoor Air Quality

- **Highly accurate VOC maeasurements**
- **Patented PID sensor**
- **Low maintenance—easy access to lamp and sensor**
- **Low cost of ownership**
- **3-year 10.6eV lamp warranty**

Workers can quickly measure VOCs and wirelessly transmit data via Bluetooth or optional Mesh radio.

---

*RAELink 3 modem is sold separately.

Wireless
AutoRAE 2 Compatible
ATEX
C SA US
ISO 9001 CERTIFIED

MiniRAE 3000

Portable Handheld VOC Monitor

RAE SYSTEMS
by Honeywell

SPECIFICATIONS

Instrument Specifications

Size	10" L x 3.0" W x 2.5" H (25.5 cm x 7.6 cm x 6.4 cm)
Weight	26 oz (738 g)
Sensors	Photoionization sensor with standard 10.6 eV or optional 9.8 eV or 11.7 eV lamp
Battery	• Rechargeable, external field-replaceable Lithium-Ion battery pack • Alkaline battery adapter
Running time	16 hours of operation (12 hours with alkaline battery adapter)
Display Graphic	4 lines, 28 x 43 mm, with LED backlight for enhanced display readability
Keypad	1 operation and 2 programming keys, 1 flashlight on/off
Direct Readout	Instantaneous reading • VOCs as ppm by volume (mg/m3) • High values • STEL and TWA • Battery and shutdown voltage • Date, time, temperature
Alarms	95dB at 12" (30 cm) buzzer and flashing red LED to indicate exceeded preset limits • High: 3 beeps and flashes per second • Low: 2 beeps and flashes per second • STEL and TWA: 1 beep and flash per second • Alarms latching with manual override or automatic reset • Additional diagnostic alarm and display message for low battery and pump stall
EMC/RFI	Compliant with EMC directive (2004/108/EC) EMI and ESD test: 100MHz to 1GHz 30V/m, no alarm Contact: ±4kV Air: ±8kV, no alarm
IP Rating	• IP-67 unit off and without flexible probe • IP-65 unit running
Datalogging	Standard 6 months at one-minute intervals
Calibration	Two-point or three-point calibration for zero and span. Calibration memory for 8 calibration gases, alarm limits, span values and calibration dates
Sampling Pump	• Internal, integrated flow rate at 500 cc/mn • Sample from 100' (30m) horizontally or vertically
Low Flow Alarm	Auto pump shutoff at low-flow condition
Communication & Data Download	• Download data and upload instrument set-up from PC through charging cradle or optional Bluetooth™ • Wireless data transmission through built-in RF modem
Wireless Network	Mesh RAE Systems Dedicated Wireless Network
Wireless Range (Typical)	EchoView Host: LOS > 660 ft (200 m) ProRAE Guardian & RAEMesh Reader: LOS > 660 ft (200 m) ProRAE Guardian & RAELink3 Mesh: LOS > 330 ft (100 m)
Safety Certifications	**US and Canada**: CSA, Classified as Intrinsically Safe for use in Class I, Division 1 Groups A, B, C, D **Europe**: ATEX II 2G EEx ia IIC T4
Temperature	-4° to 122° F (-20° to 50° C)
Humidity	0% to 95% relative humidity (non-condensing)
Attachments	Durable bright yellow rubber boot
Warranty	3 years for 10.6 eV lamp, 1 year for pump, battery, sensor and instrument
Wireless Frequency	ISM license-free band. IEEE 802.15.4 Sub 1GHz
Wireless Approvals	FCC Part 15, CE R&TTE, Others[1]
Radio Module	Supports Bluetooth or RM900

Sensor Specifications

Gas Monitor	Range	Resolution	Response Time T90
VOCs	0 to 999.9 ppm 1,000 to 15,000 ppm	0.1 ppm 1 ppm	< 3 s < 3 s

MONITOR ONLY INCLUDES:

- MiniRAE 3000 Monitor, Model PGM-7320
- Wireless communication module built in, as specified
- Datalogging with ProRAE Studio II Package
- Charging/download adapter
- RAE UV lamp, as specified
- Flex-I-Probe™
- External filter
- Rubber boot
- Alkaline battery adapter
- Lamp-cleaning kit
- Tool kit
- Operation CD-ROM
- Operation and Maintenance manual
- Soft leather case

OPTIONAL CALIBRATION KIT ADDS:

- 100 ppm isobutylene calibration gas, 34L
- Calibration regulator and flow controller

OPTIONAL GUARANTEED COST-OF-OWNERSHIP PROGRAM:

- 4-year repair and replacement guarantee
- Annual maintenance service

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[1] Contact RAE Systems for country-specific wireless approvals and certificates.

Specifications are subject to change.

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ATTACHEMNT 2

DustTrak™ ii Aerosol Monitor (Model 8530)
Specification Sheet

HEALTH AND SAFETY

Exposure Monitoring

DustTrak™ II Aerosol Monitor

Models 8530, 8531, and 8532

Desktop or Handheld Units for Any Environment, Any Application

The new DustTrak II Aerosol Monitors are battery-operated, data-logging, light-scattering laser photometers that give you real-time aerosol mass readings. They use a sheath air system that isolates the aerosol in the optics chamber to keep the optics clean for improved reliability and low maintenance. Suitable for clean office settings as well as harsh industrial workplaces, construction and environmental sites and other outdoor applications. DustTrak II monitors measure aerosol contaminants such as dust, smoke, fumes and mists.

Features and Benefits

- Easy to program, easy to operate
- New graphical user interface with color touch-screen
- Perform in-line gravimetric analysis for custom reference calibrations
- Automatic zeroing (with optional zero module) minimizes the effect of zero drift
- Measure aerosol concentrations corresponding to PM_1, $PM_{2.5}$, PM_{10}, or Respirable size fractions

Applications

- Industrial/occupational hygiene surveys
- Indoor air quality investigations
- Outdoor environmental monitoring
- Baseline trending and screening
- Point source monitoring
- Engineering control evaluations
- Engineering studies
- Remote monitoring
- Process monitoring
- Emissions monitoring
- Aerosol research studies

TRUST. SCIENCE. INNOVATION.

Easy to Program and Operate

The new graphical user interface with color touch-screen puts everything at your fingertips. The easy-to-read display shows real-time mass concentration and graphical data as well as other statistical information along with instrument pump, laser and flow status, and much more. Perform quick walk-through surveys or program the instrument's advanced logging modes for long-term sampling investigations. Program start times, total sampling times, logging intervals, alarm setpoints and many other parameters. You can even set up the instrument for continuous unattended operation.

Desktop Models: Ideal for Long-Term Surveys and Remote Monitoring Applications

Manual and programmable data logging functions also make DustTrak II desktop monitors ideal for unattended applications. They come with USB (device and host), Ethernet, and analog and alarm outputs allowing remote access to data. User adjustable alarm setpoints for instantaneous or 15-minute short-term excursion limit (STEL) are available on desktop models. The alarm output with user-defined setpoint alerts you when upset or changing conditions occur.

All DustTrak II desktop monitors have three unique features:

- Gravimetric sampling capability using a 37-mm filter cassette which can be inserted in-line with the aerosol stream allowing you to perform an integral gravimetric analysis for custom reference calibrations.
- They can be zeroed automatically using the external zeroing module. This optional accessory is used when sampling over extended periods of time. By zeroing the monitor during sampling, the effect of zero drift is minimized.
- STEL alarm feature for tracking 15-minute average mass concentrations when alarm setpoint has been reached for applications like monitoring fugitive emissions at hazardous waste sites.

Handheld Models: Perfect for Walk-Through Surveys and Single-Point Data Collection Applications

DustTrak II handheld models are lightweight and portable. They're perfect for industrial hygiene surveys, point source location monitoring, indoor air quality investigations, engineering control evaluations/validation, and for baseline trending and screening. Like desktop models, they have manual and programmable data logging functions. In addition, they have single-point data logging capability. Single-point data collection is used for walk-through industrial hygiene surveys and indoor air quality investigations.

New Software Makes Monitoring Easier than Ever

TrakPro™ Data Analysis Software allows you to set up and program directly from a PC. A new feature is the ability for remote programming and data acquisition from your PC via wireless (922 MHz or 2.4 GHz) communications or over an Ethernet network. As always, you can print graphs, raw data tables, and statistical and comprehensive reports for recordkeeping purposes.

DustTrak II Aerosol Monitor Features

All Models

- Li-Ion rechargeable batteries
- Internal and external battery charging capabilities
- Outlet port for isokinetic sampling applications
- User serviceable sheath flow and pump filters
- Logged test pause and restart feature
- Logged test programming
  - Color touch screen—either manual mode or program mode
  - TrakPro™ Data Analysis Software via a PC
- User adjustable custom calibration settings
- Instantaneous alarm settings with visual and audible warnings
- Real-time graph display
- View statistical information during and after sampling
- On-screen instrument status indicators: FLOW, LASER and FILTER
- Filter service indicator for user preventative maintenance

All Desktop Models

- Hot swappable batteries
- Gravimetric reference sample capability
- Long life 10,000-hour internal pump
- TrakPro Data Analysis Software
- Auto zeroing module (optional accessory)
- STEL alarm setpoint

All Handheld Models

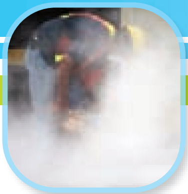
- Long life 2,500-hour internal pump
- Single-point data collection for walk through surveys
- TrakPro Data Analysis Software

Battery Performance

Models 8530/8531 (typical) **6600 mAH Li-Ion Battery Pack (P/N 801680)**	**1 Battery**	**2 Batteries**
Battery Runtime (hours)	up to 6	up to 12
Charge Time * (hours) in DustTrak	4	8
Charge Time* (hours) in external battery charger (P/N 801685)	4	8

Model 8532 (typical) **3600 mAH Li-Ion Battery Pack (P/N 801681)**	**Battery**
Battery Runtime (hours)	up to 6
Charge Time * (hours) in DustTrak	4
Charge Time* (hours) in external battery charger (P/N 801686)	4

*of a fully depleted battery



Specifications

Models 8530, 8531, and 8532

DustTrak™ II Aerosol Monitor

Sensor Type
90° light scattering

Particle Size Range
0.1 to 10 µm

Aerosol Concentration Range

8530 Desktop	0.001 to 150 mg/m^3
8531 Desktop High Conc.	0.001 to 400 mg/m^3
8532 Handheld	0.001 to 150 mg/m^3

Resolution
±0.1% of reading or 0.001 mg/m^3, whichever is greater

Zero Stability
±0.002 mg/m^3 per 24 hours at 10 sec time constant

Flow Rate
3.0 L/min set at factory, 1.40 to 3.0 L/min, user adjustable

Flow Accuracy
±5% of factory set point, internal flow controlled

Temperature Coefficient
+0.001 mg/m^3 per °C

Operational Temp
32 to 120°F (0 to 50°C)

Storage Temp
-4 to 140°F (-20 to 60°C)

Operational Humidity
0 to 95% RH, non-condensing

Time Constant
User adjustable, 1 to 60 seconds

Data Logging
5 MB of on-board memory (>60,000 data points)
45 days at 1 minute logging interval

Log Interval
User adjustable, 1 second to 1 hour

Physical Size (HWD)

Handheld	4.9 x 4.8 x 12.5 in. (12.5 x 12.1 x 31.6 cm)
Desktop	5.3 x 8.5 x 8.8 in. (13.5 x 21.6 x 22.4 cm)

Weight

Handheld	2.9 lb (1.3 kg), 3.3 lb (1.5 kg) with battery
Desktop	3.5 lb (1.6 kg), 4.5 lb (2.0 kg)–1 battery, 5.5 lb (2.5 kg)–2 batteries

Communications

8530/31	USB (host and device) and Ethernet. Stored data accessible using flash memory drive
8532	USB (Hose and device). Stored data accessible using flash memory drive

Power–AC
Switching AC power adapter with universal line cord included, 115–240 VAC

Analog Out

8530/31	User selectable output, 0 to 5 V or 4 to 20 mA User selectable scaling range

Alarm Out

8530/31	Relay or audible buzzer Relay Non-latching MOSFET switch User selectable set point –5% deadband Connector 4-pin, Mini-DIN connectors
8532	Audible buzzer

Screen

8530/31	5.7 in. VGA color touchscreen
8532	3.5 in. VGA color touchscreen

Gravimetric Sampling

8530/31	Removable 37 mm cartridge (user supplied)

CE Rating

Immunity	EN61236-1:2006
Emissions	EN61236-1:2006

Specifications are subject to change without notice. TSI, the TSI logo, DustTrak, and TrakPro are trademarks of TSI Incorporated. Microsoft and Windows are trademarks of Microsoft Corporation.

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C.T. MALE ASSOCIATES ENGINEERING,
SURVEYING, ARCHITECTURE &
LANDSCAPE ARCHITECTURE, D.P.C

STANDARD OPERATING PROCEDURE
#4
SURFACE and SUBSURFACE SOIL SAMPLING

Revision 2

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: SURFACE AND SUBSURFACE SOIL SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) provides the methodology for collecting discrete surface and subsurface soil samples to characterize the nature of soil contamination, the areal and vertical extent of contaminated soil, to determine the geotechnical, physical, and chemical properties of the soil, and for remedial action confirmatory and/or documentation sampling.

2.0 SCOPE

This SOP applies to all C.T. Male Associates personnel and sub consultants engaged in collecting or otherwise handling surface or subsurface soil samples.

This SOP focuses on the most commonly used soil sampling tasks and applications and should be used in conjunction with other applicable project SOPs, including the following:

- SOP: Note Taking and Field Logs.
- SOP: Organic Vapor Monitoring and Air Monitoring
- SOP: Drilling and Associated Sampling Methods.
- SOP: Equipment Decontamination Procedures.
- SOP: Field Screening Soil Samples
- SOP: Collection of Quality Control Samples
- SOP: Documentation on a Chain-of-Custody
- SOP: Domestic Transport of Samples to Laboratories in USA

3.0 GENERAL

Selecting the proper methods and tools for surface and subsurface soil sampling is a critical part of field investigations and remedial actions. This SOP describes the methods generally used for surface and subsurface soil sampling, as well as the tools commonly used.

Soil sample collection activities should adhere to the note-taking, decontamination, labeling, packaging, shipping, storage, and chain-of-custody requirements applicable to the soil sampling activities being conducted according to the site-specific QAPP.

Personnel who collect or handle the soil samples should wear, at a minimum, disposable nitrile gloves to prevent cross-contamination and provide personal protection. New gloves should be donned for sample collection at each location, or whenever gloves are torn or otherwise compromised. The project-specific Health and Safety Plan (HASP) provides information on site-specific personal protective equipment (PPE) requirements.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager is responsible for providing adequate resources and ensuring that field staff have adequate experience and training to successfully comply with and execute project-specific SOPs and implement the project health, safety, and environment (HS&E) program. The Project Manager will solicit the appropriate technical expertise to identify suitable sampling methods and technology for the job given the current understanding of the site and project goals.

4.2 Health & Safety Officer

The Health & Safety Officer is assigned to oversee site-specific HS&E and ensure overall compliance with project HS&E requirements. The Health & Safety Officer conducts PPE evaluations, selects the appropriate PPE for the project, lists the requirements in the site-specific HASP, coordinates with the Field Team Leader to complete and certify the PPE program, and conducts project Health & Safety audits on the effectiveness of the HS&E program.

4.3 Site Health and Safety Officer

The role of Site Health and Safety Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Site Health and Safety Office /Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Team Leader

The Field Team Leader should ensure that soil samples are collected according to this procedure and other SOPs identified in Section 2.0. The Field Team Leader should also be required to make rational and justifiable decisions when deviations from this procedure are necessary because of field conditions or unforeseen problems. The Field Team Leader should consult the Project Manager if deviations from the site-specific QAPP are necessary because of field conditions. The Field Team Leader should document that the applicable requirements the site-specific HASP are followed.

5.0 PROCEDURES

5.1 General Guidelines

The following procedures should be used to collect soil samples for laboratory analysis:

- Unless otherwise specified, laboratory soil samples must be discrete samples and may not be composited before analysis.
- Soil samples must be collected according to the method specifications appropriate for the laboratory parameters to be analyzed.
- Soil samples must be collected with disposable or clean tools that have been decontaminated as outlined in SOP, Equipment Decontamination Procedures.
- Disposable nitrile gloves (at a minimum) must be worn and changed between sample collections.
- Soil samples must be placed in containers quickly and in the order of volatility; for example, volatile organic aromatic samples must be taken first, gasoline range organics next, heavier range organics next, and soil classification samples last.

- Sample containers must be quickly and adequately sealed, and rims must be cleaned before tightening lids; tape may be used only if known not to affect sample analysis.

- Sample containers must be labeled and handled as outlined in the site specific QAPP.

- Samples must immediately be preserved according to the method specifications appropriate for the laboratory parameters to be analyzed. And unless specified otherwise, at a minimum, the samples must be immediately chilled to 4 ±2 degrees Celsius (°C) and this temperature must be maintained through delivery to the laboratory for analysis.

- Sample holding times must conform to the method specifications of the required analytical methods.

- Alternative methods to obtain soil samples may be used only if the alternative methods have been approved by the Project Manager and documented in the site-specific QAPP and Environmental Services field Log.

- Soil samples collected for analysis of volatile organic compounds (VOCs) will be collected with special precautions as detailed below in Section 5.7.

- Each soil sample fraction collected for analyses other than VOCs will be thoroughly homogenized using a sampling spoon or trowel. The homogenized material will then be divided equally among the appropriate sample containers. The sample containers will then be sealed tightly. Care should be taken so that the sampling tools and containers (such as spoons and bowls) used for sample collection and homogenization does not interfere with the analytes of interest.

- Multi-incremental samples (MIS) should be collected by placing equal amounts (or aliquots) of soil collected from multiple locations into a decontaminated, dedicated collection container. The aliquots will then be homogenized using a sample collection tool such as a scoop or spoon. The homogenized material will be divided equally among the appropriate sample containers, and the sample containers will be sealed tightly.

5.2 Sampling Tools and Equipment

Equipment that may be used to facilitate the collection of surface or subsurface soil samples includes, but is not limited to, the following items:

- Photoionization detector (PID) devices.
- Stainless-steel trowel, scoop, or spoon.
- Stainless-steel hand (bucket) auger.
- Stainless-steel or carbon steel split spoon, split barrel, or macro-core sampler.
- Shovels, pickaxes, pick mattocks, or similar excavating tools.
- Soil core samplers (En Core® sampler, TerraCore®, or equivalent).
- Stainless-steel bowls or pans.
- Paper towels.
- Decontamination equipment (buckets, brushes, Alconox, etc.).
- High-density polyethylene (HDPE) sheeting.
- PPE.
- Sample cooler.
- Ice.
- Sample jars and labels.
- Chain-of-custody forms.
- Soil classification charts.
- Ziploc® (or similar) re-sealable bags.
- Survey stakes or flags.

- Hammer.

5.3 Decontamination

Before collecting soil samples, reusable, non-disposable sampling equipment should be decontaminated. Decontamination supplies must be on hand so that equipment can be decontaminated in the field if sampling equipment is to be reused. Each piece of reusable sampling equipment should be decontaminated between each sample location or sampling interval. Procedures presented in SOP Equipment Decontamination Procedures, shall be followed for decontamination of re-usable field equipment and for personnel decontamination.

Disposable sampling equipment will be used whenever feasible to minimize decontamination and the potential for cross-contamination. Disposable sample equipment will be observed before use to document that it is clean and free of potential contaminants.

5.4 Surface Soil Sampling

Surface soil sample will be collected using a stainless steel scoop, spoon, or other appropriate tools. Samples for VOC analysis will be collected directly from the soil column at the specified sampling depth interval if possible. For non-VOC samples (i.e., PCBs), the sampler, wearing clean disposable nitrile gloves, will remove materials, including pebbles and roots, from the mixture as the sample is collected. Each non-VOC sample will be collected by thoroughly homogenizing material from the appropriate depth interval from the respective sampling location. A clean, decontaminated stainless-steel scoop or spoon will be used to collect the soil sample and fill all laboratory-supplied analytical sample containers.

5.5 Subsurface Soil Sampling

Before subsurface soil sampling, each sample location should be checked and cleared for buried utilities before intrusive activities begin.

5.5.1 Shallow Subsurface Soil Sampling with Hand Tools

Shallow subsurface soil samples can be collected by hand using a variety of sampling equipment and devices. Common equipment used to collect shallow subsurface soil samples include soil coring devices, various types of hand augers (bucket-type, continuous-flight, and posthole), and other common hand tools such as shovels and pickaxes. Depending on field conditions or sampling objectives, several types of sample collection equipment may be used to collect soil samples at a single location. Of the equipment listed, only soil coring devices collect an undisturbed soil sample and thus are recommended for sampling of VOCs. Bucket augers and other common hand tools are not recommended when an undisturbed soil sample for volatile organics is desired. Sampling personnel should choose the sampling equipment that is best suited for project requirements and task needs.

Using a decontaminated hand auger (or similar equipment), the soil borehole will be advanced to the depth immediately above the sampling interval, and cuttings will be removed from the borehole. Before advancing a borehole, remove unnecessary rocks, twigs, and other non-soil materials from the selected sampling location. Assemble the sampling equipment, if necessary, per the manufactures specifications and place the sampler in position with the bit or cutting shoe touching the ground. Begin turning the auger with a clockwise motion or driving the soil core device with the slide hammer until the desired sampling depth is obtained. During advancement of the auger or coring device, cuttings from within and around the borehole will be periodically removed and placed next to the borehole. If the sample is to be collected using the same hand auger or soil coring device, the auger bucket or core sampler will be decontaminated (or replaced with a decontaminated bucket or sampler) before collecting the soil sample. The discrete sample will then be collected by advancing the sampling equipment to the appropriate depth interval and retrieving the soil sample. When collecting samples at depths greater than 12 inches, it is advisable to discard approximately the upper 1 inch of material in the top portion of the auger or sampler because of borehole slough and cave-in. The sample will then be promptly transferred into laboratory-cleaned sample containers using a decontaminated stainless steel spoon or trowel.

5.5.2 Deep Subsurface Soil Sampling

Deep subsurface soil samples are typically collected using split-spoon and/or macro-core samplers. A split-spoon sampler is a soil coring device that consists of a length of carbon or stainless-steel tubing, split longitudinally and equipped with a sample shoe and a drive head. A macro-core sampler is a soil coring device that consists of a length of stainless steel tubing equipped with a screw-on sample shoe and drive head. Split-spoon samplers and macro-core samplers are used in conjunction with a power auger drill rig or direct-push vehicle, and are usually either hammered or hydraulically pushed into the interval to be sampled. The interval(s) to be sampled may be either predetermined or determined according to criteria observed during advancement of the drilling equipment as specified in the site-specific QAPP. The following procedures focus on sampling soil for chemical analysis, using a split-spoon or direct push system continuous macro-core sampler. Soil samples obtained for physical characterization are typically collected using similar procedures.

Drilling Method

Using hollow stem auger or advancing flush joint casing, the soil borehole will be advanced to the depth immediately above the sampling interval as described in SOP for Drilling and Associated Sampling. Utilize a split-spoon sampler to collect a relatively undisturbed, representative soil sample during the drilling activities. Standard Penetration Test blow counts for that sample, as well as the interval from which the sample was obtained, will be recorded on the Subsurface Exploration Logs. Depending on the size of the split-spoon employed, typically 18 to 24 inches of soil should be recovered in advance of the drill bit. The split-spoon sampler will then be removed from the borehole and opened exposing the soil core for sample collection and examination. Soil samples for laboratory analysis should be collected from the undisturbed, middle portion of the soil core and soil from the very ends of the soil core must be discarded as they often contain disturbed soils. The sample will then be immediately and quickly transferred into clean, laboratory sample containers using a decontaminated stainless steel spoon or scoop as described in Section 5.1. The soil core will be examined by the field geologist, screened for VOCs using a PID (see SOP Organic Vapor Monitoring and Air Monitoring), and logged for lithology on the Subsurface Exploration Log.

Direct Push System Drilling Method

Direct push system soil samples are typically collected using a continuous macro-core sampler with acetate liners using the direct push system drilling procedures described in SOP for Drilling and Associated Sampling. At the top of each sample interval, the macro-core sampler will be driven into the substrate to a depth equal to the length of the sampler. After the sampler has been advanced, it is retrieved from the borehole and the acetate liner containing the soil core is placed on a firm, horizontal surface, for opening, inspection, and sampling. The acetate liner for each sample core is then cut open to expose the soil sample core for soil sampling and examination. Samples for laboratory analysis will be immediately transferred into clean laboratory sample containers using a decontaminated stainless-steel spoon or scoop, as described in Section 5.1. The soil core will then be examined by the field geologist, screened for VOCs using a PID, and logged for lithology. Special attention must be given to labeling and storage of individual core samples when continuous soil samples are collected from a single boring. In many instances, soil cores can be produced faster than they can be opened, logged, screened and sampled by a Field Geologist/Environmental Scientist. In those instances when a backlog of cores is being generated, protect the cores from direct sunlight, excessive ambient temperatures, and rain. These conditions may have an adverse effect on highly sensitive volatile organics within the core or the instruments used for screening. Keep the cores labeled so that the up/down orientation is not lost. If necessary, log soils for lithology information after sample collection.

5.6 Excavation and Stockpile Sampling

Soil sampling of excavations and stockpiles should be conducted using similar techniques as described in Sections 5.4 and 5.5.1.

5.6.1 Excavation Sampling

When collecting soil samples from excavations including test pits, soil samples should generally be collected from freshly uncovered soil. Remove 4 to 6 inches of soil promptly before sample collection. If the excavation has been open for longer than 1 hour, remove at least 12 inches of soil immediately before collection. Do not collect samples from disturbed soil that has fallen into the bottom of the excavation pit. If the depth of the excavation (i.e., greater than 4 feet) is such that sampling cannot be safely conducted within the excavation, soil samples may be collected directly from the excavator bucket. When collecting soil samples from an excavator bucket, samples should be collected from the center of the bucket and away from the bucket sides. Refer to the project-specific HASP and/or consult with the Project Manager and/or Health & Safety Officer regarding excavation safety before entering open excavations.

5.6.2 Stockpile Sampling

Stockpiled soil must be field screened before sample collection. Field screening and analytical soil samples must be collected at least 18 inches beneath the exposed surface of the stockpile, unless additional shallower field screening samples are needed to represent soil contaminant heterogeneity. Contamination can be persistent near the bottom of long-term stockpiles, so some samples shall be collected near the base. Soil samples from the surface, within, and near the bottom of a stockpile will be collected using the methods previously discussed in Sections 5.4 and 5.5.1.

5.7 Volatile Organic Soil Sampling

If VOCs are among the analytes to be investigated at a particular site, discrete soil samples will be collected following opening of the soil core. Soil samples for VOC analysis should be collected in a way that minimizes sample volatilization through excessive atmospheric exposure, mixing, and/or other disturbance. It is recommended that VOC samples be collected using core-type samples such as split-spoons, macro-core samplers, and soil coring devices that reduce the loss of volatiles during sampling. Soil core samplers must be constructed of non-reactive materials that will minimize the loss of volatile organics from the sample.

VOC soil samples analyzed using U.S. Environmental Protection Agency (EPA) Method SW8260B will be collected as follows:

- To collect a sample, have ready a pre-weighed, pre-preserved, and labeled 40 mL VOC vial containing methanol (MeOH) supplied by the laboratory. Place 10 grams of soil into the VOC vial containing 10 mL of MeOH. Interim storage/containers (such as resealable plastic bags) are not allowed.

- After sealing, gently agitate the sample so that entire sample is submerged.

- Do not place tape, including evidence tape, on the container directly.

- Samples collected shall be placed inside coolers to maintain the samples at 4°C ± 2 degrees Celsius (°C).

- Collect a sample of the same material from the same location in an unpreserved jar for percent moisture determination.

- Collect appropriate field and laboratory quality control samples including field duplicates and matrix spike/matrix spike duplicate (MS/MSD) samples.
- Analytical samples should be collected in the following order:
  - VOCs
  - Semi-volatile organic compounds (SVOCs); including pesticides, herbicides and polychlorinated biphenyls (PCBs)
  - Metals, including hexavalent chromium and cyanide
- VOC samples should be accompanied by an appropriate trip blank from the time of the collection until analysis at the project laboratory.

VOC soil samples analyzed using U.S. Environmental Protection Agency (EPA) Method SW-846 Method 5035A will be collected as follows:

- Discrete soil samples can be collected using a 5-gram soil core sampler with a new, dedicated, and disposable sample syringe or tip as described in American Society for Testing and Materials (ASTM) standard D6418-09. These devices are used to collect a specific soil sample mass for volatile organic analysis in a manner that minimizes loss of contaminants because of volatilization or biodegradation. Frequently accepted discrete soil core samplers are listed below.
  - En Core® sampler
  - TerraCore® sampler
  - EasyDraw Syringe® with PowerStop Handle® sampler
  - Core N' One™ sampler
  - Lock N' Load™ sampler
- Soil samples will be collected from a specified location and soil depth as determined by field screening or as determined in the project-specific HASP.

After determining the sample location, the soil core sampler will be plunged into the soil core to collect a sample.

- To collect a sample, have ready a pre-weighed, pre-preserved, and labeled 40 mL VOC vial containing sodium bisulfate/water preservative. With the syringe or plunger seated in the handle, push the soil core sampler into freshly exposed soil until the sample chamber is filled. Do not pull the syringe or plunger back before use.

- Wipe soil or debris from the outside of the soil core sampler and remove excess soil that extends beyond the end of the sampler, so that the soil plug is flush with the end of the sampler. A filled chamber will deliver approximately 5 grams of soil.

- Place the mouth of the soil core sampler into the 40-ml VOC vial containing sodium bisulfate/water preservative and extrude the 5-gram sample into the VOC vial by pushing the syringe or plunger down.

- Quickly seal the lid back on the 40-ml VOC vial.

- Take care not to leave soil grains along the threaded cap area of the VOC vial so that the lid can be screwed on tightly forming a tight seal. Be sure to remove soil or debris from the top and/or threads of the vial.

- Following collection, samples will be labeled with unique sample identification, and packaged appropriately.

- Samples collected shall be placed inside coolers to maintain the samples at 4°C ± 2 degrees Celsius (°C).

- VOC containers should be padded so that the glass walls of the containers do not come into direct contact with ice or other samples, thereby reducing the risk of cracking the glass containers.

5.8 PFAS Soil Sampling

If PFAS are among the analytes to be investigated at a particular site, discrete soil samples will be collected following the surface or subsurface investigation activity. Soil samples for PFAS analysis should be collected in a way that minimizes sample volatilization or degradation through excessive atmospheric exposure, mixing, and/or other disturbance. PFAS samples shall be collected using split-spoons, macro-core samplers, and hand tools.

PFAS soil samples analyzed as specified in the site specific work plan and site specific QAPP. Samples should be collected as follows:

- Soil samples will be collected from a specified location and soil depth as determined by field screening or as determined in the project-specific work plan.
- To collect a sample, place soil into a laboratory supplied container specifically required for PFAS media samples. Ensure non-PFAS containing PPE is used.
- Wipe soil or debris from the outside of the sample container and place lid on container.
- Following collection, samples will be labeled with unique sample identification, packaged appropriately, and kept at a temperature of approximately 4 degrees Celsius inside a cooler for preservation.
- Containers should be padded so that the glass walls of the containers do not come into direct contact with ice or other samples, thereby reducing the risk of cracking the glass containers.

5.9 Diesel Range Organics (DRO) / SVOC / General Chemistry / Metals

Using either a composited sample or a homogenized, discrete sample, fill the remaining containers in the order listed in the QAPP. Unless aliquot weights are listed, pack the soil into the sample jars leaving no headspace. If allowed by applicable regulations, the WIDRO sample may be weighed directly into the sample container by placing the pre-weighed sample container on the field balance, taring the field balance, then adding the appropriate amount of soil to the container to reach the desired sample weight (~25 g).

Wipe the container lip and screw threads to remove soil and provide a good sealing surface, and immediately screw on the lid.

5.10 Quality Assurance/Quality Control Procedures and Samples

Quality Assurance/Quality Control (QA/QC) samples will be collected during soil sampling according to the site-specific QAPP and will include duplicate (replicate), matrix spike, matrix spike duplicate, trip blank and equipment (field) blank samples. One set of QA/QC samples will be collected per 20 field samples per media (i.e., soil, groundwater, etc.).

QA/QC samples will be assigned unique sample identifications and handled and submitted to the laboratory the same as field samples.

5.10.1 Equipment Blanks

An equipment blank sample is collected in the field by running ASTM Type II Reagent-Grade water (or deionized water with less than 15 microSiemens conductivity) across the surface of re-usable, decontaminated sampling equipment and into appropriate sample containers.

5.10.2 Field Duplicate Samples

Field duplicate samples will be collected simultaneously or in immediate succession to the normal samples using identical sampling techniques.

5.10.3 Matrix Spikes and Matrix Spike Duplicates

Matrix spike/matrix spike duplicate samples will be collected simultaneously or in immediate succession to the normal samples using identical sampling techniques.

5.10.4 Trip Blanks

A trip blank is a sample of analyte-free water prepared by the laboratory, taken to the sampling site along with the sample bottles, and returned to the laboratory for analysis, to measure possible cross contamination of containers/samples during shipping to and from the site. Typically there is only one trip blank per chain of custody per sample cooler, except when trip blanks require different preservatives for different methods.

6.0 SAMPLE HANDLING

After collection, all samples should be handled as few times as possible. Samplers should use extreme care to ensure that samples are not contaminated. Immediately after samples are collected, they are bubble wrap or bagged and placed in a cooler containing bagged ice. Samples will be kept cold (≤ 6 °C, but not frozen) until receipt at the laboratory, where they are to be stored in a refrigerated area. Keep samples secure to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

6.1 Shipment/Delivery

Once the cooler is packed to prevent breaking of containers, the proper COC documentation is relinquished by the sampler, placed into a plastic bag, and included in the cooler. Custody seals may be used, and the coolers should be taped shut if not hand delivered.

7.0 DISPOSAL

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and SOP ‘Investigative Derived Waste’. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

8.0 RECORDS

Records should be documented on the Environmental Services Field Logs and Subsurface Exploration Logs.

9.0 DEFINITIONS

Discrete soil sample: A discrete aliquot from a distinct sampling interval (of a specific sample size) that is representative of one specific location at a specific point in time.

Surface soil: Generally considered to be the top 6 inches of a soil horizon profile (that is, soil from 0 to 6 inches bgs), soil down to depths of 2 feet bgs may be considered surface and/or near-surface soil.

Subsurface soil: The soils below surface soil.

C.T. MALE ASSOCIATES ENGINEERING,
SURVEYING, ARCHITECTURE &
LANDSCAPE ARCHITECTURE, D.P.C

STANDARD OPERATING PROCEDURE
#5

MONITORING WELL INSTALLATION

Revision 2

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: MONITORING WELL/PIEZOMETER INSTALLATION

1.0 PURPOSE

This standard operating procedure (SOP) provides the methodology for installing and constructing groundwater monitoring wells and piezometers.

2.0 SCOPE

This SOP applies to all C.T. Male Associates personnel and subcontractors engaged in installation and construction of groundwater monitoring wells and piezometers.

This SOP focuses on the most common monitoring well installation tasks and should be used in conjunction with other applicable project SOPs, including the following:

- SOP: Note Taking and Field Logs.
- SOP: Organic Vapor Monitoring and Air Monitoring.
- SOP: Drilling and Associated Sampling Methods.
- SOP: Equipment Decontamination Procedures.
- SOP: Groundwater Sampling Procedures.

3.0 GENERAL

Data collected from monitoring wells and piezometers at investigation sites support various site characterization objectives, including delineation of the nature and extent of contaminant plumes, development of a conceptual model of the subsurface lithology, assessment of aquifer properties, and development of a long-term monitoring network to detect trends in site groundwater elevations and contaminant concentrations. Wells installed for each of these purposes must satisfy different requirements, and may require different strategies for well design and installation. Representative groundwater samples and groundwater level measurements depend upon proper monitoring well design and construction, which should reflect anticipated contaminant types and concentrations, project objectives, and site conditions. Selection of monitoring well type, construction materials, and drilling method is commonly a site-specific determination and often site logistics, economics influence well design, installation choices, and State regulations. Well design and installation must prevent the introduction of surface contaminants into the groundwater and prevent the transfer of groundwater or contaminants between stratigraphic intervals within the well borehole or along the well annulus. Do not install monitoring wells in locations where they are subject to periodic or seasonal inundation by floodwaters, unless the well has special watertight construction. Protect monitoring well integrity from soil erosion, soil settlement, shrink-swell soil conditions, frost heaving of soils, damage by vehicles or heavy equipment, or other site specific hazards.

Drilling techniques commonly used for monitoring well installation include hollow-stem auger, flush joint casing direct push, and Rotosonic (sonic) systems:

- Hollow stem auger and flush joint casing drilling is typically used to install 2- to 4-inch diameter (or greater) permanent groundwater monitoring wells or when consolidated geologic conditions are expected. The drill rig is typically mounted on a heavy-duty truck or self propelled by an all-terrain mechanized track system.

- Direct push system drilling is typically used for soil sampling in unconsolidated lithologies and to install 0.75- to 1.0-inch-diameter micro-wells or piezometers. The drill rig is typically mounted on a heavy duty truck or is self propelled by an all-terrain mechanized track system.

- Sonic system drilling is typically used for soil sampling in the deep overburden or the installation of deep wells and/or bedrock wells 200-500 foot depth (or more). The wells are typically 4-inch diameter (or greater) permanent groundwater monitoring wells. The sonic rig is a standalone motorized drilling vehicle.

Micro-wells and piezometers will have a 0.75- to 1.25-inch-diameter casing with an attached screen; they are used primarily to temporarily monitor the static water level or obtain a finite number of water samples for water quality or contaminant screening purposes. Micro-wells can use pre-packed or non-pre-packed screens for installations in small-diameter direct push system boreholes.

Successful installation of a well requires that the procedures for installing each component of the well are followed and well documented. There are nine essential components of a well installation:

- Well casing.
- Well screen.
- Filter pack.
- Annular seals (lower and upper surface seals).
- Surface completion.
- Well protection.
- Field logs (including description of soil lithology and water level observations).
- Monitoring Well Construction Logs.
- Records Management.

Definitions are provided in Sections 7.0. Figure 1 on the following page illustrates the design of a typical groundwater monitoring well.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager verifies that monitoring well and piezometer installation procedures comply with this SOP and the requirements of the enforcing agencies. Alternate installation requirements and procedures required by local agencies or other modifications must be documented and approved by the Project Manager.

4.2 Health & Safety Officer

The Health & Safety Officer oversees site-specific health, safety, and environment (HS&E) protocols and overall compliance with project HS&E requirements. The Health and Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the Project-specific Health and Safety

Plan (HASP), coordinates with the Project Manager and Field Manager to certify the PPE, and conducts project health and safety audits to evaluate the effectiveness of the HS&E program.

4.3 Site Safety and Health Officer

The role of Site Safety and Health Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Team Leader

The Project Manager will develop or direct the development of a sampling plan that includes the specifics of the well design and installation, particularly the materials and procedures to be used. The Field Team Leader should know the requirements for well installations and should maintain adequate documentation of the installation process and materials used to demonstrate that the well has been properly installed.

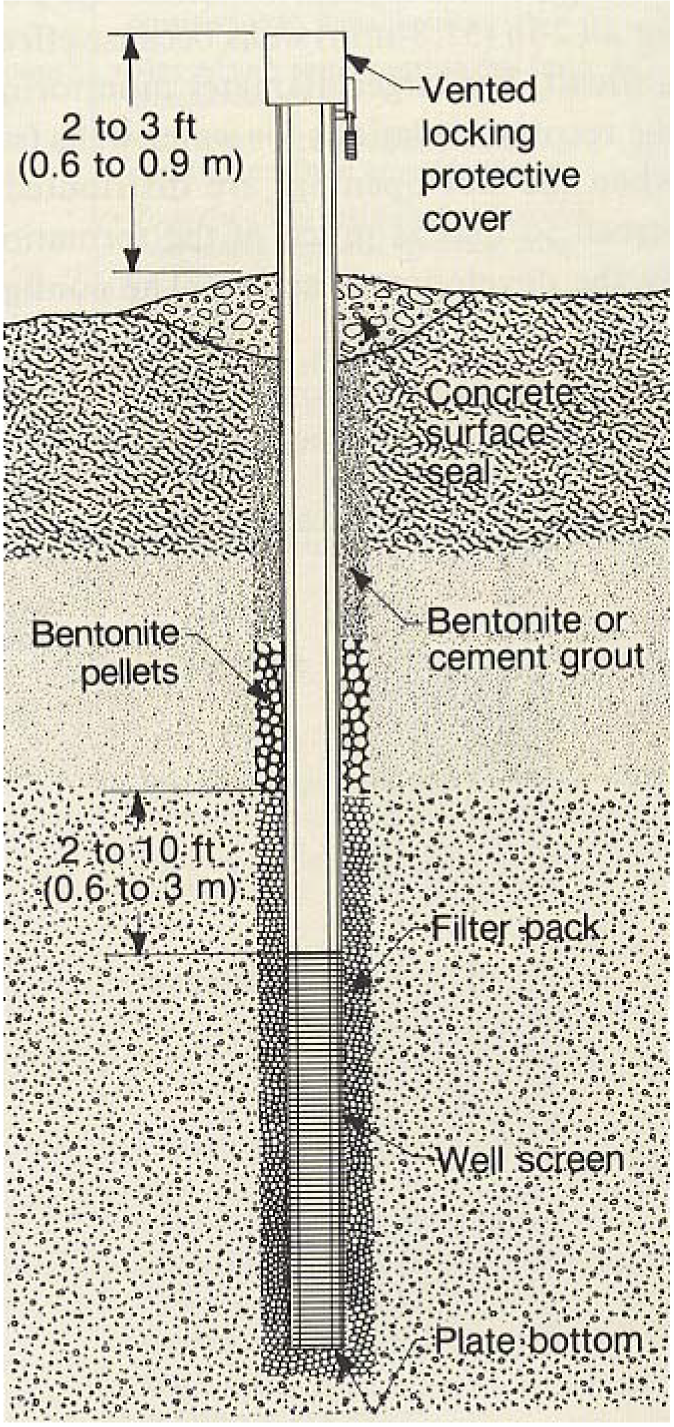

Figure 1. Typical Monitoring Well (Driscoll, 1986)

5.0 PROCEDURE

Installation of monitoring wells will be performed under the direct supervision of a qualified geologist, engineer, or other professional. Permanent monitoring wells should be constructed in accordance with ASTM Standard D5092: Standard Practice for Design and Installation of Groundwater Monitoring Wells.

A monitoring well is generally composed of a well casing, well screen, filter pack, and sanitary or grout seal. Permanent monitoring wells will be installed in open boreholes advanced by a hollow stem auger drill rig. Soil borings should be advanced until the desired depth is obtained and the subsurface soil demonstrates saturated soil conditions. Once the desired borehole depth is obtained, all drill tooling will be removed from the borehole and the monitoring well will be installed. The diameter of the hollow stem auger boreholes will be at least 4 inches larger than the outside diameter of the blank casing and screen. This allows for proper installation of materials within the annular space to create an adequate annular seal.

The following general guidelines will be followed to properly complete each monitoring well to the desired depth:

1. Properly decontaminate well construction materials before installation.
2. Prevent contamination when joining casings and attaching the screen.
3. Pour the filter pack into the annulus to a minimum of 2 feet above the top of the screen and 1 foot beneath the well end cap.
4. Use bottom caps or end plugs.
5. Use permanent or temporary surface casing if contamination or sloughing is a potential issue.
6. Apply filter packs with a tremie pipe or similar method (unless using a pre-packed filter).
7. After installation, “sound” the filter pack for proper placement.

8. Place a fine-grain sand filter 0.5 to 2 feet thick at the top of the filter pack and below the annular seal to help prevent infiltration of bentonite into the filter pack.

9. Apply bentonite pellets or granules to seal the annular space by pouring them freely or through a tremie pipe.

10. If the well is 40 feet or greater in depth, pump grout or slurry into the annular space by using a tremie pipe.

11. For wells less than 40 feet deep, pour grout or slurry freely into the annular space, with or without the use of a tremie pipe.

12. If more than 10 feet of standing water is present, use a tremie pipe to install neat cement and bentonite-cement grouts.

13. Submerge the end of the tremie pipe in the sealing material when installing a slurry or grout.

14. When using a slurry or grout, allow 24 hours between installation of the annular space seal and installation of the protective pipe cover. Fill any settlement in the annular space seal before installing the protective cover.

15. Install a cement surface seal at the ground surface.

5.1 Well Casing and Well Screen

5.1.1 Well Casing

The well casing allows access to groundwater from the ground surface. To eliminate the introduction of contaminants when sampling, join casing sections together with threaded couplings rather than glues, in order to eliminate the introduction of adhesive contaminants into the groundwater. Threaded couplings should have not O-rings to complete the seal, and the well casing should be flush, on the inside.

The inside diameter of the well casing should be at least 1.9 inches, with the exception of micro-wells and piezometer installations. Monitoring wells are commonly constructed using nominal 2-inch-diameter Schedule 40 polyvinyl chloride (PVC) casing. Deeper wells, or wells that need large, dedicated pumps or tubing, may require 4-, 6-, or 8-inch-diameter casing. However, most monitoring wells will use a smaller casing (2 or 4-inch-diameter) to minimize the amount of water generated during sampling events.

5.1.2 Well Screen

The well screen is the part of the well that allows groundwater to enter into the monitoring well and allows access to the aquifer. Determining the slot size and well screen length characteristics of a well screen depends on the purpose of the monitoring well and aquifer characteristics. The proper slot size of the well screen should be determined based upon the filter pack selected for the monitoring well and the formation material. Monitoring wells typically installed within unconsolidated soil use a 20-slot (0.020-inch) well screen with a No. 10-20 silica sand pack, or 10-slot (0.010-inch) well screen with a No. 20-40 silica sand pack. Screen slots will be sized to prevent 90% of the filter pack from entering the well.

The standard screen slot size anticipated for the newly installed wells is 10-slot (0.010-inch), unless field conditions indicate otherwise and approval of the Project Manager has been obtained. Monitoring wells will be constructed of commercially manufactured, machine-slotted well screens.

The type of well screen and slot size controls the amount of open area in a well intake. In addition, the depth of the screened interval and the well screen length can affect the water quality and hydraulic characteristic results. Minimize the length of the well screen to avoid dilution during sampling. Increased open area in the monitoring well screen allows effective development and easy flow of water from the formation into the well. The well screen depth and length are determined on a site-specific basis in consideration of water table variations, site stratigraphy, expected contaminant behavior, and groundwater flow.

Typically, well screens are 1 to 10 feet in length, but sometimes equal or exceed 20 feet. Conventional monitoring well screens are typically 5 or 10 feet long and are installed with a portion of the screen above the high water table to allow for seasonal water table fluctuations.

5.1.3 Materials

A variety of construction materials are used for the well casings and well screens. The material used for well screens is generally selected based on the same guidelines used for selecting well casing. There are many different casing materials used in design of a monitoring well; thermoplastic materials (such as PVC) and stainless steel are the most widely used.

5.1.4 Installation Procedures

The following general procedures should be followed when installing well casings and well screens:

- Keep the well casing sealed in plastic until it is ready to be installed into the borehole.
- Carefully assemble and install well casings and screens to prevent damage to the sections and joints.
- Sections of well casing and screen must be mechanically connected, such as flush threading. Use of glue or solvents to connect or seal casing is prohibited.
- Secure an end cap at the bottom of the well screen before installing section(s) of well screen into the well boring.
- If using pre-pack well screens, take care to not tear or damage the outer fabric or screen holding the pre-pack filter sand to the well screen.
- Install the well casing and well screen straight and plumb and centered within the middle of the borehole.
- Install the filter pack from the bottom of the borehole to at least 2 feet (up to 5 feet) above the top of the well screen. At locations that have shallow groundwater, the filter pack can be placed to extend to at least 1 foot above the top of the screen.
- During installation, place a cap on top of the casing to prevent well materials from entering the well casing.

- A completed monitoring well should be sufficiently straight to allow passage of pumps or sampling devices.
- Document the calculated and actual quantities of materials used in the well installation and the condition of well materials on the Monitoring Well Construction Logs.

5.2 Filter Pack

The well screen of each monitoring well should be surrounded by a permeable, coarse-grained sand known as the filter pack. Fill the annular space surrounding the well screen with a filter pack of uniform-grain-size sand that is coarser and has a higher permeability than the natural, surrounding formation. The filter pack should allow groundwater to flow freely into the well from adjacent formation material and minimize or eliminate fine-grain material from entering the well. The filter pack should extend above the well screen to a length of 20 percent of the well screen length, but no less than 2 feet.

5.2.1 Materials

Filter pack materials must be poorly graded (well sorted) to provide good permeability and hydraulic conductivity of the materials near the screen. The filter pack material should be clean, chemically inert, and well-rounded siliceous material and should be slightly coarser than the surrounding formation. Using coarser material increases the effective well diameter.

The sand or gravel used for filter packs should be of uniform size, be hard and durable, and have an average specific gravity of 2.50 or greater. The filter pack material should be obtained from known clean sources and should be well washed and free of clay, dust, and organic matter. No more than 5 percent of the sand or gravel should be soluble in hydrochloric acid.

Filter pack material should meet the National Sanitary Foundation (NSF) standards and be packaged in properly sealed and marked packages. Record the NSF label information and any associated lot or identification numbers on the Monitoring Well Construction Logs. The filter pack is designed for the anticipated and tested grain size distribution in the screened formation and the size of well-screen openings. The filter pack should have a grain size distribution and uniformity coefficient compatible with the formation materials and the screen. The filter pack must not extend across more than one water-bearing unit (or aquifer). Install the filter pack in all wells (deep or shallow) in a manner that minimizes bridging and void spaces in the filter pack. Any open annular space outside of a pre-pack filter should be filled to the maximum extent practical with additional filter pack material, as previously described. Natural collapse can also be allowed to fill annular space around a pre-pack filter.

5.2.2 Installation Procedures

The following procedures should be followed to optimize the installation of the filter pack and the quality of the well:

- Calculate the volume of the well annulus (that is, the filter pack required), and document on the Monitoring Well Construction Log the type and volume of the filter pack material installed.

- Record on the Monitoring Well Construction Log the National Sanitary Foundation label information and any associated lot or identification numbers from the filter pack material.

- Document that the drilling contractor periodically measures the filter pack during installation by using a sounder or weighted measuring tape to confirm uniform placement and prevention of bridging.

- Document that the drilling contractor measures the depth of the top of the filter pack to verify the thickness of the pack and to confirm proper depth placement above the well screen (at least 2 feet above the screen.

- Document that the filter pack does not extend into any aquifer other than the aquifer to be monitored.

5.3 Annular (Bentonite) Seal

Annular seals prevent vertical movement of water or contaminants between the filter pack, the adjacent soil formation, and the natural backfill material above the screen. There should be two annular seals in standard monitoring wells, one above the filter pack (lower seal) and one at the ground surface (upper seal). All permanent monitoring wells should be constructed with a lower annular seal at the top of the filter pack to confine the well screen within the desired sampling interval. The lower annular seal should be installed at least 2 feet thick on the top of the filter pack to prevent seal material from leaching into the filter pack. Pelletized bentonite is preferred for this application; however, a bentonite slurry or similar material may also be used, if appropriate.

Install the upper annular seal near the ground surface to protect the well from infiltration of surface runoff and potential aboveground contaminants. The upper annular seal should be installed at least 2 feet thick and extend from approximately 1 to 2 feet below ground surface (bgs) to 3 to 4 feet bgs. This annular seal should be bentonite pellets, bentonite slurry, or similar material.

For shallow wells constructed with approximately only 5 to 6 feet between the top of the filter pack and the ground surface, it is acceptable to combine the upper and lower annular seals into a single annular bentonite seal approximately 3 to 4 feet thick from the top of the filter pack to approximately 1 to 2 feet bgs. For deeper wells, the annular space between the two seals should be filled with a bentonite slurry or coarse bentonite chips.

When using bentonite pellets to seal the filter pack, install the pellets in sequential, 1-foot thick layers. Hydrate each layer by pouring an approximately equal volume of clean, potable water into the borehole before placing the next layer of pellets. Continue this process until the required minimum 2-foot seal thickness is installed. Use a weighted tape measure, measuring rod, or similar measurement device to check that the filter pack seal is installed in the proper depth interval. Bentonite grout is suggested when freeze–thaw processes may affect the well.

5.3.1 Materials

Pelletized bentonite is preferred for this application; however, the following may also be used:

- Neat cement grout (not recommended for use with schedule 40 PVC well casing or where there might be shrinkage that would allow leakage along the casing).

- Sodium-based bentonite slurry with a mud weight of at least 10 pounds per gallon.

- Sodium-based bentonite granules.

- Sodium-based bentonite pellets.

- Bentonite-cement grout.

Measure the thickness of the bentonite before hydration. The permeability of the seal must be one to two orders of magnitude less than that of the surrounding formation. The seal must be chemically compatible with the anticipated contaminants and chemically inert so that it does not affect the quality of groundwater samples.

Use fine-grain bentonite, such as granules and powder, for seals placed above the existing water level. A bentonite slurry should be used for the bentonite seal below the existing water level. Coarse bentonite, such as pellets and chips, can also be used for bentonite seals located just below the groundwater water level.

5.3.2 Installation Procedures

The following procedures should be followed for placement of the annular seals:

- When installing an annular seal, determine the type and volume of annular seal material needed by referring to the information on the Monitoring Well Construction Log. Record the type, calculated volume, and actual volume of annular seal material used on the Monitoring Well Construction Log.

- Install at least 2 feet of lower annular seal material above the filter pack.

- Install at least 2 feet of upper annular seal material at least 1 to 2 feet bgs.

- At locations where there is shallow groundwater, the upper and lower annular seal may be combined so that there is 2 feet of filter pack above the well screen and 3 to 4 feet of annular seal. Document alternative procedures like this on the Monitoring Well Construction Log.

- Install the annular seal in 1-foot layers or less and hydrated with clean, potable water between layers.

- Water used for bentonite hydration or for mixing bentonite slurry should be from an approved potable source, of suitable quality, and free of pollutants and contaminants. Document the volume of water used on the Monitoring Well Construction Log.

- Document that the drilling contractor measures the depth to the seal by using a weighted tape measure, measuring rod, or similar measurement device to confirm that the thickness and depth of the seal meets the design requirements.

- Allow the bentonite to completely hydrate in accordance with the manufacturer's instructions before filling the remainder of the annular space with bentonite/cement grout.

- For deep wells, install the seal material by using a tremie pipe to prevent bridging. When using cased borehole drilling methods (such as hollow stem augers), the annulus between the monitoring well casing and drill stem may serve as the tremie pipe.

- Record the actual volumes of bentonite and grout used during well construction on the Monitoring Well Construction Log and explain any discrepancy between the calculated and actual volume.

- Record the details of the well construction including annular seal depth, thickness, seal material type, and installation methods on the Monitoring Well Construction Log.

5.4 Surface Completion and Well Protection

Two types of surface completions are typical to monitoring well installations: (1) aboveground completion and (2) flush-mounted completion. Surface completion and well protection prevent surface runoff from infiltrating the well annulus and protects the well from accidental damage or vandalism. Survey the well installation after completion and document the survey measurements.

5.4.1 Surface Seals

There should be a surface seal of concrete around the protective well casing at each well that fills the upper annular space. A surface seal is a separate upper annular seal installed above, but not connected to, the bentonite seal (except in very shallow monitoring wells). Because of the temporary nature of micro-wells, surface seals other than hydrated bentonite are not necessary.

5.4.2 Surface Completion and Monuments

Construct each monitoring well with a surface monument to protect the well casing from damage. Depending on site conditions, concrete may be used to create a secure monument foundation and provide an additional surface seal. Constructed concrete monument foundations (slabs) should be sloped away from the well so that it sheds rain and surface water. On a site-specific basis, alternative well construction designs may be used if approved by the Project Manager (for example, in areas of shallow groundwater). If an aboveground monitoring well monument is installed, construct the well monument with a protective casing, preferably made of steel. Extend the protective casing at least 6 inches above the top of the well casing, and at least 2 feet into the ground. Install the protective casing before the upper annular seal sets. Seal and immobilize the protective casing within the concrete monument foundation. To accommodate sampling equipment, make sure there is sufficient clearance, usually 6 inches, between the lid of the protective casing and the top of the riser. Drill an approximately ¼-inch-diameter weep hole in the protective casing approximately 6 inches above ground surface to permit water to drain out of the annular space between the protective casing and the riser. In winter, this hole will also prevent water freezing between the protective casing and the well casing. Place dry bentonite pellets, granules, or chips in the annular space from 3 to 4 inches below the weep hole within the protective casing. Place coarse sand or pea gravel (or both) in the annular space above the dry bentonite pellets and within 6 to 12 inches below the top of the well casing to allow water to drain from within the protective casing and prevent insect habitation.

If a flush-mount monitoring well monument is installed, construct the well monument with a steel protective cap with a subsurface casing that extends approximately 2 feet bgs. The top of the steel protective cap and protective casing must be flush with the ground. Drill an approximately ¼-inch-diameter weep hole in the protective casing approximately 18 to 24 inches from the top of the protective casing to permit water to drain out of the annular space between the protective casing and the well casing. Install the protective casing before the upper annular seal sets, making sure that the weep hole is above the top of the upper annular seal. Seal and immobilize the protective casing in a concrete, flush-mount foundation, if possible. To accommodate sampling equipment, make sure there is sufficient clearance, usually 6 inches, between the steel protective cap and the top of the well casing. Place coarse sand or pea gravel (or both) in the annular space within the protective casing to within 2 to 3 inches below the top of the well casing to allow water to drain from within the flush-mount monument and prevent insect habitation.

Regardless of the type of monument, each well should be fitted with a locking well casing cap that easily fits below the protective well monument cap. Install a leak-proof, locking well casing cap on the top of each well casing to prevent vandalism and to prevent water from entering the well casing. The protective well monument cap should be leak-proof and secured with multiple bolts for additional protection. Document all construction details and materials used on the Monitoring Well Construction Log. Clearly mark monitoring wells with a unique well identifier on the inside and outside of the protective casing.

Aboveground Completions

The following basic procedures will be followed for aboveground completions:

- Extend the well casing approximately 2 to 3 feet above the ground surface.
- Install a protective casing around the aboveground well casing. Install the protective casing in a plumb, vertical position. Place concrete (surface seal) above and around the base of the protective casing up to and becoming part of the surface concrete pad. The concrete seal should not extend below the base of the protective casing; this will allow trapped water during installation and sampling events to drain.
- The protective casing may be painted if requested by the client.

- Install a weatherproof, locking well monument cap on the top of the protective casing so there is adequate clearance between the top of the well casing cap and the bottom of the well monument cap.

- A concrete surface pad may be placed around the well protective casing. The pad should be approximately 3 feet square by 4 inches thick and sloped away from the protective casing.

- Install bollards around wells where traffic might threaten the integrity of the well.

- When possible, attach a stainless steel, well identification tag to the outside of the protective casing.

Flush-mounted Completions

The following procedures will be followed for flush-mounted completions:

- Cut off the well casing below grade, leaving enough space to install a leak-proof, locking well casing cap.

- Install a subgrade, protective casing with a steel protective cap around the top of the well casing. Install the protective casing to approximately 2 feet bgs. The top of the steel protective cap and protective casing must be flush with the ground.

- Drill an approximately ¼-inch-diameter weep hole in the protective casing approximately 18 to 24 inches from the top of the protective casing to permit water to drain.

- To accommodate sampling equipment, make sure there is sufficient clearance (typically 6 inches) between the steel protective cap and the top of the well casing.

- Place coarse sand or pea gravel (or both) in the annular space within the protective casing to prevent water infiltration and insect habitation.

- A concrete flush-mount foundation may be placed around the well protective casing. The concrete foundation must slope away from the protective casing.

- For flush-mounted completions located in high-traffic areas, follow the procedures outlined above except that traffic-rated cement or a steel vault should be used and cemented flush with the traffic surface.

- For flush-mounted completions, be careful to construct watertight bonds between the protective structure and the cement surface seal.

- Install a weatherproof, locking well monument cap on the top of the protective casing and weatherproof, locking well casing cap on top of the well casing.

- Where significant amounts of runoff occur, additional protection measures may be required.

- When possible, attach a stainless steel, well identification tag to the inside of the protective casing.

5.4.3 Well Protection

Monitoring wells can have either aboveground or flush-mount completions. If the well casing is composed of metal and completed above the ground surface, attach a lockable cap to the top of the protective well casing and lock the cap with a padlock. If the well is not cased with metal and is completed above the ground surface, install a metal protective casing around the well. For flush-mount wells, install a protective well monument vault (or equivalent) around the well with a lockable or bolt-on cover that has a waterproof seal. Install the cover level with the ground surface to help prevent the inflow of surface water.

Construct flush-mount well covers to withstand the maximum expected loadings (such as vehicular traffic or material staging). Install bollards around aboveground wells where traffic might threaten the integrity of the well. Install three or four bollards in a triangular or rectangular array at least 2 feet from the casing. Use 3-inch-diameter steel or wooden bollards that extend at least 4 feet above and 3 feet below the ground surface; the bollards must be tall enough to be easily visible to traffic. Bollards should not be placed in the concrete surface pads around the wells. In areas where there is a high probability of damage to the well (such as where there is high traffic, heavy equipment, or poor visibility), it may be necessary to also install posts, markers, signs, or other safety features. The level of protection should adequately mitigate the potential risk of damage to the well.

5.5 Installation of Micro-Wells

Micro-wells are small-diameter monitoring wells. Micro-wells are generally installed in boreholes driven by direct push systems and are typically less than 2 inches in diameter. Micro-wells installed by the direct push system method generally have the same installation requirements as conventional wells.

- Keep the well casing sealed in plastic until it is ready to be installed into the borehole.
- Carefully assemble and install well casings and screens to prevent damage to the sections and joints.
- Sections of well casing and screen must be mechanically connected, such as flush threading. Use of glue or solvents to connect or seal casing is prohibited.
- Secure an end cap at the bottom of the well screen before installing section(s) of well screen into the well boring.
- If using pre-pack well screens, take care to not tear or damage the outer fabric or screen holding the pre-pack filter sand to the well screen.
- Install the well casing and well screen straight and plumb and centered within the middle of the borehole.
- Install the filter pack from the bottom of the borehole to at least 2 feet (up to 5 feet) above the top of the well screen. At locations that have shallow groundwater, the filter pack can be placed to extend to at least 1 foot above the top of the screen.
- During installation, place a cap on top of the casing to prevent well materials from entering the well casing.

- Install an annular seal from the filter pack to the top of the well.
- The annular seal must prevent vertical migration of liquids into the borehole annular space.

6.0 RECORDS

All materials and procedures used during installation of wells should be documented in the Field Logs and Monitoring Well Construction Logs in accordance with SOP Field Note taking and Field Logs.

7.0 DEFINITIONS

Annular Space or Annulus: The space between the borehole wall and the well casing, or the space between the casing pipe and well casing.

Bentonite Seal: A seal with expansion potential that is placed above the filter pack to provide a positive seal above the filter pack.

Filter Pack: A chemically inert, uniform, well-rounded material (sand or gravel) that is placed in the annulus between the well screen and the surrounding formation to prevent formation material from entering the screen.

Monitoring Well: A well constructed to extract groundwater for physical, chemical, or biological testing, or for measuring water levels.

Piezometer/Micro-Well: A small diameter (typically well 0.75 to 1 inch) well installed to measure hydraulic head.

Surge Block: A plunger-like tool consisting of rubber or Teflon® discs sandwiched between steel discs that may be solid or valved; used to alternate flow from the well casing into the surrounding formation.

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STANDARD OPERATING PROCEDURE
#6

MONITORING WELL DEVELOPMENT

Revision 2

January26, 2018

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: MONITORING WELL DEVELOPMENT

1.0 PURPOSE

The purpose of this procedure is to describe how to develop new monitoring wells or redevelop existing monitoring wells that have just been installed or existing monitoring wells that may have become partially filled with sediment during use as a monitoring well. These procedures are performed with the objective of obtaining representative groundwater information and water quality samples from aquifers. These procedures may also be employed for development of fractured bedrock formation monitoring wells.

2.0 SCOPE

This SOP applies to all C.T. Male Associates personnel and subcontractors engaged in development and sampling of groundwater monitoring wells and piezometers. This SOP focuses on the most common monitoring well development tasks and should be used in conjunction with other applicable project SOPs, including the following:

- SOP: Note Taking and Field Logs.
- SOP: Organic Vapor Monitoring and Air Monitoring.
- SOP: Equipment Decontamination Procedures.
- SOP: Groundwater Sampling Procedures.

3.0 RESPONSIBILITIES

3.1 Project Manager

The Project Manager verifies that monitoring well development procedures comply with this SOP and the requirements of the enforcing agencies. Alternate well development requirements and procedures required by local agencies or other modifications must be documented and approved by the Project Manager.

3.2 Field Team Leader

The Project Manager will develop or direct the well development procedures to be used. The Field Team Leader should know the requirements for well development and should maintain adequate documentation of the development process and materials used to demonstrate that the well has been properly developed.

3.3 Health & Safety Officer

The Health & Safety Officer oversees site-specific health, safety, and environment (HS&E) protocols and overall compliance with project HS&E requirements. The Health and Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the Project-specific Health and Safety Plan (HASP), coordinates with the Project Manager and Field Manager to certify the PPE, and conducts project health and safety audits to evaluate the effectiveness of the HS&E program.

3.4 Site Safety and Health Officer

The role of Site Safety and Health Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.0 EQUIPMENT, REAGENTS, and SUPPLIES

The following items are applicable to this SOP:

- Pumps (e.g., submersible or peristaltic)
- Pump discharge hose/tubing
- Bailers
- Chemical resistant gloves
- Water level indicator or interface probe
- Surge block (optional)
- Water quality meter (optional)
- Turbidimeter (optional)

5.0 PROCEDURE

These procedures are used to remove the fine-grained materials from a well or well bore as a result of boring or well construction. Monitoring wells must be developed to provide water free of suspended solids and to yield representative samples. Well development should result in a well that yields visibly clear groundwater.

5.1 Calibration

If used, the water quality meter and turbidimeter will be calibrated as per the applicable CT Male SOP. The meters will undergo calibration checks, at a minimum, before and after sampling. The calibration check will be documented on a calibration form (as appropriate) and/or in the field notebook. Any significant issues found during the calibration check will be noted in the field notebook.

5.2 Development

Successful development methods include bailing, surging, pumping/over-pumping, and jetting with water. The basic principle behind each method is to create reversals of water flow into and out of the well screen (and/or bore hole) to break-down any potential mud cake or disturbed zones where fine-grained particles may be concentrated at the borehole-formation interface, and to draw the finer materials into the well or borehole for removal. This process also helps remove fine fraction formation materials in proximity to the borehole wall, leaving behind a “natural” pack of coarser-grained materials.

5.2.1 Bailing

In relatively clean, permeable formations where water flows freely into the borehole, bailing is an effective development technique. Let the bailer fall down the well until it strikes the surface of the groundwater which produces an outward surge. Rapidly withdraw the bailer to create a drawdown and/or after the bailer hits the groundwater lower it to the bottom of the well and agitate it with rapid short strokes. Continue bailing with repeated up and down “surging motions” until water bailed from the well is free from suspended particles.

Note: During this process, if the well goes dry, stop bailing and let the well recharge before continuing.

5.2.2 Surge Block

A surge block is a tool used to break up bridging of fine grained material by inducing agitation and inducing flow into and out of the well and aquifer formation. Bridging is the tendency for particles moving towards a well under unidirectional flow (pumping) to develop a blockage that restricts subsequent particles to move into a well. Surge block is used alternately with either a pump or bailer. Let the surge block fall down the well until it strikes the groundwater surface. This creates a vigorous outward surge; rapidly retrieve the surge block. Lower the surge block to the top of the well intake and begin a pumping action with a typical stroke of approximately 3 feet and gradually work downward through the screened interval. Remove the surge block at regular intervals to discard the loosened suspended particles by either bailing or pumping. Continue the cycle of surging/bailing/pumping until satisfactory development has been attained.

5.2.3 Pumping/Over-pumping

In both pumping techniques, the groundwater flow is induced to flow into the well and the fine particulate material moves into the well and is discharged by the pump. In the case of over-pumping, the pump is operated at a capacity that substantially exceeds the ability of the formation to deliver water. Once pumping has begun, start the surging action by lowering and raising the hose/pumping apparatus through the screened interval. Bailing or bailing and surging may be combined with pumping for efficient well development. Continue pumping until such time as satisfactory development has been attained based on field observation of visibly clear water produced. If an analytical measure is needed, use turbidity meter readings to document initial turbidity and final turbidity readings. Well stabilization parameters may also be measured and documented pre- and post-development.

If pumping/over-pumping is completed by air lifting, the air compressor must be of an oil-less type or fitted with an oil trap capable of removing compressor oil from the air stream to avoid contaminating the well or boring.

5.2.4 High Velocity Jetting

Development by high velocity jetting may be completed with either water or air. In practice, jetting with water is typically followed by or simultaneously occurring air-lift pumping/over pumping to remove the fine materials. The jetting procedure consists of operating a horizontal water jet(s) inside of the well screen so high velocity streams of water shoot through the screen openings into the sand pack/formation. The jetting tool is worked similar to a surge block. The jetting tool ideally will have four openings located 90 degrees apart and should be worked up and down the screened interval while being rotated. At a minimum, the amount of water introduced during jetting and, if feasible, an additional 10 well volumes of water should be purged from the well.

5.3 Data Reduction/Calculations

No data reduction or calculations are associated with this procedure.

5.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and CT Male's SOP 'Investigative Derived Waste'. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

6.0 RECORDS

The field technician(s) will document the method of development, any deviations from this SOP, volume of water purged, and any volume of water introduced to the well (e.g., high velocity jetting, flushing).

Other CT Male SOP subjects referenced within this SOP: field water quality measurements and groundwater sampling.

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STANDARD OPERATING PROCEDURE
#7

EQUIPMENT DECONTAMINATION PROCEDURES

Revision 2

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: EQUIPMENT DECONTAMINATION PROCEDURES

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide the step-by-step procedures for field decontamination of environmental sampling equipment and personal protective equipment (PPE). Decontamination of equipment and PPE is designed to document that sample cross-contamination, human-health exposure, and contamination transport are minimized.

2.0 SCOPE

This procedure applies to all C.T. Male Associates personnel engaged in collecting environmental samples or operating in environments in which hazardous or contaminating substances are suspected to be present.

3.0 GENERAL

Decontamination consists of physically removing contaminants from the surface of sampling equipment and materials potentially exposed to those contaminants. A decontamination plan should be based on conservative, worst-case scenario, using available information about the work area. The plan can be modified, if justified by supplemental information. Initially, the decontamination plan assumes that protective clothing and equipment which leave the exclusion zone are contaminated. Based on this assumption, a system is established to wash and rinse non-disposable equipment and dispose of disposable equipment.

The type of decontamination procedures and solutions needed at each site should be determined after considering the following site-specific conditions:

- The type of equipment to be decontaminated.
- The type of contaminant(s) present.
- Extent of contamination.
- Potential human, environmental and ecological risk scenarios.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager is responsible for overall compliance with this procedure and for documenting that field staff are properly trained and meet project Health, Safety, and Environmental (HS&E) requirements.

4.2 Health & Safety Officer

The Health & Safety Officer is assigned to oversee site-specific HS&E and overall compliance with project HS&E requirements. The Health & Safety Officer conducts PPE evaluations, selects the appropriate PPE for the project, lists the requirements in the project-specific Health and Safety Plan (HASP), coordinates with the Field Team Leader to complete and document the PPE program, and conducts project health and safety audits on the effectiveness of the HS&E program.

4.3 Site Health and Safety Officer

The role of Site Health and Safety Officer is delegated to the Field Team Leader by the Project Manager and/or Health & Safety Officer to assist in implementing the project HASP. The Field Team Leader assists the Project Manager and/or Health & Safety Officer with the health and safety program, implements the PPE requirements described in the project HASP, and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Team Leader

The Field Team Leader is responsible for following these procedures or delegating tasks to technicians to perform decontamination tasks. The Field Team Leader should document that subcontractors are taking necessary precautions to decontaminate field equipment before and throughout field activities. The Field Team Leader should also document that decontamination waste and PPE are disposed of properly.

5.0 PROCEDURE

Decontaminate non-disposable sampling equipment used at the site both before activities begin, after each sample is collected, and if needed when leaving the exclusion zone. Decontaminate drilling and excavation equipment both before activities begin, between each investigation/remedial action location, and leaving the exclusion zone.

Materials and solutions used for decontamination procedures will be non-hazardous and will not be used if they could potentially contaminate samples (i.e., acids and solvents).

5.1 Decontamination Area

Set up a decontamination zone adjacent to the exclusion zone for drill rigs, excavators, other sampling equipment, and personnel. Select and set up the decontamination area so that decontamination fluids and soil wastes can be managed in a controlled area with minimal risk to the surrounding environment. The decontamination area should be large enough to allow temporary storage of cleaned equipment and materials before use, as well as to stage drums of decontamination investigation/remediation-derived waste. In the case of large decontamination areas (for example, for hollow stem auger and excavator bucket decontamination), line each area with heavy-gauge plastic sheeting and include a collection system designed to capture potential decontamination investigation/remediation-derived waste. Decontamination areas will be constructed to mitigate overspray while performing decontamination activities.

Smaller decontamination tasks, such as sampling equipment (i.e., trowels, shovels, split-barrel sampler, macro-core sampler, etc.) decontamination, may take place at the sampling locations. In this case, required decontamination supplies and equipment should be mobilized to the site and smaller decontamination areas for personnel and portable equipment will be provided as necessary. These locations will include basins, buckets and/or tubs to capture decontamination investigation/remediation-derived waste, which will be transferred to larger containers as necessary.

5.2 Decontamination Equipment

The following is a list of equipment and materials that may be needed to perform decontamination:

- Concrete or synthetic material-lined decontamination pad.
- HDPE sheeting/membrane to serve as secondary containment for liquids.
- Brushes and flat-bladed scrapers.
- Garden-type water sprayers (without oil-lubricated, moving parts).

- High-pressure washer.
- Portable steam cleaner.
- Sump or collection system for contaminated liquid.
- Wash basins and buckets.
- Spray and rinse bottles.
- Potable PFAS free water, deionized water, laboratory-grade water and laboratory grade detergent (Liquinox or Alconox).
- Plastic waste bags.
- Leak-tight liquid waste containers (55-gallon drums or similar).
- Bulk solid waste containers (super-sacks, 55-gallon drums, or similar).

5.3 Decontamination Procedures

5.3.1 Personnel and Personal Protective Equipment

Decontamination of personnel and PPE reduces the potential for human-health exposure to contaminants via ingestion, absorption, and inhalation. Personnel and PPE will be decontaminated as outlined in the site-specific HASP. Concerns regarding personnel and PPE decontamination procedures may be addressed directly with the Project Manager, Health & Safety Officer, and/or Site Specific Health and Safety Officer.

5.3.2 Sampling Equipment

Conduct consistent decontamination of sampling equipment to maintain the quality of the samples collected. Decontaminate equipment that comes into contact with potentially contaminated samples. Disposable equipment intended for one-time use that is factory wrapped generally does not need to be decontaminated before use, unless evidence of contamination is present. Disposable equipment, such as disposable bailers, spoons is preferred over reusable equipment; use wherever appropriate. Decontaminate sampling equipment, including split-barrel and macro-core samplers, hand augers, reusable bailers, spoons, trowels, shovels, and pumps used to collect samples for chemical analyses before each use and before sampling at a new sampling location. Take the following steps to decontaminate non-dedicated sampling equipment:

- Decontamination personnel will wear the appropriate PPE as required by the site-specific HASP.
- The sequence of actual decontamination will be as follows:
  - Remove gross contamination (such as pieces of soil) from equipment at the sampling site.
  - If heavy petroleum residuals are encountered during sampling, an appropriate solvent such as methanol will be used to remove petroleum residues from sampling equipment, but should be kept to a minimum. If a solvent is used, it must be properly used, collected, stored, and disposed of according to the site-specific HASP. If heavy petroleum residuals are not encountered, this step should be omitted.
  - If PCB oils are observed on sampling equipment an appropriate solvent, such as Mycelx, will be used to remove liquid PCB residues from sampling equipment. If a solvent is used, it must be properly used, collected, stored, and disposed of according to the site-specific HASP.
  - Wash water-resistant equipment thoroughly and vigorously with potable water and laboratory-grade detergent such as Liquinox, or Alconox and use a bristle brush or similar utensil to remove remaining residual contamination. This shall be done within a containment tub or similar.
  - Rinse equipment thoroughly with potable water (1st and 2nd rinse).
  - Rinse equipment thoroughly with distilled or deionized water (3rd and 4th rinse).

  - For sensitive field instruments, rinse equipment with distilled, deionized, or American Society for Testing and Materials (ASTM) reagent grade water (3rd rinse).

  - Air dry at a location where dust or other fugitive contaminants may not contact the sample equipment. Alternatively, wet equipment may be dried with a clean, disposable paper towel to assist the drying process. Equipment should be dry before reuse.

- If the equipment is not used soon after decontamination, it should be covered or wrapped in new, HDPE sheeting to protect the decontaminated equipment from fugitive contaminates before reuse.

- Store decontaminated equipment at a secure, unexposed location out of the weather and potential contaminant exposure.

- Depending on site conditions and the number of samples collected at each location, rinse and detergent water may be replaced with new solutions between borings or sample locations.

5.3.3 Groundwater Sampling

Proper decontamination between wells is necessary to avoid introducing contaminants from the sampling equipment. For decontamination of peristaltic pumps, replace the pump head tubing after sampling each well. If sampling with pumps such a submersible, bladder, or similar pump in which mechanisms of the pump come in direct contact with contaminated water, or sampling with a reusable stainless steel bailer, decontaminate the pump or bailer. The following steps will be used for pumps and bailers contaminated with dissolved phase contamination only:

1. Wash the exterior of the pump or bailer and associated cable thoroughly and vigorously with potable water, of filtered water where PFAS is a contaminant of concern, containing the non-phosphate laboratory-grade detergent Liquinox or Alconox. Washing will be completed using a dedicated wash bristle brush or similar brush.

2. Place the pump into clean potable or filtered water wash basin/reservoir containing Liquinox or Alconox making sure that the pump intake is fully submerged and the pump outlet is allowed to flow directly back into the wash reservoir. It should be noted if the wash water and wash basin are not clean, the contaminants from previously used wash water including debris or soils would recirculate through the pump. Set the pump to a very low flow rate and turn the pump on, allowing the wash water to re-circulate through the pump mechanism for a minimum of 5 minutes. Disregard this step for reusable bailers.

3. Initially, rinse the pump or bailer by repeating Steps 1 and 2 using potable water, a dedicated rinse bristle brush, and a rinse basin/reservoir containing only potable water (1st and 2nd rinse).

4. Final rinse the pump or bailer by duplicating Step 3 using distilled, deionized, or ASTM reagent grade water (3rd and 4th rinse).

5. Dry off excess water with a clean, disposable paper towel and allow to air dry at a location where dust or other fugitive contaminants may not contact the sample pump or bailer.

If the pump or bailer is used to sample groundwater containing non-aqueous phase liquid (NAPL) or other heavy petroleum contamination, field-dismantle (field-strip) the equipment per the manufacturer’s guidelines and decontaminate the interior and exteriors surfaces of the pump or bailer using the wash, double rinse, and dry steps outlined in the previous Steps 1, 3, 4, and 5 above. If significant heavy petroleum residue is encountered during decontamination, use an appropriate solvent such as methanol to remove petroleum residues from pump or bailer surfaces. This should be kept to a minimum. If a solvent is used, it must be properly used, collected, stored, and disposed of according to the project-specific HASP. If heavy petroleum residuals are not encountered, omit this step.

5.3.4 Measurement Devices and Monitoring Equipment

For water quality instruments, oil-water interface indicators, water level indicators, continuous water level data-loggers, and other field instruments that have the potential to come into contact with site media, at a minimum, wash with dilute laboratory-grade detergent (Liquinox or Alconox) and double rinse with potable and distilled/deionized water before and after each use using a similar procedure as discussed in Section 5.3.2. If heavy petroleum residuals are encountered during sampling, use an appropriate solvent such as methanol to remove petroleum residues per the manufacturer's maintenance guidelines.

5.3.5 Drilling and Subsurface Soil Sampling Equipment

Drilling equipment and associated materials will be decontaminated by the drilling contractor prior to drilling operations and between borings, or as outlined in the site specific work plan. Decontaminate tools used for soil sampling (i.e., split-barrel and macro-core samplers) before and between collecting analytical samples. Thoroughly clean external and internal surfaces of drilling equipment (that is, drill bits, auger, drilling stem, and hand tools) before beginning drilling operations and between borings using the following basic sequence:

- Remove as much gross contamination as possible off equipment at the sampling site.
- Wash equipment thoroughly and vigorously with high-temperature potable water using a high-pressure washer and/or steam cleaner, if possible. If steam cleaning is not going to be used it will be outlined in the site specific work plan. A bristle brush is also suggested to remove persistent gross contamination.
- Rinse equipment twice thoroughly with potable water (1st and 2nd rinse).
- Rinse equipment twice thoroughly with filtered water (3rd and 4th rinse), when PFAS are contaminants of concern or will be sampling at the site.
- Air dry at a location where dust or other fugitive contaminants may not contact the sample equipment. Equipment should be dry before reuse.
- Store decontaminated equipment at a location away from potential exposure from fugitive contamination.

5.3.6 Decontamination of Earthwork Equipment

Wash earthwork equipment (such as excavators, back-hoes, and trucks) with high-pressure potable water and/or filtered water, if possible, before leaving a contaminated area, using similar steps as outlined in Section 5.3.5.

Portable steam-cleaners and hand washing with a brush and detergent, followed by a potable water and filtered water rinse, can also be used. In some instances, tires and tracks of equipment may only need to be thoroughly brushed with a dry brush. Take particular care with the components in direct contact with contaminants, such as tires and backhoe buckets. Earthwork equipment (or localized part) that may come in direct contact with analytical samples (i.e., sample collection of soils in direct contact with the excavator bucket) must be thoroughly decontaminated before excavation activities and between sample locations.

5.3.7 Air Sampling Equipment

For non-laboratory manifold equipment, methanol soak manifold components for a minimum of two hours. Remove from the methanol bath and place in an oven pre-heat to 90 ° C and continue to heat manifold components for at least 3 hours or until interior and exterior surface inspections of the manifold components indicate that they are free of liquid methanol.

5.4 Investigation/Remediation-Derived Wastes

Depending on the contaminant, potentially hazardous investigation/remediation-derived wastes (such as wash water or rinsate solutions) will be contained in 55-gallon drums and staged in a designated waste storage area.

6.0 RECORDS

Sampling personnel will be responsible for documenting decontamination of sampling, excavation and drilling equipment. Record information on the Environmental Services Field Logs. The information entered on the Environmental Services Field Logs concerning decontamination should include the following:

- Decontamination personnel.
- Decontamination solutions used (i.e., Alconox, Liquinox, distilled water, etc.).

- Date and time (start and end).
- Location of decontamination.
- General decontamination methods, tools used, and observations.
- Manufacturer names and lot numbers of decontamination solutions.
- Location and amount of decontamination investigation/remediation-derived wastes collected, stored, and/or disposed.
- Identification number, date, sampling area, and information of stored decontamination investigation/remediation-derived wastes.
- Decontamination investigation/remediation-derived waste spills or releases and associated corrective actions.

7.0 DEFINITIONS

Decontamination Area: An area that is not expected to be contaminated and is upwind of suspected contaminants.

Decontamination Equipment: Equipment used during the process of decontamination of personnel or sampling equipment.

Drilling and Subsurface Soil Sampling Equipment: Equipment and tools used during the process of drilling or subsurface soil sampling.

Health and Safety Plan: A plan developed to require that hazards associated with a site are evaluated prior to site entry.

Measurement\Monitoring Equipment: Equipment used to check or evaluate site conditions.

Personal Protective Equipment (PPE): Personal health and safety equipment used to protect the individual from contaminant exposure, physical injury, or death.

Potable Water: Water acceptable for drinking and washing.

Sampling Equipment: Equipment used during the process of sample collection.

Earthwork Equipment: Heavy earthmoving equipment typically used for excavation and test pit investigations.

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STANDARD OPERATING PROCEDURE
#8

GROUNDWATER SAMPLING

Revision 2

December 28, 2017

______________ ______________________ _________
Print Technical Reviewer Signature Date

______________ ______________________ _________
Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: GROUNDWATER SAMPLING PROCEDURES

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the methodology for planning groundwater sampling events, well purging, and collection of groundwater samples through the use of positive displacement, submersible, and peristaltic pumps, and bailers.

2.0 SCOPE

This SOP applies to all C.T. Male Associate's personnel, subconsultants or subcontractors working for C.T. Male, engaged in groundwater sampling. This SOP focuses on the most commonly used monitoring well development tasks and should be used in conjunction with other applicable project SOPs, including the following:

- SOP: Note Taking and Field Logs.
- SOP: Organic Vapor Monitoring and Air Monitoring.
- SOP: Drilling and Associated Sampling.
- SOP: Equipment Decontamination Procedures.
- SOP: Monitoring Well Installation.
- SOP: Field Water Quality Measurements and Calibration
- SOP: Measuring Static Water Level, Immiscible Layers (DNAPL and LNAPL), Total Well Depth in Wells.
- SOP: Collection of Groundwater samples using low-flow purging and sampling.
- SOP: Collection of Quality Control Samples.
- SOP: Documentation on a Chain-of-Custody.
- SOP: Domestic Transport of Samples to Laboratories in USA.
- SOP: Filtering of Water Samples.

3.0 GENERAL

Groundwater sampling consists of collecting a water sample that is representative of the in situ conditions and chemistry of a specific aquifer, or portion of an aquifer. Four methods for well sampling are addressed in this SOP, including the no-purge method, the low-flow method, the well-volume method, and low-permeability formation method.

If multiple groundwater monitoring wells are to be sampled during the same sampling event, samples should be collected from the monitoring wells expected to be uncontaminated or to have only low levels of contamination first, progressing to wells expected to have higher levels of contaminant last. This practice helps reduce the potential for cross-contamination between monitoring wells.

Groundwater samples should be collected as close as possible to the vadose zone/saturated zone interface (water table) unless analysis indicates that contamination is at a different depth. If further vertical delineation of contaminant concentration(s) is necessary, groundwater samples should be collected at the interval(s) within the water column based on the physical characteristics of the contaminant. This should be a consideration especially for light, nonaqueous phase liquids (LNAPLs) (such as petroleum fuels) and dense nonaqueous phase liquids (DNAPLs) (such as chlorinated solvents). If multiple different contaminant analytes are to be sampled from the same well, samples will be transferred to sample containers in the order of volatility. Contaminant analytes should be collected in the following order:

1. In-field water quality parameters.
2. Polyfluoroalkyl Substances (PFAS).
3. Volatile organic compounds (VOCs) and volatile natural attenuation parameters.
4. Semi-volatiles organic compounds (SVOCs).
5. PCBs and pesticides.
6. Inorganic compounds (such as total metals, dissolved metals, nitrate/nitrite, and sulfide).

3.1 Equipment and Materials

Groundwater sampling may be performed using several sampling devices including submersible pumps, peristaltic pumps, inertial pumps, and bailers. The choice of sampling device will be based on site-specific considerations including the well diameter, depth to groundwater, well yield and required sample analysis Groundwater sampling devices must compliment the intended data use and site decisions, and selected groundwater purging and sampling equipment should minimize increases in suspended sediment, sample temperature, water column agitation, and sample agitation.

Materials used during groundwater sampling must not absorb, desorb, or leach contaminants of concern from or into a potential groundwater sample. The materials used must be resistant to chemical and biological degradation. For bailer use, the bailer must be made of stainless-steel, other suitable materials. The use of disposable bailers shall be made out of materials such as silicone and HDPE. Bailers containing or made of Polyvinyl chloride (PVC) are not acceptable for sampling of VOCs. Bailers made of, polytetrafluoroethylene (PTFE), fluorinated ethylene propylene (FEP), ethylene tetrafluoroethylene (ETFE) or Teflon are not acceptable for sampling of or PFAS.

3.2 Historical Groundwater Level Information

The initial step in developing a groundwater sampling plan for a particular site is to acquire historic groundwater elevation data from monitoring wells at the site, if available. Personnel shall refer to the CSM and site specific site work plans. If no monitoring wells currently exist, attempt to acquire groundwater level data for wells at or as close as possible to the site, if available. Evaluate the data to determine the range of seasonal water level fluctuations that occur at the site and the shallowest and deepest observed water levels over the period of record. This information defines the depth interval of the intermittently saturated zone that rises and falls with seasonal water level fluctuations.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager is responsible for providing adequate resources and verifying that field staff have adequate experience and training to successfully comply with and execute project-specific SOPs and implement the project health, safety, and environment (HS&E) program. The Project Manager will solicit the appropriate technical expertise to verify that the project has identified the best sampling methods and technology for the job given the current understanding of the site and project goals. The Project Manager is also responsible for the coordination and scheduling of daily field activities, for verifying compliance with this SOP and that all field staff engaged in this activity are trained in this SOP.

4.2 Field Team Leader

The Field Team Leader should know the requirements for groundwater sampling and should maintain adequate documentation of groundwater sampling measurements and calibration activities.

4.3 Health & Safety Coordinator

The Health & Safety Coordinator is assigned to oversee site-specific HS&E and verify overall compliance with project HS&E requirements. The Health & Safety Coordinator conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE for the project, lists the requirements in the Project-specific Health and Safety Plan (HASP), coordinates with the Project Manager to complete and certify the PPE program, and conducts project health and safety audits on the effectiveness of HS&E program.

4.4 Site Safety and Health Officer

The role of Site Safety and Health Officer is delegated to the Field Team Leader by the Project Manager and/or Health & Safety Officer to assist in implementing the project HASP. The Field Team Leader assists the Project Manager and/or Health & Safety Officer with the health and safety program, implements the PPE requirements described in the project HASP, and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

5.0 PROCEDURES

5.1 Pre-sampling Tasks

5.1.1 Planning Tasks

The Field Team Leader should work with the Project Manager to obtain historical information on which wells have historically had contaminants present, so that wells with the greatest concentrations may be sampled last to minimize potential cross contamination. Site background information including depth to water, well total depth, and water quality parameters from previous events (if available), should be obtained before the field sampling event to augment data quality and allow for verification of data consistency. Expected purge volumes should be estimated before field deployment such that proper pumps may be selected and purge water management may be planned.

5.1.2 Field Equipment Decontamination

Clean (and/or decontaminate) all equipment and materials used during groundwater sampling before use. Groundwater sampling equipment that typically requires decontamination before purging a well includes the water level or oil-water interface probe, water quality meters and probes, inside of flow-thru cells, and submersible pumps. Decontaminate submersible pumps between sampling at each well. Portable decontamination supplies (for example, decontamination water containers, spray bottles, Alconox, and deionized water containers) should be available during sampling so that all appropriate accessory equipment can be decontaminated in the field. Place used decontamination solutions in the purged well water containers and manage as investigation-derived waste. Refer to SOP Equipment Decontamination Procedures.

5.1.3 Field Equipment Calibration

Before going into the field, the Field Team Leader or designee should verify that field instruments are operating properly and that there are no obvious defects that could prevent proper operation. Calibrate all instruments before obtaining field data. Minimize field sampling time or data quality lost because of malfunctioning equipment through proper preventative maintenance, planning and by using adequate backup equipment, as necessary. Collect field measurements per the site-specific work plan and QAPP. Field measurements may include temperature, pH, turbidity, specific conductance, dissolved oxygen, temperature, and oxidation-reduction potential (ORP). Refer to SOP Field Water Quality Measurements and Calibration.

5.1.4 Equipment Selection

Obtaining a representative sample is greatly dependant on the methodology and technology used to obtain the sample. Four methods for well sampling are addressed in this SOP, including the no-purge method, the low-flow method, the well-volume method, and low permeability formation method. Each method uses different sampling technology and equipment, as necessary to accommodate the appropriate well installation and construction, drilling and sampling methods (such as conventional or direct push system methods) employed, and project objectives. However, most sampling methods require physically withdrawing water from the aquifer by pumping or bailing.

The use of positive displacement pumps is highly encouraged to obtain the best sample and geochemical parameter data. These types of pumps include bladder, gear, and piston pumps. Bladder pumps are the simplest of these pumps (which makes them easiest to decontaminate) and have diameters as small as 0.625 inch, which can sample 3/4-inch inside diameter (ID) or greater wells. Submersible pumps are acceptable for most analytes; however, take care to select the proper submersible pump for the estimated sample depth so that the pump does not become overheated and alter the well chemistry.

For PFAS sampling, avoid using pumps, packers, transducers, tubing, liners, valves and wiring with polytetrafluoroethylene (PTFE), fluorinated ethylene propylene (FEP), ethylene tetrafluoroethylene (ETFE); Vitron; Niskin; GoFlo; Teflon; Teflon check balls; O-rings; compression fittings; and impellers.

Peristaltic pumps are generally not recommended for purging and sampling for the following analyses because of potential loss of the volatile fraction related to negative pressure gradients: VOCs, SVOCs, dissolved oxygen (DO), oxidation reduction potential (ORP), CO2, pH, and dissolved iron. If the depth to water is less than approximately 25 to 27 feet below ground surface (bgs), the monitoring well has low recovery, the sampled analyses do not include VOCs and SVOCs, and/or the well or direct push system method sample point is constructed such that no other pumping method is feasible or practical, peristaltic pumps may be used.

5.2 Pump Setup

Groundwater sample pumping equipment is setup slightly different depending on the method of sampling and the types of equipment employed. Different types of pumps have different requirements; therefore, pumping equipment should be set up according to the manufacture's recommendations. However, there are general similarities in equipment set up no matter what type of pump is used.

5.2.1 Bladder and Submersible Pumps

- Connect the pump to the sample intake-discharge tubing. Connect either the air pressure tubing (bladder pumps) or the pump power control cable (submersible pumps) to the pump. Tightly secure the tubing to the pump with one or two zip-tie fasteners. If the well is very deep, connect a separate deployment cable or line to the pump.

- Slowly and carefully lower the pump with tubing (and cable) into the well to the desired well depth. Lower the pump with the deployment cable (if used) or the most secure and largest diameter tubing or cable attached.

- Secure the pump and tubing to the top of the casing by the deployment cable (if used) or the most secure and largest diameter tubing or cable attached. Use with multiple zip-tie fasteners or a spring clamp if the pump is relatively light and the well is shallow.

- Connect the opposite end of the air pressure tubing or the pump power control cable to the pump controller. Both bladder and submersible pumps have some kind of pump controller.

- Clamp the other end of the sample intake-discharge tubing to the purge bucket in a way that discharging purge water will flow into the bucket.

- Connect the pump controller to either an air compressor (bladder pump) or directly to a generator (submersible pump) using a compressed air hose or extension power cord as appropriate.

- If a bladder pump and air compressor are used, connect the compressor to the generator using an extension power cord.

- Place the generator downwind of the sampling area a significant distance away (~20 feet or more). If a bladder pump is used, the generator should not be operating while a sample is being collected.

- Make sure that the generator supplying power to the pump is sufficiently fueled before purging and sampling to avoid power loss.

- In lieu of using a generator, obtain power from the field vehicle power supply (i.e., cigarette lighter). Be sure that the field vehicle is located downwind of the sample collection site.

5.2.2 Peristaltic Pumps

- Connect an appropriate length of sample intake tubing to one end of an approximately 8- to 12-inch piece of silicone tubing. Connect the other end of the silicone tubing to a 3- to 4-foot piece of pump discharge tubing. Try and minimize the length of sample tubing whenever possible to reduce sample turbulence and aeration during pumping.

- Slowly and carefully lower the sample intake tubing into the well to the desired sample intake depth.

- Secure the sample intake tubing to the top of the casing using multiple zip-tie fasteners or a spring clamp.

- Insert the 8- to 12-inch silicone tubing section into the peristaltic pump head and lock the tubing within the pump head.

- Clamp the other end of the discharge tubing to the purge bucket in a way that discharging purge water will flow into the bucket.

- Connect the peristaltic pump directly to the generator (or battery if available) using an extension power cord.

- Place the generator downwind of the sampling area a significant distance away (~20 feet or more). If a battery is available, it should used while a sample is being collected.

- Make sure that the generator supplying power to the pump is sufficiently fueled before purging and sampling to avoid power loss.

- In lieu of using a generator or battery, obtain power from the field vehicle power supply (i.e., cigarette lighter). Be sure that the field vehicle is located downwind of the sample collection site.

5.3 Well Purging

Most groundwater methods (except no-purge sampling methods) require purging of the well before groundwater sampling. The purpose of well purging is to remove stagnant water from the well and obtain a water sample representative of the aquifer being sampled with a minimum of disturbance to the water column. Using the low-flow or the well-volume approach methodology, purge the well until three well casing volumes are purged, or until the well is purged dry. Do not collect a representative groundwater sample until the groundwater level has recovered at least 90%. Containerize purge water and manage as investigation derived waste.

5.4 Well Stabilization

Well stabilization is typically conducted to help verify that the groundwater sample is representative of aquifer conditions. A well is considered 'stabilized' after the groundwater stabilization parameter measurements are within acceptable limits for three consecutive readings. The stabilization parameters should be monitored at a frequency of five minute intervals or greater unless there are other project requirements. The pump's flow rate must be able to 'turn over' at least one flow-through cell volume between measurements (e.g., flow rate = 50 mL/min, flow-through cell = 250 mL, monitor every five minutes; every 10 minutes with a 500 mL flow-through cell). Well stabilization parameters may vary by project or regulatory agency, but at a minimum typically include pH, specific conductance (temperature corrected electrical conductivity), oxidation-reduction potential (ORP), turbidity, and dissolved oxygen (DO). Temperature should also be measured and recorded, but will not be used to determine stability. Turbidity and DO usually require the longest time for stabilization.

Most wells should stabilize within two hours. Prior to going on-site, review previous low-flow groundwater sampling logs from the site (if available) and discuss with the project or task manager what should be done if wells take longer than two hours to stabilize (e.g., collect a pair of filtered/unfiltered samples for metals analysis when turbidity > 5 NTU). Initially, the field technician should verify that the field equipment is functioning properly and that operator error is not an issue. If the checks produce no new insight, one of three optional courses of action may be taken: 1) continue purging until stabilization is achieved, 2) discontinue purging, do not collect any samples, and record in the field log data sheets or field notebook and in the Field Sampling Report that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), or 3) discontinue purging, collect samples and clearly document in the field log data sheets or field notebook and in the Field Sampling Report that stabilization was not achieved.

5.5 Preparation for Groundwater Sampling

The following procedures should be performed at each well in preparation for groundwater sampling:

- Wear PPE and take any other precautions as specified in the site-specific HASP and work plan.
- Monitor the ambient air and any vapors within or near a well while opening the well and during sampling according to SOP Organic Vapor Monitoring and Air Monitoring. Check the area around the well for organic vapors (background reading) using a photoionization detector (PID). Open the well cap and check for organic vapors in the well casing and breathing zone.
- Inspect the condition any permanent monitoring wells for any unusual site or well conditions. Record the condition of the well monument, concrete well pad, protective posts (if present), or other well condition around the well on the Groundwater Services Field Log. Any deficiencies encountered should be reported to the Project Manager as soon as possible.

- Measure the depth of the static water level and the total well depth with a water level (or oil-water indicator probe if contamination is suspected) to the nearest 0.01 foot from the measurement reference point on the well casing pipe Record information on the Groundwater Services Field Log. Refer to SOP Measuring Water levels, Immiscible layers, and total depth in wells.

- If previous total well depth information is available from either well construction or previous sampling events, compare the current total well depth with the previously measured total well depth and note any differences greater than 0.5 foot on the Groundwater Services Field Log.

5.6 Groundwater Sampling Procedures

5.6.1 No-Purge Sampling

No-purge groundwater sampling is a method for obtaining representative groundwater samples under natural flow conditions without purging the well beforehand. This procedure is directed primarily at monitoring wells that have a screen, or an open interval of 10 feet or less. This method may be appropriate for wells that are unconfined and screened through the water table, do not contain a non-aqueous phase liquid, and have been previously sampled using conventional sampling techniques to provide data for comparison.

Advantages to this method include that less time is needed for sampling and elimination of purge water management and disposal costs. Samples obtained using this procedure are also suitable for the analysis of groundwater contaminants such as PFAS, VOCs, SVOCs, herbicides, pesticides, PCBs, metals, and naturally occurring compounds. Disadvantages include potentially low-biased results for volatile and redox-sensitive parameters if groundwater is stagnant in the well and in contact with air.

No-purge groundwater sampling can be conducted using either bailers or pumps and is commonly used for direct push system groundwater sampling. No-purge groundwater sampling is expected when using a direct push screen point sampler and is potentially used during sampling of direct push system well points. No-purge groundwater sampling should be conducted as follows using bailers and pumps:

No-Purge Method with a Bailer

- Measure the water level within the well using a water level meter and record readings on the Groundwater Services Field Log.
- Securely connect a bottom-filling bailer to a retrieval line or cord. The bailer line and any leader used that comes in contact with the water should be constructed of HDPE or new silicon cord. Fit reusable bailers with a new bailer line for each well sampled; the bailer and line may be handled only by personnel wearing clean disposable gloves. Prevent the new bailing line from contacting the outside of the well, equipment, and clothing before or during sampling.
- Very slowly, lower the bailer down the well and below the water table, taking care to not disturb the water column or stir up sediment in the bottom of the well as the bailer fills with water from the bottom.
- Obtain samples as close as possible to the water table, unless analysis indicates that contamination is at a different depth.
- Lift the bailer slowly and transfer, with minimum disturbance and agitation, approximately 1 to 2 pints of water into a decontaminated sample cell. If applicable, measure the pH, temperature, conductivity, DO, ORP, and turbidity, and record readings on the Groundwater Services Field Log.
- Slowly transfer the remaining water in the bailer into analytical sample containers with a minimum of disturbance and agitation to prevent loss of volatile compounds.

No-Purge Method with a Pump

- Measure an initial water level within the well using a water level meter and record on the Groundwater Services Field Log.
- Set up the sampling equipment and pump according to the manufacturer's instructions.

- Very slowly, lower the pump or pump intake tubing down the well to the desired sample intake depth.

- Start the pump on the lowest setting. Adjust the flow slowly until water begins to discharge. Continue pumping and begin low-flow sampling.

- First fill approximately 1 to 2 pints of water into a decontaminated sample cell; if applicable, measure the pH, temperature, conductivity, DO, ORP, and turbidity, and record readings on the Groundwater Services Field Log.

- Next, slowly fill the required analytical sample containers with a groundwater sample, taking care to minimize disturbance and agitation of the sample and prevent loss of volatile compounds.

5.6.2 Low-flow Sampling

Low-flow sampling is a method of collecting samples from a well that does not require purging large volumes of water from the well and relies on natural flow of formation water through the well. Using this method, the water flowing into and through the well is representative of the groundwater within the formation surrounding the screen and thus representative groundwater samples can be obtained by slowly pumping.

"Low flow" refers to the velocity with which water enters the pump intake and is imparted during pumping to the formation pore water adjacent to the well screen. Low-flow does not necessarily refer to the flow rate of water discharged by a pump at the surface, which can be affected by valves, connections, and discharge tubing restrictions. However, typical low-flow surface discharge rates should be limited to less than 0.5 liters per minute (L/min) (0.13 gal/min). Low-flow sampling methods emphasize minimal stress to the groundwater by low water-level drawdown and low pumping rates in order to collect samples with minimal alterations to water chemistry This is the preferred method for natural attenuation monitoring, which requires careful measurements of DO and oxidation-reduction sensitive analytes, such as iron and manganese. Low-flow sampling is the most recommended sampling method for collecting groundwater samples and should be used whenever possible and practical, including at conventional, permanent wells, micro-wells, and at direct push system well points if possible. Wells with low recharge rates may require special pumps capable of very-low-flow rates, such as bladder or peristaltic pumps. If the well is dewatered during purging, then it should be sampled as discussed below for low-permeability formations.

Low-flow sampling is typically conducted using positive displacement pumps, submersible pumps, or peristaltic pumps. Low-flow groundwater sampling should be conducted as follows:

Setup

- Measure an initial water level within the well using a water level meter and record on the Groundwater Services Field Log.
- Set up the sampling equipment and pump apparatus.
- Connect a short discharge tube to the effluent connector at the top of the flow-through cell and run the other end of the discharge tube into a 5-gallon graduated purge water discharge bucket.
- Very slowly lower the pump or pump intake tubing down the well to the desired sample intake depth (preferably within the screened interval).
- Run the aboveground end of the intake tube from the pump directly into the 5-gallon purge water bucket.

Purging

- Turn on the pump and start to pump on the lowest setting. Adjust the flow slowly until water begins to discharge. Slowly pump until the purge water begins to visually clear up. A continuous effort should be made to keep air bubbles and significant air volume to a minimum.
- Continue pumping and begin low-flow purging the monitoring well at a flow rate of approximately 1 liter (0.25 gallons) every 3 minutes or 0.1 gal/min, such that the pumping rate does not lower the water level more than 0.3 foot. Initially monitor the drawdown frequently, to establish a steady pumping rate that

minimizes drawdown. If the minimal drawdown exceeds 0.3 foot, but remains stable, continue purging.

- Purge the water into a 5-gallon graduated purge water discharge bucket. Observe the purge rate and cumulative total discharge volume based on the graduated marks on the purge bucket. Empty the purge bucket into an investigation derived waste drum.

- Groundwater parameter measurements should be monitored and recorded on the Groundwater Services Field Log.

- Following purging, sampling may begin once the well has stabilized.

- Collect groundwater samples without altering the flow rate or extensively interrupting the flow. While sampling, discharge any groundwater pumped between filling sample containers in a 5-gallon groundwater purge bucket. Dispose of this water along with other purge water accumulated.

- Begin filling the laboratory-supplied analytical sample containers in the order of volatility as previously described in Section 3.0. Fill the analytical sample containers as discussed in Section 5.6 until complete.

- Record the sample ID, date and time, sampler, analytes, and other sample information on the sample bottle labels, the sample chain-of-custody, and on the Groundwater Services Field Log.

5.6.3 Well-Volume Approach

The well-volume approach method is based on purging three to six well volumes before sampling. This method can be conducted with either a bailer or pump. This method is also the default method used during low-flow sampling if groundwater parameter stabilization cannot be achieved.

Well-volume approach sampling should be conducted as follows:

- Measure the water level within well using a water level meter. Record the depth to water on the Groundwater Services Field Log.

- Securely connect a bottom-filling bailer to a retrieval line or cord or setup the sampling equipment and pump according to the manufacturer's instructions.
- Very slowly lower the bailer, pump, or pump intake tubing to the desired sample intake depth.
- Begin bailing or pumping the well, starting at low rate and then increasing the flow.
- If applicable, routinely measure and record the DO, ORP, conductivity, pH, turbidity, temperature, and current groundwater level throughout the purge and record on the Groundwater Services Field Log.
- After three to six well casing volumes have been purged, if applicable, record the final parameter measurements, final water level, total purge volume, and any other purge observations on the Groundwater Services Field Log.
- Begin filling the laboratory-supplied analytical sample containers in the order of volatility as previously described in Section 3.0. Fill the analytical sample containers as discussed in Section 5.6 until complete. Water should be transferred to the sample containers with minimum of disturbance and agitation.
- Record the sample ID, date and time, sampler, analytes, and other sample information on the sample bottle labels, the sample chain-of-custody, and on the Groundwater Services Field Log.

5.6.4 Low-Permeability Formations

If a well is screened in a low permeability zone (such as silts and clay layers), natural recharge flow into the well may be so low that there may be no way to avoid pumping or bailing the well dry. Low-flow purging and sampling are particularly useful for wells that purge dry or take 1 hour or longer to recharge. If a well is purged dry, a minimum of two hours between purging and sampling should be observed and groundwater samples should not be collected until the well has recharged to approximately 90% of its pre-purge volume. For this method, a bailer may be used, since many sampling pumps have tubing capacities that would exceed the water volume in the well and cause it to be pumped dry again. A very-low-flow device, such as a peristaltic pump, can also be used if the groundwater depth is less than approximately 25 feet.

The following procedures apply for purging low-permeability formations, where it is not possible to obtain stabilization of field parameter data:

- Purge the well dry and allow the well to recover until at least one of the following is met:
  - A minimum of 2 hours has elapsed since purging.
  - There is sufficient water volume present to obtain a water sample.
  - The water in the well has recovered to 80% of the pre-pumping elevation.
- Begin filling the laboratory-supplied analytical sample containers in the order of volatility as previously described in Section 3.0. Fill the analytical sample containers as discussed in Section 5.7 until complete. Water should be transferred to the sample containers with minimum of disturbance and agitation.
- Record the sample ID, date and time, sampler, analytes, and other sample information on the sample bottle labels, the sample chain-of-custody, and on the Groundwater Services Field Log.

5.7 Sampling Collection

Groundwater samples should be collected as follows:

- Fill sample containers so that the sample is allowed to flow gently along the inside wall of the container. Take care to minimize turbulence, agitation, and aeration of the sample.
- Minimize the headspace in the sample container by filling the sample jar until a positive meniscus is present.
- Quickly and adequately seal the containers.
- Clean rims before tightening lids.

- Record the sample ID, date and time, sampler, analytes, and other sample information on the sample bottle labels, the sample chain-of-custody, and on the Groundwater Services Field Log.

- Preserve containers. At a minimum, immediately cool the samples to 4±2°C and maintain this temperature through delivery to laboratory until the samples are analyzed.

6.0 RECORDS

Record details regarding the pumping method, parameter readings, purge volumes, and samples collected on the Groundwater Services Field Log.

C.T. MALE ASSOCIATES ENGINEERING,
SURVEYING, ARCHITECTURE &
LANDSCAPE ARCHITECTURE, D.P.C

STANDARD OPERATING PROCEDURE
#9

MEASURING STATIC WATER LEVEL, IMMISCIBLE LAYERS (DNAPL and LNAPL), and TOTAL WELL DEPTH IN WATER

Revision 0

January26, 2018

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

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SOP: MEASURING STATIC WATER LEVEL, IMMISCIBLE LAYERS (DNAPL and LNAPL), and TOTAL WELL DEPTH IN WATER

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the procedure for measuring static water level, light non-aqueous phase liquid (LNAPL) level, dense non-aqueous phase liquid (DNAPL) level, and total well depth in a groundwater well.

2.0 SCOPE

This SOP applies to all C.T. Male Associates personnel and subcontractors engaged in measuring static water level, light non-aqueous phase liquid (LNAPL) level, dense non-aqueous phase liquid (DNAPL) level, and total well depth in a groundwater well. This SOP focuses on the measuring static water level tasks and should be used in conjunction with other applicable project SOPs, including the following:

- SOP: Note Taking and Field Logs.
- SOP: Organic Vapor Monitoring and Air Monitoring.
- SOP: Equipment Decontamination Procedures.

3.0 RESPONSIBILITIES

3.1 Project Manager

The Project Manager will develop the site specific scope of work based upon the needs of the project. These work plans can include a site specific work plan, Health and Safety plan, community air monitoring plan, field sampling plan, and a QAPP.

3.2 Field Team Leader

The Field Team Leader will develop site specific or direct the water level measuring procedures to be used and direct field technicians in the proper procedures in the SOPs. The Field Team Leader shall know the requirements for water level measurements, measuring immiscible layers, and total well depth and maintain adequate documentation of the sampling process.

3.3 Field Technician

Experienced Field Technicians are responsible for the proper measurement and documentation of water levels, immiscible (does not dissolve in water) layers (DNAPL and LNAPL), and total water depth. They are also responsible for maintaining the equipment in working order and aid in troubleshooting equipment issues.

3.4 Health & Safety Officer

The Health & Safety Officer oversees site-specific health, safety, and environment (HS&E) protocols and overall compliance with project HS&E requirements. The Health and Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the Project-specific Health and Safety Plan (HASP), coordinates with the Project Manager and Field Manager to certify the PPE, and conducts project health and safety audits to evaluate the effectiveness of the HS&E program.

3.5 Site Safety and Health Officer

The role of Site Safety and Health Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.0 EQUIPMENT, REAGENTS, and SUPPLIES

The following items are applicable to this SOP:

- Electronic water level indicator
- Personnel protective equipment
- Oil/water interface probe

5.0 PROCEDURE

This section below describes the procedures and equipment used for measuring static water level, light non-aqueous phase liquid (LNAPL) level, dense non-aqueous phase liquid (DNAPL) level, product thickness, and total well depth in a groundwater well.

5.1 Calibration

The electronic water level indicator and oil/water interface probe will be tested prior to use to ensure they are functioning properly. Instruments that are not properly functioning should be tagged for inspection by the Field Team Leader or sent to the manufacturer for repair. AA or 9V batteries are normally used for a power source; spare batteries should be kept on hand.

5.2 Measurements

The water level, total depth, and immiscible layers are measured prior to well purging or sampling. For new wells, measurements should not be taken until the water table has stabilized—preferably 24 hours after well installation and/or development. Decontaminate reusable equipment per CT Male's SOP 'Equipment Decontamination Procedures'.

5.2.1 Water Level

Groundwater levels are usually measured at all wells on the same day and before purging any wells. Typically, the water level is measured with an electronic water level indicator probe that is lowered into the well. An oil/water interface probe may also be used if oil layers may be encountered (see section below). The electronic water level indicator consists of a spool of marked cable, a probe attached to the end, and an indicator. When the probe comes in contact with the water, the circuit is closed, and a meter light and/or tone signals the contact.

To ensure consistent results, groundwater level measurements are made in reference to an established point (e.g., top of well casing, top of riser pipe). Water level measurements are made from the high side of the riser pipe or well casing unless otherwise specified. If the top of the riser is apparently level, take the readings at the north side of the riser. The depth to water is indicated by the markings on the cable. Read the water level directly off of the tape. The groundwater level should be measured three times consecutively (without completely winding up the water level indicator probe) to help ensure accuracy. Record the water level to the nearest 0.01 foot on the appropriate field sheets.

5.2.2 Total Well Depth

Determine the total well depth by lowering the water level indicator probe (or equivalent) into the well. After feeling the bottom of the well, raise and lower the water level indicator probe three times to ensure the bottom is being felt. Record the total well depth to the nearest 0.01 foot on the appropriate field sheets.

5.2.3 Immiscible Layer Thickness – Oil/Water Interface Probe

An immiscible layer may consist of LNAPL or DNAPL. LNAPL has a specific gravity less than water and is typically at the water surface of a well. DNAPL has a specific gravity greater than water and tends to accumulate at the bottom of a well. An oil/water interface probe is used to measure the layer and consists of a flat measuring tape with a probe attached to the end, an indicator, and a grounding mechanism. After grounding the instrument to a metal source (well casing), determine the product thickness by slowly lowering the probe into the well.

5.2.3.1 LNAPL

If LNAPL (floating product) is present, a steady tone will activate. If there is no floating product, an intermittent tone will activate indicating the air/water interface (water level). Raise and lower the probe gently to clear product from the conductivity sensor and to determine the exact upper level of the floating product. The air/product level should be measured three times consecutively (without completely winding up the product level interface probe) to help ensure accuracy. Read the level of the air/product interface from the measuring tape and record to the nearest 0.01 foot.

Continue lowering the probe through the product until the original signal changes to an intermittent tone. This signals the contact of the water level. Raise and lower the probe gently to clear product from the conductivity sensor and to determine the exact lower level of the floating product. The product/water interface should be measured three times consecutively (without completely winding up the product level interface probe) to help ensure accuracy. Read the level of the product/water interface from the measuring tape and record to the nearest 0.01 foot.

5.2.3.2 DNAPL

If there isn't any LNAPL, an intermittent tone will activate when the water level is reached. Continue lowering the probe until a steady tone is activated indicating the upper level of the product layer. Raise and lower the probe gently to clear product from the conductivity sensor and to determine the exact upper level of the product. The water/product level contact should be measured three times consecutively (without completely winding up the product level indicator probe) to help ensure accuracy. Read the level of the water/product interface from the measuring tape and record to the nearest 0.01 foot.

Continue lowering the probe through the product until coming into contact with the bottom of the well. Raise and lower the probe gently to ensure the bottom is being felt. The bottom of the well should be measured three times consecutively (without completely winding up the product level interface probe) to help ensure accuracy. Read the depth to the bottom of the well from the measuring tape and record to the nearest 0.01 foot.

5.3 Data Reduction/Calculations

The water column in the well is calculated by subtracting the measured water level from the total well depth.

The difference in the LNAPL upper level and the LNAPL lower level is the LNAPL thickness. The difference in the DNAPL upper level and the bottom of well is the DNAPL thickness.

5.4 Disposal

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations and CT Male's SOP 'Investigative Derived Waste'. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

6.0 RECORDS

The field technician(s) will document the water level, total depth, or product level measurements on the water level data sheet and the field log data sheet for each well, if required.

Examples of common field documentation are available in CT Male's "Note taking and Field Logs". Field documentation specific to this SOP are listed below:

- Field Sampling Report
- Field Log Data Sheet
- Water Level Data Sheet

Other CT Male SOP subjects referenced within this SOP: field water quality measurements and groundwater sampling.

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STANDARD OPERATING PROCEDURE
#10
FIELD WATER QUALITY MEASUREMENTS and CALIBRATION

Revision 0

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice

Initials		**Date**	
Initials		**Date**	

SOP: FIELD WATER QUALITY MEASUREMENTS and CALIBRATION

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe general methods for calibrating, maintaining, and operating water quality meters and probes used for groundwater sampling. This technical procedure provides general guidelines; however, the manufacturer's manual describing calibration and standard operating procedures for each field instrument should be referred to for complete calibration and operating instructions

2.0 SCOPE

This SOP applies to all C.T. Male, sub consultants and subcontractors engaged in ground water sampling activities. Other applicable project SOPs, including the following:

- SOP #1: Note Taking and Field Logs.
- SOP #3: Organic Vapor Monitoring and Air Monitoring.
- SOP #8: Groundwater Sampling.
- SOP #7: Equipment Decontamination Procedures.
- SOP #11: Collection of Quality Control Samples.
- SOP #12: Documentation on a Chain-of-Custody.
- SOP #13: Domestic Transport of Samples to Laboratories in USA.

3.0 GENERAL

Water quality meters are typically used in the field to measure the following parameters:

- Dissolved oxygen (DO)
- Oxidation-reduction potential (ORP)

- Conductivity
- pH
- Turbidity
- Temperature

Instructions for maintenance and operation of all these field instruments are described in the operation manuals provided by the manufacturer.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager verifies that monitoring well and piezometer installation procedures comply with this SOP and the requirements of the enforcing agencies. Alternate installation requirements and procedures required by local agencies or other modifications must be documented and approved by the Project Manager.

4.2 Health & Safety Officer

The Health & Safety Officer oversees site-specific health, safety, and environment (HS&E) protocols and overall compliance with project HS&E requirements. The Health and Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the Project-specific Health and Safety Plan (HASP), coordinates with the Project Manager and Field Manager to certify the PPE, and conducts project health and safety audits to evaluate the effectiveness of the HS&E program.

4.3 Site Safety and Health Officer

The role of Site Safety and Health Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Team Leader

The Field Team Leader will know how to use the field instruments and conduct the daily instrument calibrations. They will also maintain adequate documentation of the calibration process and measurements taken while using the instruments.

5.0 PROCEDURES

The following sections describe typical materials, equipment, and procedures for soil vapor probe installation and soil vapor sampling.

5.1 Instruments and Supplies

Water quality meters and instruments vary in their manufacturer and model number. Below is a list of commonly used meters and instruments, and other related supplies that can be used for field water quality measurements:

- YSI 556 MPS Multi-parameter Instrument
- YSI 650 MDS Multi-parameter datalogger
- YSI 6-Series sonde or similar multiparameter probe
- YSI 5083 Flow Cell or similar flow-thru cell
- Hach 2100P Portable Turbidimeter
- Data transfer connector cables
- Discharge hoses (two)
- Fittings to attach sample tubing to flow through cell (barbs and master flex pump tubing, PFAS free)
- Distilled water
- Calibration solutions and buffers (ORP, conductance, pH, and turbidity)

5.2 Calibration

Calibrate all instruments for all field parameters daily before collecting water quality data, according to the manufacturer calibration specifications developed for the instrument being calibrated. In addition, if there are anomalous readings during sample collection, stop sample collection and re-calibrate, if possible. Document field calibration in the Field Logs. Section 5.2.4 has a table of calibration acceptance limits for DO, pH, conductivity, and ORP.

If a field instrument will not calibrate, perform troubleshooting as described in the manufacturer's manual. Check that the calibration standards have not expired. If the issue cannot be resolved, use a backup instrument. If one is not available, consult with the Project Manager on whether data collection should continue and on any other corrective actions to be taken. Flag any data recorded from a meter with calibration problems on the Groundwater Purge and Sampling Field Datasheet, and other appropriate Field Logs.

5.2.1 pH Calibration (2-point or 3-point calibration)

Calibrate all instruments recording pH daily, using at minimum a 2-point calibration method. A 2-point calibration uses only two pH buffer calibration solutions (typically pH 7 and pH 10) and is valuable only if the water being monitored is known to be either basic or acidic. If the pH is known to vary between 5.5 and 7, a 2-point calibration with a pH 7 and pH 4 buffer solutions is recommended. When starting the calibration process, calibrate with buffer pH 7 first regardless if performing a 2 or 3 point calibration.

Follow the recommended manufacturer pH calibration instructions for additional detailed instruction for the instrument being used. Enter all pH calibration values based on the appropriate temperature as labeled on the pH calibration solutions used. Record the final pH calibration reading, with the corresponding temperature, in the Field Logs.

If the pH of water being measured is unknown, a 3-point calibration method is preferred. Using this calibration, the pH sensor is calibrated with a pH 7 buffer and two additional buffers (such as pH 4 and pH 10). The 3-point calibration method accounts for the full pH range and assures maximum accuracy when the pH of the media to be monitored cannot be anticipated. Typically, the procedure for a 3-point calibration is the same as for a 2-point calibration, but the instrument may prompt you to select a third pH buffer.

pH Buffer Calibration Check Acceptance limits:

Record the pH millivolts for each calibration point. The acceptable mV outputs for each buffer are shown below. See Table 5.2.4 in Section 5.2.4 for a table of calibration acceptance limits for pH using standard units:

pH 7 mV value = 0 mV +/- 50 mV

pH 4 mV value = +165 to +180 from 7 buffer mV value

pH 10 mV value = -165 to -180 from 7 buffer mV value

- A value of +50 or -50 mVs in buffer 7 does not indicate a bad sensor.
- The mV span between pH 4 and 7 and 7 and 10 mV values should be ≈ 165 to 180 mV. 177 is the ideal distance. The slope can be 55 to 60 mV per pH unit with an ideal of 59 mV per pH unit.
- If the mV span between pH 4 and 7 or 7 and 10 drops below 160, clean the sensor and try to recalibrate.

5.2.2 Conductivity Calibration

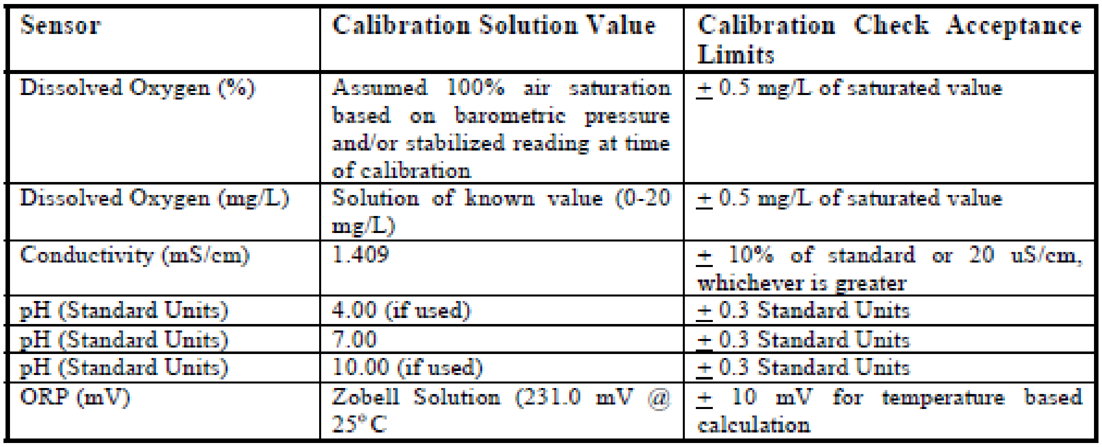
Perform daily calibration for conductivity according to the recommended manufacturer's calibration instructions. Conductivity should be calibrated for Specific Conductance and is typically entered as milliSiemens per centimeter (mS/cm) at 25 degrees Celsius (ºC). Conductivity standard solutions have a specific conductance value such as 1.413 mS/cm or 1.409 mS/cm; which is equivalent to 1413 or 1409 microSiemens per centimeter (µS/cm); and 1413 or 1409 µmho/cm. The meter is calibrated by entering the specific conductance of the solution being monitored and the instrument will calibrate and the instruments screen will indicate if the calibration has been accepted. Record the final conductivity calibration reading, with the corresponding temperature, on the Field Calibration Sheet. See section 5.2.4 for a table of calibration acceptance limits for conductivity.

5.2.3 Calibration Check of the Oxidation Reduction Potential (ORP) Probe

A calibration check of the ORP probe can be performed by placing it into a Zobell™ solution that is within approximately 10°C of the expected groundwater temperature, or as close to groundwater temperature as practical. This is not a calibration solution, but a check that the probe is working properly. Zobell™ solution has a short shelf life, typically lasting only 3 months. If expired, make or obtain new solution before measurement. The Zobell™ reading is dependent upon temperature and should fall within ± 10 mV of the ORP reading shown on the meter. The table with the appropriate temperature and Zobell Solutions Value in mV will be listed in the field instruments operation manual. Record the Zobell™ solution ORP reading on the Field Log. See section 5.2.4 for a table of calibration acceptance limits for OPR probe.

5.2.4 Calibration Check acceptance limits for DO, pH, Conductivity, ORP

Below is a table of calibration acceptance limits for each parameter listed.



Sensor	Calibration Solution Value	Calibration Check Acceptance Limits
Dissolved Oxygen (%)	Assumed 100% air saturation based on barometric pressure and/or stabilized reading at time of calibration	± 0.5 mg/L of saturated value
Dissolved Oxygen (mg/L)	Solution of known value (0-20 mg/L)	± 0.5 mg/L of saturated value
Conductivity (mS/cm)	1.409	± 10% of standard or 20 uS/cm, whichever is greater
pH (Standard Units)	4.00 (if used)	± 0.3 Standard Units
pH (Standard Units)	7.00	± 0.3 Standard Units
pH (Standard Units)	10.00 (if used)	± 0.3 Standard Units
ORP (mV)	Zobell Solution (231.0 mV @ 25°C	± 10 mV for temperature based calculation

5.2.5 Turbidity Calibration (4-point calibration)

Perform routine calibration of the turbidity instrument according to the recommended manufacturer's calibration instructions. Turbidity instruments should be calibrated using a 4-point calibration method; typical calibration standards used are <0.1 NTU, 20 NTU, 100 NTU, and 800 NTU StablCal standard or formazin standard. This 4-point calibration method accounts for turbidity over a wide range from 0 to 1000 NTU.

Record the calibration standard value and the calibrated turbidity value of each calibration point (< 0.1, 20, 100, and 800 NTU) on the Field Calibration Sheet.

5.3 Water Quality Instrument Field Measurement and Usage

The general procedures for measuring groundwater quality parameters and flow-through cell setup are as follows:

1. Before taking any field measurements, calibrate instruments according to the manufacturer's procedures and record the calibration on the Field Calibration Sheet.

2. Perform a saturated air check of the DO probe by placing a wet piece of cloth in the cap that covers the probe. Check the dissolved oxygen reading against the theoretical value of saturated oxygen at different elevations. If the instrument is not reading in the proper range, it should be recalibrated, or the dissolved oxygen probe membrane should be replaced.

3. Secure the multi-meter sonde (or analyte specific probes) to the flow-through cell. Connect a short discharge tube to the effluent connector at the top of the flow-through cell and run the other end of the discharge tube into a 5-gallon purge water capture bucket.

4. Place the tube from the pump directly into the 5-gallon purge water bucket and start to purge (pump) for approximately 1 to 2 minutes or until the purge water begins to visually clear up. The intent is to limit any initially high turbidity water from filling and settling in the flow-through cell.

5. Once the turbidity has stabilized, briefly turn off the pump and secure the tube from the pump to the influent connector at the bottom of the flow-through cell. Turn on the pump again and then allow the flow-through cell to completely fill with water. Effort should be made to keep air bubbles from collecting in the flow-through cell. To remove any collected air from the cell, disconnect the probes from the cell while pumping until all the air escapes and then reconnect the probes.

6. Continue pumping and begin low-flow purging of the monitoring well at a flow rate of approximately 1 liter (0.25 gallons) every 3 minutes or 0.1 gallon per minute (gal/min).

7. Routinely measure and record the DO, ORP, conductivity, pH, turbidity, temperature, and current groundwater level throughout the purge at approximately every 3- to 5-minute interval. A minimum of three of these parameters should be monitored and recorded. Record the purge groundwater parameters on the Field Log.

8. Continue to measure and record the groundwater parameters and current groundwater level until the parameters stabilize according to the following stabilization criteria, or until 3 well casing volumes are purged. Groundwater parameters are considered stable after purging if three successive readings are within:

    - ± 0.5 °C temperature
    - ± 0.1 pH
    - ± 5% conductivity
    - ± 10 millivolt (mV) ORP
    - ± 10% DO or three consecutive readings less than or equal to 0.5 mg/L apart
    - ± 10% turbidity or three consecutive readings ≤ 5 nephelometric turbidity units (NTUs) apart

9. Note the following before and during water quality measurement and groundwater purging:

- Obtain the typical ranges for the water quality parameters at a well (or site) prior to measurement and purging, if possible, and bring these values to the field for reference during sampling. Water quality parameter ranges can often be obtained from historical groundwater purging and sampling events. These previous values should be used as clues to determine if an instrument is reading correctly and/or is drifting during water quality measurement.

- ORP and DO measurements should always correlate with each other. Generally ORP should be negative whenever DO is near or less than 1 milligram per liter(mg/L); likewise, DO should be greater than 1 mg/L if ORP is positive.

- DO measurement should always be positive and range between 0 and 14.62 mg/L.

- ORP measurements should range between -500 mV and 275 mV.

- The pH of environmental samples will typically range from 6 to 8 pH units.

- When measuring turbidity, be sure to clear any moisture or dust off of the turbidity sample cell and emplace the sample cell and light cover completely and securely. Also, be sure to put the turbidity instrument out of direct sunlight (it should be shadowed), or else light interference may provide false readings.

10. When parameters have stabilized, record final measurements and collect samples as specified in SOP Groundwater Sampling Procedures.

5.4 Storage

Perform the following tasks each day upon conclusion of using any water quality measurement instrument:

1. Decontaminate the instrument(s): rinsing with distilled water, a dilute solution of Alconox or Liquinox (or similar), and rinsing with distilled water as specified in SOP Decontamination of Sampling Equipment.

2. Moisten protective caps that are made to protect the tips of probes or sensors with fresh water and replacing them back to their probes or sensors for storage while the instrument is not in use.

3. Recharge or replace batteries on any instruments and meters to verify full battery charge for next use.

4. Store the instrument or meter in the protective case provided with the instrument or meter.

5. Take any additional storage and maintenance steps recommended by the manufacturer as specified in the instruments operations and maintenance manual.

5.5 Service and Maintenance

Perform service and maintenance according to manufacturer's instructions.

6.0 RECORDS

Record all instrument calibration information on a Field Calibration Datasheet or Log. Calibration information that should be recorded into the field log and field book for each instrument calibrated includes the brand and model number, unique identification number, type, lot number, expiration date of any calibration solutions, and results of the calibration. Record all field data collected during groundwater sampling on a Groundwater field logs.

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STANDARD OPERATING PROCEDURE
#11

CHAIN OF CUSTODY PROCEDURES

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: CHAIN OF CUSTODY PROCEDSURES

1.0 PURPOSE

The purpose of this procedure is to describe how to properly document information on a Chain-of- Custody (COC) form. A COC is a legally binding document that identifies sample identification, analyses required, and shows traceable possession of samples from the time they are obtained until they are introduced as evidence in legal proceedings. CT Male Associates (CT Male) personnel will complete the information on the COC at the time he/she collects samples and the COC accompanies the samples during transport to a storage facility or to the laboratory for analysis.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel.

2.0 SCOPE

This procedure applies to all C.T. Male personnel engaged in the collection of samples from several Site media (water, soil, etc.) for laboratory analysis per an accepted New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) or Environmental Protection Agency (EPA) laboratory method.

3.0 GENERAL

As part of this SOP, there are limitations on the COC procedures, and they are as follows:

- The SOP does not apply to sample aliquots that are only collected for field screening purposes.
- The SOP does not apply to samples remaining on-site.

4.0 RESPONSIBILITIES

4.1 Project Manager

Field sampling personnel, in conjunction with the Project Manager are responsible for overall compliance with this technical procedure. The Project Manager, or designee, is responsible for verifying that the data entries made on the COC comply with this SOP.

The Project Manager will also provide copies of COC to the Quality Assurance Officer for general review.

4.2 Site Personnel

Experienced Field Personnel are responsible for the proper sample identification and for accurate and complete documentation on the COC. Site personnel who make COC entries are required to read this procedure before engaging in this activity. The Project Manager, or designee, will inform personnel who will be responsible for COC procedures.

5.0 PROCEDURE

The COC is the most important sampling document; it must be filled out accurately and completely every time a sample is collected. The COC will be supplied by the laboratory that will be performing the analytical analysis on the environmental media (soil, water, drinking water, sediment, etc). Depending on the laboratory, the COC may be available in electronic format that will allow for certain fields on the COC to be filled out ahead of time (e.g., project number, project name, project manager, purchase order number, data validation package, turnaround time, etc.) while other information should be completed when sampling. Complete one COC or more as needed for each set of project samples. The COC should be completed prior to leaving the sampling location.

The laboratory receiving the samples will sign and record when received, the lab work order number, and whether any custody seals were used and if intact.

5.1 Common Chain of Custody Information

Listed below are common fields or information that is listed on the COC, which may or may not be applicable to the sampling media or analytical analysis:

- COC numbered pages (e.g., 1 of 1).
- Report and invoice recipient information.
- Purchase order number or account number (if applicable).
- Project name and number.
- Project Manager name.
- Field Technician (sampler) name.
- Sample Identification (Sample ID).

- Analysis requested.
- Sample collection date and time.
- Sample matrix (COC may have abbreviation codes).
- Sample type – composite or grab.
- Sample Preservation Code or written name.
- Sample filtration (if needed).
- Sample Comments, if any.
- Laboratory name and location.
- Requested due date.
- Turnaround time for analysis.
- Method of analytical delivery – email, hard copy – and to whom.
- Data deliverable information.
- An EDD (electronic data deliverable) format.
- Signature of Field Technician (i.e. sampler) under the first 'relinquished by'.
- Date and time of sample transfers.
- Method of transport (UPS, FedEx, local courier, sampler, etc.).
- Air Bill number (if applicable).

For Air Sampling in SUMMA Canisters, the laboratory may supply a different type of COC that is specific for the collection of air samples. These labs supplied COC typically have different fields that need to be completed, in addition to the ones listed above that area applicable. These fields include, but are not limited to:

- Canister serial number and size or lab identifier.
- Flow controller serial number or lab identifier.
- Initial and final vacuum.
- Stop and start time of air flow.
- PID reading.

5.2 Completing a Chain of Custody Information

The sample collector is responsible for the care and custody of the samples until they are properly transferred or sent to the laboratory. This means that samples are in their possession, under constant observation, or secured. Samples may be secured in a sealed container, locked vehicle, locked room, etc.

All samples leaving the site should be accompanied by a COC record. This record documents sample custody transfer from the sampler, often through another person, to the laboratory. The individuals relinquishing the samples should sign and date the record.

Shipping containers should be sealed and include a tamper indicating seal that will indicate if the container seal has been disturbed. The method of shipment, courier name, or other pertinent information should be listed in the COC record.

The original COC record should accompany the samples. A copy of the record should be retained by the individual or organization relinquishing the samples. Page one (white copy) accompanies the sample shipment to the laboratory; page two (yellow copy) is the Field Technician's copy; and page three (pink copy) is retained by CT Male for filing. In some instances, the yellow copy goes to the lab and the pink copy is retained by the Field Technician. The transmittal of the copies of the COC will be designated by the laboratory providing the analytical service.

The individual receiving the samples should sign and date the record. The condition of the container and the tamper indicating seal should be noted on the COC record. Any problems with the individual samples, such as a broken container, should be noted on the record.

Instructions on how to complete a COC are provided by the laboratory. The CT Male Project Manager will ensure that the field personnel are experienced and have the knowledge to complete the COC prior to sampling activities.

6.0 Document Control - Records

The Field Technicians copy of the COC will be kept in the project files and scanned to C.T. Male Associate's electronic project directory. The Project Manager will be responsible for ensuring that the COC record received by the laboratory is signed and dated by the lab as the receiver of the COC and samples, and note any issues with the samples upon receipt.

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STANDARD OPERATING PROCEDURE
#12

DOMESTIC TRANSPORT OF SAMPLES TO LABORATORIES IN THE USA

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: DOMESTIC TRANSPORT OF SAMPLES TO LABORATORIES in United States of America

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures necessary for personal delivery or shipment of samples from locations within the United States of America and its territories to analytical laboratories located within the United States of America and its territories. This procedure applies to the transportation of ground and surface water, soil, wipe, sediment, paint chip, debris, and air samples to the appropriate laboratory.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 SCOPE

This procedure applies to all C.T. Male personnel engaged in the collection of samples from several Site media (water, soil, etc.) for laboratory analysis.

3.0 GENERAL

As part of this SOP, there are limitations, and they are as follows:

- Maintaining proper sample temperatures (<6°C or ambient air temperature in accordance with the analytical method requirements) and delivering samples to the laboratory within 24 to 48 hours from collection are primary concerns.

- This procedure does not apply to the transportation of ground and surface water, soil, wipe, sediment, paint chip, debris, and air samples to laboratories outside of the United States of America – States and Territories.

4.0 RESPONSIBILITIES

4.1 Project Manager

Field sampling personnel, in conjunction with the Project Manager are responsible for overall compliance with this technical procedure. The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, Sampling Analysis Plan (SAP), etc.).

4.2 Site Personnel

Experienced Field Personnel shall ensure the security, temperature, and packaging of environmental samples during transport and shipment.

4.3 Health & Safety Officer

The Health & Safety Officer is responsible for site-specific HS&E and overall compliance with project HS&E requirements. The Health & Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE for the project, lists the requirements in the project-specific HASP, coordinates with the Field Team Leader to complete the PPE program, and conducts project audits on the effectiveness of the HS&E program.

4.4 Site Specific Health and Safety Officer

The role of Site Specific Health and Safety Officer is designated to the Field Team Leader by the Project Manager and/or Health & Safety Officer, to assist in implementing the project-specific HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the HS&E program, implements the PPE requirements described in the project-specific HASP, and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

5.0 EQUIPMENT, REAGENTS, and SUPPLIES

The following items are applicable to this SOP:

- Rigid Cooler
- Ziplock baggies
- Absorbent padding
- Ice
- Chain of Custody record
- Directional arrow labels may be used to ensure samples remain upright
- Environmental Samples
- Bubble wrap / bubble bags (inner packing material)
- Heavy bag for containing ice and preventing leakage of melted water
- Packing tape

- Shipping papers – if shipped via delivery service

6.0 PROCEDURE

6.1 Packaging of water, soil and sediment samples (requiring chilled preservation per the analytical method of analysis)

6.1.1 Packaging Samples

Place samples in a rigid cooler, pack glass containers in bubble wrap or other cushioning material to avoid breakage. (Note: Bubble-wrap is the preferred packing material.) Methanol sample containers must be placed in a Ziploc® Baggie to meet shipping requirements for preventing leaks. Place samples and cushioning material in strong plastic bag with enough absorption padding to absorb all of the liquid in the packaging. Be sure to zip tie this bag shut.

Add enough ice to maintain a constant temperature at < 6 °C, (but not frozen) until the samples arrive at the laboratory. Package ice in double-lined bags to ensure sample labels will not be compromised, and the cooler(s) will not leak melt water.

Before sealing cooler, fill out the chain-of-custody form completely and include required copies with the samples (see Standard Operating Procedure for Documentation on a Chain-of-Custody).

Adhere two to three strips of packaging tape on the cooler from top to bottom, and adhere an additional strip of tape covering the gap between the lid and sides of cooler to seal the cooler to avoid leakage. Custody Seals must be adhered on the cooler if project quality assurance plan or sampling and analysis plan require them. The custody seal must be adhered to the crack of the lid and the side of the cooler to ensure the cooler lid has not been tampered with in transit. Be sure to attach the courier shipping label to the top of the cooler.

6.1.2 Labeling

A secondary label with the same information should also be attached with packaging tape to the cooler in event that the original label is damaged or destroyed during sample shipment.

When shipping samples preserved with methanol, the cooler must have a Dangerous Goods in Excepted Quantities label (see attachment 4) placed on the outside of the cooler. Be sure to add the number "3" to each label in permanent marker to indicate the hazard class being shipped.

Each cooler shall not exceed 500 mL of Methanol (16 vials, 30 mL of methanol per vial) and each vial shall not have more than 30 mL of methanol to meet the requirements of a dangerous good in excepted quantities. Acid/base preserved samples vials are often 40 mL or larger and do not qualify for excepted quantities.

Directional arrow labels can be attached to the cooler to insure the cooler remains upright during shipping. Directional arrow labels should be attached to the outside of the cooler to keep the cooler in an upright position during sample shipment.

6.2 Packaging of wipe, paint chips, debris, and air samples (requiring ambient air temperature per the analytical method of analysis)

6.2.1 Packaging Samples

Place the samples in a cooler or cardboard box in a manner that will avoid breakage.

Adhere two to three strips of packaging tape from top to bottom on the cooler or box. Fill out the chain- of-custody completely and include required copies with the samples (see Standard Operating Procedure for chain-of-custody record).

Custody Seals must be adhered over the lid if project quality assurance plan or sampling and analysis plan require them. The custody seal must be adhered to the crack of the lid and the side of the cooler or over the flaps of the box to ensure the container remained shut and has not been tampered with in transit.

6.3 Sample Storage

For samples requiring ice as a preservative, the samples will be bubble wrapped, bagged immediately after collection, stored in a sample cooler, packed on double bagged wet ice and accompanied with the proper chain-of-custody documentation. The samples will be kept cold (< 6 °C, but not frozen) until receipt at the laboratory, where they are to be stored in a refrigerated area.

For samples that are stored at ambient air temperature, the samples (wipe, paint chip, debris, and air samples) will be placed in a baggie or shipping carton (i.e. cardboard box) and accompanied with the proper chain-of-custody documentation.

For sample shipments, custody seals shall be present, at minimum; the coolers must be taped shut with two to three straps of packing tape. All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured. The coolers must be delivered to the laboratory via hand or over-night delivery courier in accordance with all Federal, State and Local shipping regulations.

Note: Samples may have to be stored indoors in winter to prevent freezing.

6.4 Shipping Consideration

6.4.1 Shipment / Delivery

Once the cooler is packed to prevent breaking of bottles, the proper chain-of-custody (COC) documentation is signed off, sealed in a plastic bag, and placed in the cooler.

All samples will be kept secured to prevent tampering. If sample coolers are left in a vehicle or field office for temporary storage, the area will be locked and secured.

Custody seals may be present, but at a minimum, the coolers must be taped shut to prevent the lid from opening during shipment.

The coolers must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations and this SOP.

6.4.2 Transport / Delivery Options

Account for samples before shipping and compare to the chain of custody (see Standard Operating Procedure for chain-of-custody record). Ship samples during times when the laboratory will be able to accept and analyze them. Whenever possible, select mode of transport/delivery to ensure delivery to the laboratory will occur with ample EPA recommended holding time remaining for the specified analytical methods required for the samples. Avoid sending samples during holidays and weekends. Federal, State and Local shipping regulations must be met.

Personal Delivery. The samples are delivered to the laboratory by the field technician(s). The chain-of- custody record is signed and dated by the laboratory representative.

Local Courier. The same procedures are followed as above; i.e., the chain-of-custody record is signed and dated and the top copy is sent with the samples. The cooler or box is then secured with packaging tape and a courier is called for pick up of the samples from the Site to the designated laboratory.

Overnight Courier. Follow the procedures above, replacing the local courier service with a courier that provides overnight services (examples Federal Express, United Parcel Service, Speedy Delivery). Date, project number, type of delivery desired, weight, and number of coolers or boxes should be included.

7.0 RECORDS

Examples of common field documentation are available in Barr's "Compendium of Field Documentation". Field documentation specific to this SOP are listed below:

- Chain-of-custody record

Chain-of-custody records are kept at field offices and in the electronic project files at CT Male office. Other SOP subjects referenced within this SOP: Standard Operating Procedure for chain-of-custody record.

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LANDSCAPE ARCHITECTURE & GEOLOGY, D.P.C

STANDARD OPERATING PROCEDURE
#13
SOIL VAPOR SAMPLING

Revision 0

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: SOIL VAPOR SAMPLING

1.0 PURPOSE

This standard operating procedure (SOP) provides technical guidance and describes the general methodology for installing soil vapor and sub-slab vapor probes and collecting soil vapor and sub-slab vapor samples for laboratory analysis by using a SUMMA Canister. Leak testing procedures for active soil vapor sample collection are also described.

2.0 SCOPE

This SOP applies to all C.T. Male, sub consultants and subcontractors engaged in active soil vapor sampling activities. Other applicable project SOPs, including the following:

SOP: Note Taking and Field Logs.

SOP: Drilling and Associated Sampling Methods

SOP: Organic Vapor and Air Monitoring.

SOP: Surface and Subsurface Soil Sampling.

SOP: Equipment Decontamination Procedures.

SOP #11: Chain of Custody Procedures

SOP: Domestic Transport of Samples to Laboratories in the USA.

3.0 GENERAL

There are two basic types of soil vapor surveys typically performed during site assessments. The first type is an active soil vapor survey, where soil vapor is typically pumped into a sample container or directly into an analyzer; if sample results of higher data quality than field screening are desired, the sample containers are shipped to the laboratory for analysis. The second type is the passive soil vapor survey, where absorbent material is buried in the vadose zone so that the contaminant vapor can be selectively absorbed over time (typically over a 1- to 2-week period). Passive soil vapor surveys are often used during site characterization to identify source areas and localized hotspots.

This SOP covers only procedures for obtaining active soil vapor samples with SUMMA Canisters (or similar devices).

Active soil vapor sampling that does not involve direct measurement of samples (by field screening methods) is typically conducted by using SUMMA Canisters. SUMMA Canisters are stainless-steel vessels that have inert inner surfaces to prevent potential reaction with organic contaminants in air. The SUMMA Canisters are pre-cleaned and prepared for sampling by repeated pressurization with humidified air, heat, and evacuation at the laboratory. Vapor samples are typically analyzed by U.S. Environmental Protection Agency Method TO15. New York State Department of Health procedures for collecting soil vapor samples will be followed. Actual analyses are project specific and specified in this work plan.

Active soil vapor samples (also known as integrated samples) can be collected over a 5 minute to 24-hour period by connecting the SUMMA Canister to a flow controller that is pre-calibrated to the sampling time required to fill up the canister.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager verifies that the soil vapor probe installation procedures comply with this SOP and the requirements of the enforcing agencies. Alternate installation requirements and procedures required by local agencies or other modifications must be documented and approved by the Project Manager.

4.2 Health & Safety Officer

The Health & Safety Officer oversees site-specific health, safety, and environment (HS&E) protocols and overall compliance with project HS&E requirements. The Health and Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE, lists the requirements in the Project-specific Health and Safety Plan (HASP), coordinates with the Project Manager and Field Manager to certify the PPE, and conducts project health and safety audits to evaluate the effectiveness of the HS&E program.

4.3 Site Safety and Health Officer

The role of Site Safety and Health Officer is delegated to the Field Team Leader by the Project Manager to assist in implementing the project HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the health and safety program, implements the PPE requirements described in the project HASP and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

4.4 Field Team Leader

The Field Team Leader should know the requirements for soil vapor sampling and should maintain adequate documentation of the sampling process and materials used to demonstrate that the soil vapor probes have been properly installed.

5.0 Procedure

The following sections describe typical materials, equipment, and procedures for soil vapor probe installation and soil vapor sampling.

5.1 Site-specific Considerations

Site-specific conditions to consider for soil vapor surveys include the following:

- Sampling depth: Soil vapor samples should be collected in the vadose zone and above the capillary fringe. Generally, soil vapor samples should not be collected actively at depths above 4 feet below ground surface (bgs) because of the risk of leakage and dilution of the sample with ambient air. Sampling at multiple depths should be considered.

- Soil permeability**:** It might not be feasible to collect soil vapor from tight-grained soil with little pore volume, such as clay. If there are clay layers in the subsurface, these intervals should be avoided. During purging and sampling, the vacuum in the sampling system should never exceed 7 inches of mercury (inches Hg) (100 inches of water). High vacuums can be caused by tight-grain soil, wet soil, or an unreleased expendable probe tip.

- Precipitation: Soil vapor sampling should generally not be performed for 48 hours after a significant precipitation event (more than 1 inch of precipitation).

Soil moisture can displace the soil vapor, dissolve volatile organic compounds, and increase the vacuum during sampling. Generally, at depths greater than 3 feet bgs, soil vapor is unlikely to be affected by precipitation. If soil vapor samples are taken at less than 3 feet bgs, then the percent of moisture in the soil should be measured.

- Seasonal changes: Soil vapor concentrations can vary significantly with fluctuating groundwater table elevation, soil moisture, temperature, and barometric pressure. Consideration should be given to the season and weather conditions during sampling. Multiple sampling events during the annual cycle may be needed to characterize the soil vapor adequately.

- Contaminant types: Some contaminants (such as hydrocarbons) are readily biodegradable. Field measurements of natural bioattenuation field parameters (carbon dioxide [CO2], oxygen [O2], and methane [CH4]) should be considered for sites where biodegradable contaminants are present and natural bioattenuation may be active.

5.2 Equipment, Supplies, and Suppliers

Soil vapor and sub-slab vapor installation and sampling equipment should be verified by the source supplier to be pre-cleaned before use to eliminate the potential for cross contamination. The following list of supplies and equipment may be needed during the course of conducting a soil vapor investigation:

- SUMMA Canister(s) (typically obtained from the analytical laboratory).

- HDPE or stainless-steel tubing for collecting samples from the desired sampling zone.

- Stainless steel soil vapor implants, certified clean silica sand and bentonite for completing semi-permanent subsurface soil vapor probe installations. Appropriate surface completions to protect probes if probes are at risk of being disturbed before sampling.

- Stainless-steel sub-slab probes for sub-slab vapor probe installation. Sub-slab probes can be assembled before field mobilization.

- Bentonite/cement mixture, PFAS free, for sub-slab probe surface seal.
- 1/4-inch Swagelok® nuts and ferrules (or similar), need to be PFAS free, and T-connections for connecting to SUMMA Canisters and leak testing equipment during leak testing.
- Oil-less, low-flow vacuum pump for leak testing, and purging of soil vapor probe lines and annular space.
- Helium detector/meter for leak testing if conducting active sampling.
- MiniRAE or MultiRAE photoionization detector (PID) instrument if field measurements of total volatile organic compounds (VOCs) are necessary.
- GEM™ 2000 Landfill Vapor Monitor if field measurements of CO2, O2, CH4 are necessary.
- Rotometer to measure flow rates during purging and leak testing before sampling.
- Vacuum gauge (0 to 30 inches Hg) (to measure the initial and final vacuum of the canister and to monitor filling rate when collecting an active soil vapor sample).
- Flow controller, supplied by laboratory (required for an active soil vapor sample).
- Generator or battery to run the vacuum pump. If generator is used, check that there is enough extension cord to place generator downwind and away from sampling location.
- Nitrile gloves.
- Camera.
- Flags and flagging.
- Shipping container/storage box for canisters.

- Field Sampling Log and Field Data Collection Forms.

Equipment necessary for soil vapor and sub-slab vapor investigations may be obtained by contacting:

- SUMMA Canister(s) provided by the analytical laboratory.
- After receipt of SUMMA Canisters from the laboratory, the canisters should be inspected for physical deformities and sufficient negative pressure. Canisters with negative pressure readings less than -28 inches Hg are acceptable sampling containers.
- Flow controller for sampling supplied by analytical laboratory.

5.3 Soil Vapor Probe Installation

Soil vapor probes should generally be deployed by using these procedures. Modifications to these procedures might be necessary depending on project objectives.

- Every probe must be at least 5 feet away from any other drilled or pushed location to avoid short circuiting.
- Soil vapor samples should generally not be collected from depths shallower than 4 feet bgs to avoid dilution of samples with ambient air.
- All down hole equipment (for example, soil vapor drive rods and continuous core soil sampling equipment) must be decontaminated before use. After the equipment is decontaminated, the probes must be free of contaminants. At a minimum, a suitably sensitive organic vapor meter (such as a PID) should be used for this purpose. Any probe that does not pass a decontamination inspection should not be used.
- Install temporary post-run tubing (PRT)-style soil vapor probes by using a direct push drill rig to push the PRT to the desired sampling depth, making sure that this depth a couple feet above the highest expected water levels. In limited-access locations, a fencepost hammer potentially can be used to push the PRT to the

desired sampling depth for shallow locations in relatively soft soil. Retract 6 inches to create an annular space for sampling

- Soil samples cannot be collected from the exact same location when installing temporary probes.

- The inner soil vapor pathway from probe tip to the surface should be continuously sealed (for example, with a sampling tube attached to a screw adapter fitted with a seal and connected to the probe tip) to prevent infiltration.

- During sampling of temporary soil vapor probes, hydrated bentonite or some other surface seal may be used around the drive rod at ground surface to prevent ambient air intrusion from occurring.

- Install permanent or semi-permanent soil vapor probes by using a direct push drill rig or a hand auger. Push down to the desired sampling depth, making sure that this depth is approximately 2 feet above the highest expected water levels.

- Install permanent or semi-permanent, stainless-steel soil vapor implants into the borehole.

- The inner soil vapor pathway from the soil vapor implant to the surface should be sealed continuously with tubing to prevent infiltration.

- Backfill with clean silica sand to at least 0.5 foot above the soil vapor probe. Add enough bentonite powder to create a 2 inch ‘dry’ layer followed by hydrated bentonite grout. At least 2 feet of the mixture are recommended to adequately seal the hole and prevent contribution from ambient air during sampling.

- After installation, allow at least 20 minutes for temporary wells and at least 30 minutes for permanent wells for equilibration before purging with leak test followed by sampling.

- Prepare soil vapor probe manifolds. Attach sampling tubing to soil vapor probes by using a 1/4-inch fitting with a ferrule at the surface end of the tubing. Tubing diameter should be small (1/8 or 1/4 inch) to avoid turbulent flow. A few feet of extra tubing coming out of the borehole is necessary to place the SUMMA Canister and stage leak testing equipment at the sampling location.

- Soil vapor sample integrity is verified by using a real time helium leak checking procedure before taking each sample. This leak checking procedure must be done after installation of each probe and before sampling as well as before each subsequent sample collected from permanent probes. Follow leak testing and SUMMA Canister deployment procedures outlined below. Low-flow purge rates, between 100 and 200 milliliters per minute, should be used during purging to limit stripping, creation of preferential pathways, and dilution with ambient air.

- If an adequate seal cannot be obtained an additional soil vapor probe should be installed in a new borehole and the leak test conducted again. Unless the leak test is passed, the SUMMA Canisters should not be deployed.

- Soil samples can be collected from ground surface down to the desired soil vapor sampling depth when drilling a borehole for installation of semi-permanent soil vapor probes. Soil sample collection beyond the soil sample probe depth in the same borehole is not recommended because of the risk for leakage of soil vapor from deeper in the borehole. If soil samples are to be collected at greater depths, a separate soil boring can be drilled a minimum of 5 feet away from the soil vapor probe. The soil boring should be sealed with grout or hydrated bentonite chips to avoid leakage of ambient air to the soil vapor probe.

5.4 Sub-slab Vapor Probe Installation

Sub-slab vapor probes generally should be deployed following these procedures, though alterations to these procedures may be necessary depending on project objectives:

- Drill through the sub-slab by using a hammer drill. First, drill a 7/8-inch- or 1-inch-diameter hole to a depth of 1 3/4 inches (measured to the center of the hole) to allow room for installing the probe nut and probe union.

- Remove the cuttings and dust from the hole by using a vacuum cleaner (shop-vac type with HEPA filter). Be careful not to compromise the integrity of the slab during drilling (for example, cracking it), although note if this occurs. It is important that the slab and the probe hole remain airtight for sampling and that cracks are noted.

- Drill a 5/16-inch- or 3/8-inch-diameter hole through the remainder of the slab and approximately 3 inches down into the sub-slab material by using the hammer drill.

- Clean out the drilled hole by using the vacuum cleaner with HEPA filter (equipped with a micro tip).

- Remove concrete dust from the drilled hole with a vacuum cleaner or Shop-Vac® with HEPA filter.

- Construct sub-slab vapor probes of appropriate length and install in the sub-slab hole.

- Seal around probe with clay or bentonite/cement. Allow 10 minutes for clay or 24 hours for bentonite/cement to dry.

- Sample integrity is verified by using a real time helium leak checking procedure before taking each sample. This leak checking procedure must be done after installation of each probe and before sampling. Follow leak testing and SUMMA Canister deployment procedures as outlined in this SOP.

- If the leak test fails, fortify the probe seal by adding more sealing material, and repeat the purge and leak check procedure.

- If an adequate seal cannot be obtained, an additional sub-slab probe should be installed and the leak test conducted again. Unless the leak test is passed, the SUMMA Canisters should not be deployed.

5.5 Purging and Leak Testing before Active Soil Vapor or Sub-Slab Vapor Sampling

The dead volume is determined as the sum of the internal volume of the sample tubing and the annual space at the end of the probe tip. Purging of three dead volumes is necessary to remove ambient air before sampling.

Leak testing is necessary to determine if the soil vapor probe or sub-slab vapor probe will provide a discrete sample from the desired sampling depth (as opposed to obtaining an air sample from the ground surface above the borehole or sub-slab where it was installed). This may be caused by short circuiting around the soil vapor probe tubing or by cracks in the surrounding formation or slab.

5.6 Active Soil Vapor and Sub-Slab Vapor Sample Collection

An active sample should be collected by using a flow controller for a period from 30 minutes to 24 hours. A gauge is used to record the initial and final vacuum and to monitor the vacuum as the canister fills. Final vacuum, canister number, and flow controller number are to be recorded on the sample tag, chain-of-custody form, and CT Male field form.

Active sampling results provide data that indicate the average concentration present in soil vapor, which is useful for determining exposure hazards. Soil vapor samples will be analyzed for parameters determined in the work plan. The general field sampling procedures for sampling are as follows:

- The SUMMA Canisters are certified clean and evacuated by the laboratory to near absolute zero pressure. Care should be used at all times to prevent inadvertent loss of canister vacuum.

- Never open canister valves unless collecting a sample or checking canister pressure.

- Check the initial vacuum of the canister with the “vacuum gauge” provided by opening the canister valve; record the vacuum reading on the sample tag attached to the canister.

- Place the SUMMA Canisters in a relatively secure location, away from vehicle traffic or other sources of vapor or fumes unrelated to the sampling objective.

- Connect the flow controller and pressure gauge to the SUMMA Canister. The flow controller should be set to closed (no flow) position.

- Attach the flow controller by using a 1/4-inch female fitting to the inlet of the canister (which is a 1/4-inch male fitting); tighten the threaded nut until it is hand tight. Do not cross the threads.

- Use a wrench to completely tighten the flow controller to the canister inlet.

- After tightening, the flow controller should not be able to be turned on the top of the canister by hand.

- To start sampling, turn the canister valve clockwise, one and one-half to two turns. Note the start time on the sample tag attached to the canister.

- The flow controller is preset for sample collection at the desired sampling rate. No field adjustments are possible.

- Record the sampling date, time, canister identification (ID), flow controller ID, and any other observation pertinent to the sampling event on the Field Sampling Log.

- After sampling for the appropriate amount of time (see site specific work plan), close the sample valve and the canister valve. After closing the valves, remove the flow controller from the canister, replace the dust cap, and package all equipment in the box in which they were received.

- The final pressure should be close to 1 and 3 inches Hg (nearly atmospheric pressure).

- If the canister is at atmospheric pressure when the field final pressure check is performed, the sampling period will be uncertain; this information should be noted in the Field Sampling Log; also record the time of day.

- Attach an identification tag to the canister. The canister serial number, sample number, sampling location, and sample completion date and time are recorded on the tag (the start date and time were already recorded).

- Record the final vacuum measurement, canister number, and flow controller number on the laboratory chain-of-custody form.

6.0 RECORDS

All field measurements will be recorded in the Field Sampling Log. Field measurements should include the coordinates of the sampling location, sample probe depth, initial and final canister pressure, sample collection start and end time, serial numbers of sample canisters and flow meters, and information on any other equipment used. In addition, if active soil gas sampling is conducted, leak testing parameters will be recorded on the field log. PID readings will be recorded at sampling locations where total VOC measurements are necessary. Other field parameters (such as CO2, O2, and CH4) will be recorded at sampling locations where bioattenuation may be significant.

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STANDARD OPERATING PROCEDURE
#14

COLLECTION OF QUALITY CONTROL SAMPLES

December 28, 2017

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: COLLECTION OF QUALITY CONTROL SAMPLES

1.0 PURPOSE

The purpose of this standard operating procedure is to describe the procedures used in the collection and handling of field quality control (QC) samples: field blanks, equipment blanks, trip blanks, field (masked) duplicate samples, matrix spikes and matrix spike duplicate samples.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel.

2.0 SCOPE

This procedure applies to all C.T. Male personnel engaged in the collection of samples from several Site media (water, soil, etc.) for laboratory analysis per an accepted New York State Department of Environmental Conservation (NYSDEC) Analytical Services Protocol (ASP) or Environmental Protection Agency (EPA) laboratory method.

3.0 GENERAL

As part of this SOP, there are limitations, and they are as follows:

- Laboratory specific QC samples (e.g., method blanks, laboratory control samples) are not discussed within this SOP.

4.0 RESPONSIBILITIES

4.1 Project Manager

Field sampling personnel, in conjunction with the Project Manager are responsible for overall compliance with this technical procedure. The Project Manager, in conjunction with the client, develops the site specific scope of work (e.g., Work Plan, Sampling Analysis Plan (SAP), etc.).

4.2 Site Personnel

Experienced Field Personnel are responsible for the accurate collection of QC samples and the laboratory is responsible for the accurate set-up and analysis of QC samples. Project staff are responsible for ordering sample containers prior to the sampling event.

4.3 Health & Safety Officer

The Health & Safety Officer is responsible for site-specific HS&E and overall compliance with project HS&E requirements. The Health & Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE for the project, lists the requirements in the project-specific HASP, coordinates with the Field Team Leader to complete the PPE program, and conducts project audits on the effectiveness of the HS&E program.

4.4 Site Specific Health and Safety Officer

The role of Site Specific Health and Safety Officer is designated to the Field Team Leader by the Project Manager and/or Health & Safety Officer, to assist in implementing the project-specific HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the HS&E program, implements the PPE requirements described in the project-specific HASP, and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

5.0 EQUIPMENT, REAGENTS, and SUPPLIES

The following items are applicable to this SOP:

- Laboratory certified containers appropriate for the required analysis
- Chemical resistant gloves (e.g. nitrile)
- Sample labels
- Matrix specific sampling devices and equipment
- Sample containers / media
- Analyte free water

6.0 PROCEDURE

This section provides the definitions and sampling procedure(s) for QC samples.

6.1 Calibration

Calibration is not applicable to this SOP.

6.2 Sampling

General considerations to be taken into account when planning and conducting sampling operations are the required sample amount, sample holding times, sample handling, and special precautions for trace contaminant sampling. Matrix specific sampling SOPs should be followed for the collection and preservation of samples. The QC samples will be handled in the same manner as the sample group for which they are intended (i.e. stored and transported with the sample group).

6.2.1 Field Blank

Field blank samples are prepared on-site and are a sample of analyte-free water exposed to environmental conditions at the sampling site by transfer from one vessel to another. It measures field and laboratory sources of contamination. Generally, blanks are collected for each parameter of interest.

6.2.2 Equipment Blank (Rinsate Blank)

Equipment blank (or rinsate blank) samples are prepared on-site by pouring analyte-free water through decontaminated sample collection equipment (e.g., bailer or pump, hand-trowel, etc.) and collecting the "rinsate" in the appropriate sample container. If collecting a blank for dissolved metals or dissolved organic carbon, the rinsate will be filtered before adding to the sample container. In addition to the field sources of contamination that may be introduced in the transferring of samples to one vessel to another, an equipment blank also tests the potential cross contamination from incomplete decontamination. Generally, blanks are collected for each parameter of interest.

6.2.3 Trip Blank

Trip blank samples are used when sampling volatile organic compounds (VOC) only. Analyte-free water is used for water samples and methanol (or other applicable sample preservative) is used for soil samples. They are prepared or provided by the laboratory along with the VOC sampling containers prior to a sampling event. Trip blank sample containers are not to be opened in the field and accompany the VOC samples during collection, storage, and transport to the analytical laboratory. There must be one set of trip blank samples per sample cooler containing VOC samples from the Site. The trip blanks should be listed on the chain-of-custody (COC) along with the samples and the analysis required. The purpose of the trip blank sample is to determine the extent of potential contamination introduced during sample transport and handling.

6.2.4 Field (Masked) Duplicate

Field (masked) duplicate samples are two aliquots of a sample collected at the same time using the same procedures, equipment, and types of containers as the required samples. The samples are collected by rotating sampling containers from the original/source sample to the field duplicate sample (using the same exact methods for both). The field duplicate sample is identified with an alias (e.g., M-1 or FD) on the sample container label and on the COC to avoid alerting laboratories to the source of the sample duplicated. The time collected should be omitted on this sample also. Analyses of field duplicate samples are the same as the required samples and give a measure of the precision associated with sample collection, preservation, and storage, as well as laboratory procedures. Field duplicate samples are submitted to the laboratory for the same analyses as the original/source sample.

6.2.5 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

Matrix Spikes (MS) and Matrix Spike Duplicate (MSD) samples are two aliquots of a sample to which known quantities of analytes are added (spiked) in the laboratory. The MS and MSD are prepared and analyzed exactly like their native/source sample aliquot. For some analyses, it is required that three separate sample aliquots are collected in the field for each analysis. One aliquot is analyzed to determine the concentrations in the native/source sample, a second sample aliquot serves as the MS and the third sample aliquot serves as the MSD. The purpose of the MS and MSD is to quantify the bias and precision caused by the sample matrix.

7.0 Quality Control and Quality Assurance (QA/QC)

The QC activities described below allow the self-verification of the quality and consistency of the work.

7.1 QA/QC Samples

The frequency of QC samples is generally one field blank/equipment blank/field duplicate/MS/MSD per twenty samples; however, specific project requirements may require alternative sampling frequencies.

7.2 Measurement Criteria

Criteria are defined in project specific documentation.

8.0 RECORDS

The field technician will document the type and number of QC samples collected during each sampling event on a COC and in a project dedicated field logbook or on field log data sheets.

Examples of common field documentation are available in SOP Field Notes. Field documentation specific to this SOP are listed below:

- Field Log Data Sheet
- COC
- Sample label
- Custody seal (if applicable)

Field documentation and COC will be kept electronically in the project files.

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STANDARD OPERATING PROCEDURE
#15

SAMPLING AND DISPOSAL OF INVESTIGATIVE DERIVED WASTE

January 5, 2018

Print Technical Reviewer Signature Date

Print QA Manager Signature Date

Review of the SOP has been preformed and the SOP still reflects the current practice			
Initials		**Date**	
Initials		**Date**	

SOP: SAMPLING and DISPOSAL OF INVESTIGATIVE DERVIED WASTE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to define the procedures for the sampling and disposal of investigative derived waste (IDW) generated during field investigation activities. This procedure is applicable to sampling IDW which are materials containing pollutants derived during investigation activities including drill cuttings, drilling fluids, cleaning liquids, waste water, DNAPL, soil and rock samples, protective clothing and equipment, or any other items or materials which are exposed to, or may contain pollutants that must be characterized for off-site disposal.

The recommended procedures in this SOP should be followed unless conditions make it impractical or inappropriate to do so. Modifications should be noted in the applicable documentation and communicated to appropriate personnel. Significant changes may result in a revision or newly created SOP.

2.0 SCOPE

This procedure applies to all C.T. Male personnel engaged in field sampling activities at a Site.

3.0 GENERAL

As part of this SOP, there are limitations, and they are as follows:

- IDW can be contaminated with various hazardous substances, characterization may be necessary.

4.0 RESPONSIBILITIES

4.1 Project Manager

The Project Manager is responsible for determining whether any solid or liquid-phase product, or other waste generated during the field activities needs to be containerized for off-site disposal in accordance with State and Federal regulations.

4.2 Field Services Supervisor

The Field Services Supervisor shall ensure the IDW is properly stored and labeled during site activities and storage as needed prior to disposal. They will also ensure the IDW is sampled and characterized prior to disposal. They will also supervise the proper transportation and disposal of the IDW to ensure it is being done in accordance with State and Federal regulations.

4.3 Field Site Personnel

Experienced Field Personnel shall ensure the security, temperature, and packaging of environmental samples during transport and shipment.

4.4 Health & Safety Officer

The Health & Safety Officer is responsible for site-specific HS&E and overall compliance with project HS&E requirements. The Health & Safety Officer conducts personal protective equipment (PPE) evaluations, selects the appropriate PPE for the project, lists the requirements in the project-specific HASP, coordinates with the Field Team Leader to complete the PPE program, and conducts project audits on the effectiveness of the HS&E program.

4.5 Site Specific Health and Safety Officer

The role of Site Specific Health and Safety Officer is designated to the Field Team Leader by the Project Manager and/or Health & Safety Officer, to assist in implementing the project-specific HASP. The Project Manager and/or Health & Safety Officer assists the Field Team Leader with the HS&E program, implements the PPE requirements described in the project-specific HASP, and receives input from project staff that the assigned PPE requirements and on-going HS&E procedures are effective.

5.0 EQUIPMENT, REAGENTS, and SUPPLIES

The following items are applicable to this SOP:

- Applicable sampling equipment
- Weatherproof container labels
- Plastic garbage bags
- IDW containers
- Permanent markers
- Plastic covering

- Shipping papers or manifests – if shipped via delivery service

6.0 PROCEDURE

The CT Male Project Manager is responsible for determining if IDW can be left on-site or if it must be disposed of off-site. The project manager shall review NYSDEC DER-10 on IDW guidelines in determining the proper disposal of the IDW for the site conditions. Two general objectives that will be considered when managing IDW are the minimization of IDW generation and managing the IDW consistent with the final remedy for the site. The extent to which the objectives can be met is dependent on the site-specific circumstances.

Any IDW that is required to be containerized will be containerized separately by media until laboratory data are received to determine the appropriate disposition of the materials. Containerization and disposal of personal protective equipment and/or other materials, if necessary, will be determined on a project by project basis and discussed in the project work plan and Field Sampling Plan (FAP).

6.1 Sampling

Representative samples will be collected, preserved, and handled following CT Male's sampling procedures as outlined in other SOPs. Sampling equipment will be cleaned following CT Male's 'Equipment Decontamination Procedures' SOP.

The samples must be delivered to the laboratory via hand or overnight delivery courier in accordance with all Federal, State and Local transportation regulations and CT Male's 'Domestic Transport of Samples to the Laboratory' SOP.

6.2 DISPOSAL

Waste generated by this process will be disposed of in accordance with Federal, State and Local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for environmental pollution.

7.0 RECORDS

Field personnel will document the IDW sampling event on the field log data sheet and/or field notebook. They will also document the type and number of bottles on the chain-of-custody record, as appropriate. The analysis for each container and the laboratory used will be documented on the chain-of- custody record. Refer to CT Male's SOP 'Chain-of-Custody (COC) procedures' for further information.

The field documents and COCs are provided to CT Male's project manager and data management personnel for storage on the internal CT Male network.

Other CT Male SOP subjects referenced within this SOP: collection of samples, collection of QC samples, equipment decontamination, domestic transport of samples, and documentation on a COC.

APPENDIX B

QUALITY ASSURANCE PROJECT PLAN

December 2018
Revised February 2019

Quality Assurance Project Plan

Hamilton Hill II – Target Area 1 Site
830 & 834 Albany Street
City of Schenectady
Schenectady County, New York
BCP Site #C447052

Prepared for:

HAMILTON HILL II LIMITED PARTNERSHIP
90 State Street, Suite 602
Albany, New York 12207

Prepared by:

C.T. MALE ASSOCIATES
50 Century Hill Drive
Latham, New York 12110
(518) 786-7400
FAX (518) 786-7299

C.T. Male Associates Project No: 16.6334

QUALITY ASSURANCE PROJECT PLAN
HAMILTON HILL II – TARGET AREA 1 SITE
CITY OF SCHENECTDAY, SCHENECTADY COUNTY

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TABLES

ATTACHMENTS

ACRONYM LIST

ARARs – Applicable or relevant and appropriate requirements
COC – Chain-of-custody
DQO – Data quality objective
HASP – Health & Safety Plan
LCS – Laboratory control sample
MDL – Method detection limit
MS – Matrix spike
NYSDEC – New York State Department of Environmental Conservation
PCB – Polychlorinated biphenyl
PARCCS– Precision, accuracy, representativeness, completeness, comparability, and sensitivity
PFAS – Per- and polyfluoroalkyl substances
PT – Proficiency testing
QA – Quality assurance
QAM – Quality Assurance Manual
QAPP – Quality Assurance Project Plan
QC – Quality control
RPD – Relative percent difference
SVOC – Semi-volatile organic compound
SOP – Standard operating procedure
TAL – Target Analyte List
TCL – Target Compound List
UFP – Uniform Federal Policy
USEPA – United States Environmental Protection Agency
VOC – Volatile organic compound
WWTP – Wastewater Treatment Plant

1.0 INTRODUCTION

C.T. Male Associates Engineering, Surveying, Architecture, Landscape Architecture & Geology, D.P.C. (C.T. Male) has prepared this Quality Assurance Project Plan (QAPP) for the Remedial Investigation (RI) to be conducted at the Hamilton Hill II – Target Area 1 Site (BCP Site #C447052) located at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York (the "Site"). The QAPP was prepared in accordance with the United States Environmental Protection Agency (USEPA) Intergovernmental Data Quality Task Force's environmental requirements as specified in the Uniform Federal Policy (UFP) QAPP guidance document Part 2A Revised (March 2012) and addresses QAPP elements described in *EPA Requirements for Quality Assurance Project Plans, EPA QA/R-5* and *EPA Guidance for Quality Assurance Project Plans, EPA QA/G-5*.

This project-specific QAPP provides the details of the organizations and the project management, objectives, data acquisition, data assessment, oversight and data review procedures associated with the project Site. Protocols for sample collection, handling, storage, chain-of-custody (COC), laboratory and/or field analyses, data evaluation and validation, and reporting are addressed. Some project details are included in the RI work plan. Field activities performed under this QAPP will be conducted in accordance with the applicable Field Sampling Plan (FSP) and the Site-Specific Health & Safety Plan (HASP).

1.1 Site History and Background

The Site is located at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York. The Site occupies the southwest and southeast corners of the intersection of Albany Street and Craig Street. The Site is comprised of vacant lots and dilapidated multi-family residential and commercial buildings. Surrounding property usage is mixed use residential and commercial.

Recent environmental investigations of the Site concluded that fill/soil and groundwater at the Site are impacted by compounds and analytes exceeding regulatory standards and guidance values. These compounds and analytes included volatile organic compounds, semi-volatile organic compounds and metals.

2.0 QAPP WORKSHEET #1 & 2 – TITLE AND APPROVAL PAGE

1. **Project Identifying Information**
    a. **Site name/project name:** Hamilton Hill II – Target Area 1 Site
    b. **Site location/number:** 830 & 834 Albany Street, City of Schenectady, Schenectady County, New York / NYSDEC Site ID No. C447052.
2. **Lead Organization**
    a. **Lead Organization:** Hamilton Hill II Limited Partnership
        i. **Project Manager (name/title/signature/date):**

        Jennica Huff, Senior Project Manager
3. **State Regulatory Agency:** New York State Department of Environmental Conservation (NYSDEC)
        i. **Project Manager (name/title/signature/date):**

        Joshua Haugh, Project Manager - NYSDEC
4. **Other Stakeholders (as needed)**
    a. **Consulting Engineers:** C.T. Male Associates
        i. **Project Principal (name/title/signature/date):**

        Daniel Reilly, P.E. / Environmental Services Manager

        ii. **Project Manager and Health & Safety Manager (name/title/signature/date):**

        3-5-2019

        Kirk Moline P.G. / Project Manager

        iii. **Quality Assurance (QA) Manager (name/title/signature/date):**

        3/5/19

        Nancy Garry, P.E. / Sr. Environmental Engineer

3.0 QAPP WORKSHEET #3 & 5 – PROJECT ORGANIZATIONAL AND QAPP DISTRIBUTION

This section identifies the reporting relationships between organizations involved in the project, including the lead organization and contractors and subcontractor organizations. It also includes recipients of controlled copies of the QAPP. The organizational chart in Attachment A identifies pertinent personnel, contractors and subcontractors who are responsible for document control within their organizations. Site-specific work plans may identify other personnel in similar roles.

4.0 QAPP WORKSHEET #4, 7 & 8 – PERSONNEL QUALIFICATIONS AND SIGN-OFF SHEET

This section identifies project personnel associated with each organization, contractor, and subcontractor participating in responsible roles. This includes the project manager, QA Manager, project contacts for organizations involved in the project, the project health & safety manager, field operation personnel, and the analytical services provider. This worksheet also lists individuals' project titles or roles; qualifications; and any specialized/non-routine training, certifications, or clearances required by the project. Signatures indicate personnel have read and understand how to implement this QAPP as written and that the QAPP will be kept on-file at each organization.

ORGANIZATION: C.T. Male Associates (C.T. Male)

Name	Title/Role	Education/Experience	Specialized Training/ Certifications	Signature/Date
Daniel Reilly, P.E.	Project Principal	See resumé included in Attachment B.	See resumé included in Attachment B.	3-5-19
Kirk Moline, P.G.	Project Manager, Health & Safety Manager	See resumé included in Attachment B.	See resumé included in Attachment B.	3-5-2019
Nancy Garry, P.E.	QA Manager	See resumé included in Attachment B.	See resumé included in Attachment B.	3/5/19

ORGANIZATION: Alpha Analytical, Inc. of Westborough, Massachusetts (Alpha).

Name	Title/Role	Specialized Training/ Certifications	Signature/Date
Candace Fox	Project Manager	Training as required by laboratory QA Manual	DocuSigned by: Candace Fox 12/12/2018 260814E82982413...
Jim Todaro	QA Manager	Training as required by laboratory QA Manual	12-10-18

5.0 QAPP WORKSHEET #6 – COMMUNICATION PATHWAYS

Communication pathways for this project are shown below.

Communication Driver	Organization	Name	Contact Information	Procedure (Timing, pathway, etc.)
Regulatory Agency Interface	NYSDEC	Joshua Haugh	Office (O): 518-357-2008 joshua.haugh@dec.ny.gov	C.T. Male will contact Hamilton Hill II Limited Partnership and the regulatory agency (NYSDEC) via email if issues with the implementation of this QAPP occur impacting data quality, when comments to the submittals occur, and when new field sampling plans are identified for implementation.
	C.T. Male	Kirk Moline	O: 518-786-7400 k.moline@ctmale.com	
	Hamilton Hill II Limited Partnership	Jennica Huff	O: 518-432-9817 jpetrik-huff@tcbinc.org	
Laboratory Problems/ Corrective Actions	C.T. Male	Nancy Garry	O: 518-786-7541 n.garry@ctmale.com	C.T. Male's QA Manager will be the contact for the laboratories should the laboratories experience issues with project samples. EDS will contact the laboratories if issues are discovered from data validation.
	Environmental Data Services, Inc. (EDS)	Nancy Weaver	O: 757-564-0090 nweaver@env-data.com	
	Alpha	Candace Fox	O: 716-427-5223 cfox@alphalab.com	
Field Problems/ Corrective Actions	C.T. Male	Kirk Moline	O: 518-786-7502 k.moline@ctmale.com	C.T. Male field staff will contact the C.T. Male Project Manager to discuss difficulties encountered during field activities. C.T. Male's Project Manager will coordinate with their QA Manager, as needed and appropriate.

Communication Driver	**Organization**	**Name**	**Contact Information**	**Procedure (Timing, pathway, etc.)**
Safety Issues	C.T. Male	Kirk Moline	O: 518-786-7502 k.moline@ctmale.com	C.T. Male field staff will contact the C.T. Male Project Manager/Health & Safety Manager and work may stop until safety issues are cleared. NYSDEC may be contacted if safety issues delay obtaining/reporting of data.
Field Activity Modifications	NYSDEC	Joshua Haugh	Office (O): 518-357-2008 joshua.haugh@dec.ny.gov	Hamilton Hill II Limited Partnership and C.T. Male will propose modifications to current sampling program via periodic updates or otherwise as needed. Reduction of testing parameters or frequencies will be performed in consultation with and approval from NYSDEC.
	C.T. Male	Kirk Moline	O: 518-786-7400 k.moline@ctmale.com	
	Hamilton Hill II Limited Partnership	Jennica Huff	O: 518-432-9817 jpetrik-huff@tcbinc.org	

6.0 QAPP WORKSHEET #9 – PROJECT SCOPING SESSION PARTICIPANTS SHEET

As noted in the introduction, investigation activities will be conducted in accordance with a RI Work Plan that has been approved by the NYSDEC. The sampling and analysis activities implemented as part of additional investigations or studies will follow the protocols set forth in this QAPP. Additionally, this QAPP will be updated as needed based on the planned sampling and analysis activities.

7.0 QAPP WORKSHEET #10 – SITE MODEL

The Site was accepted into the BCP (Site #C447052) pursuant to contaminants in fill/soil and groundwater at concentrations exceeding regulatory standards and guidance values for the intended use of the Site.

Parameters that will be analyzed to evaluate the environmental quality of the Site's media include per- and polyfluoroalkyl substances (PFAS), 1,4-dioxane, the Target Compound List (TCL) of volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs), the Target Analyte List (TAL) of metals (including mercury and hexavalent chromium), and cyanide. The laboratory performing the analytical services is depicted in Table 1, which includes the laboratory's address and the list of parameters that the laboratory will perform.

The sample type, laboratory analysis, sampling method and sampling rationale for the samples collected during the RI are summarized in the site-specific work plans.

The proposed sampling activities are summarized below and are described in more detail in the RI Work Plan and FSP.

- Advancement of boreholes to collect subsurface fill/soil samples for visual and/or olfactory evidence of contamination and laboratory analysis, to install monitoring wells, and for installation of soil vapor sampling points.
- Development of monitoring wells. Purging and collection of groundwater samples for laboratory analysis from the monitoring wells.
- Collection of soil vapor samples.
- Collection of quality control field samples for laboratory analysis.
- Collection of equipment rinse blank samples.
- Collection of investigation-derived waste samples for laboratory analysis.

8.0 QAPP WORKSHEET #11 – PROJECT/DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) are qualitative and quantitative statements that clearly state the objective of a proposed project, define the most appropriate type of data to collect, determine the appropriate conditions for data collection, and specify acceptable decision error limits that establish the quantity and quality of data needed for decision making.

DQOs for measurements during this project will be addressed in terms of the data quality indicators: precision, accuracy, representativeness, completeness, comparability, and sensitivity (PARCCS). The numerical PARCCS parameters will be determined from the project DQOs to ensure that they are met. The DQOs and resulting PARCCS parameters will require that the sampling be performed using standard methods with properly operated and calibrated equipment, and conducted by trained personnel and are summarized in Worksheet #12.

9.0 QAPP WORKSHEET #12 – MEASUREMENT PERFORMANCE CRITERIA TABLE

This worksheet displays the data quality indicator, QC activity, matrix, and measurement performance criteria for both the sampling and analytical measurement systems.

Data Quality Indicator	QC sample or measurement performance activity	Matrix	Measurement Performance Criteria
Precision (field)	Field duplicate samples	Water, soil and soil vapor	Values > 5x RL; RPD ≤ 30%
Precision (laboratory)	Laboratory duplicate samples	As required by the method	Values > RL; method-specific (See Table 2)
Overall accuracy/bias (field and laboratory) /representativeness	Field, equipment, rinsate blanks	Water and soil	No target analyte concentrations ≥ RL
	Laboratory Trip blanks	Water (volatile organics and PFAS)	
Overall accuracy/bias (laboratory)	Method blanks	Water, soil and soil vapor	No target analyte concentrations ≥ RL
Analytical accuracy/bias/precision (laboratory)	Laboratory control samples (LCS) and LCS duplicates	Water and soil	Water and soil - analyte-specific (See Table 2)
Analytical accuracy/bias/precision (laboratory)	Matrix Spikes (MS) and MS duplicates	Water and soil	Analyte-specific (See Table 2)
Analytical accuracy/bias (laboratory)	Surrogate recoveries	Water and soil	Analyte-specific (See Table 2)
Sensitivity	Samples reported to method detection limit (MDL)	All	Analyte-specific (See Table 2)
Completeness	See Worksheet #34	All	See Worksheet #34

10.0 QAPP WORKSHEET #13 – SECONDARY DATA USES AND LIMITATIONS TABLE

Secondary data and information that will be used for the project and their originating sources are identified. Analytical data obtained prior to this QAPP is presented.

Data type	**Source**	**Data uses relative to current project**	**Factors affecting the reliability of data and limitations on data use**
Surface soil sampling and Phase II Environmental Site Assessments conducted in 2016, 2017 and 2018	C. T. Male	Data used to determine if the Site's media (fill/soil and groundwater) was impacted above regulatory standards and guidance values for the Site's intended use.	Limitations on analytical data for groundwater due to possible matrix interference and sampling procedures. The analytical data did not undergo independent third-part data validation.

11.0 QAPP WORKSHEET #14 & 16 – PROJECT TASKS & SCHEDULE TABLE

Listed are the project activities as well as the QA assessments that will be performed during the course of the project.

Activities	**Organization**	**Dates**		**Deliverable(s)**	**Anticipated Deliverable Due Date**
		Anticipated Date(s) of Initiation	**Anticipated Date of Completion**		
Advancement of test borings for sample collection and installation of monitoring wells and soil vapor probes.	C.T. Male	March 2019	March 2019	Field reports and sample results	March 2019
Collecting fill/soil, groundwater and soil vapor samples	C. T. Male	March 2019	March 2019	Field reports and sample results	March 2019
Chemical analysis	Alpha	March/April 2019	March/April 2019	Laboratory reports	April 2019
Data evaluation / validation	EDS	After receipt of data reports	April 2019	Validation Report	April 2019
Summarizing data	C.T. Male	After receipt of data reports	April 2019	Analytical Data Tables	April 2019
RI report	C.T. Male	After receipt and review of relevant data reports	April 2019	RI Report	April 2019

12.0 QAPP WORKSHEET #15 – PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

Analytical data quality objectives are used to ensure that the analysis will accurately and adequately identify the contaminants of concern. The applicable or relevant and appropriate requirements (ARARs) are related to defining satisfactory cleanup efforts. To be able to evaluate the data generated with respect to potential ARARs, the samples will be reported to the MDL. The analytical methods selected for this project are designed to achieve ARAR values. The laboratory limits for specific parameters are included in Table 2A for soil, Table 2B for groundwater and Table 2C for soil vapor.

13.0 QAPP WORKSHEET #17 – SAMPLING DESIGN AND RATIONALE

The design and rationale of the sampling program is outlined in Worksheet #10 and will be specified in the RI Work Plan.

14.0 QAPP WORKSHEET #18 – SAMPLING LOCATIONS AND METHODS

The RI Work Plan and Field Sampling Plan (FSP) will provide specific detail regarding the individual sample locations and methods.

15.0 QAPP WORKSHEET #19 & 30 – SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES TABLE

Sample Parameters, Matrix, Containers, Preservation, Hold Times per Analytical Group

Analytical Group	Matrix	Containers (number, size & type per sample)(1)	Preservation	Preparation/ Analytical Holding Time(2)
PFAS	Water	250 mL HDPE	Cool ≤6°C, Trizma (drinking water only)	14 days (water) until extraction; analysis within 28 days of extraction
	Soil	250 mL HDPE	Cool ≤6°C	28 days (soil, sedminet, wipe, other) until extraction; analysis within 28 days of extraction
TCL VOCs	Water	3-40 mL glass VOA vials	HCl to pH<2, cool ≤6°C, no headspace	14 days. Unpreserved samples - 7 days
	Soil	40 mL VOA vial or coring device kit	1:1 solvent or zero headspace, cool ≤6°C. Additional unpreserved for %moisture if solvent collection	48 hours from sample collection to preservation; 14 days
TCL SVOCs	Water	2-1000 mL amber glass	Cool ≤6°C	7 days until extraction/analysis within 40 days of extraction
	Soil	8 oz glass jar	Cool ≤6°C	14 days until extraction/analysis within 40 days of extraction
TCL Pesticides	Water	2-1000 mL amber glass	Cool ≤6°C	7 days until extraction/analysis within 40 days of extraction
	Soil	8 oz. glass jar	Cool ≤6°C	14 days until extraction/analysis within 40 days of extraction
TCL PCBs	Water	2-1000 mL amber glass	Cool ≤6°C	1 year until extraction / analysis within 40 days of extraction
	Soil	8 oz. glass jar / each analysis	Cool ≤6°C	1 year until extraction / analysis within 40 days of extraction
TAL Metals (Excluding Mercury	Water	500 ml plastic	HNO_3 to pH <2 Cool, 4°C	180 days to analysis
	Soil	8 oz. glass jar	Cool ≤6°C	
Mercury	Water	500 ml plastic	HNO_3 to pH <2 Cool, 4°C	28 days to analysis
	Soil	8 oz. glass jar	Cool ≤6°C	

Analytical Group	**Matrix**	**Containers (number, size & type per sample)(1)**	**Preservation**	**Preparation/ Analytical Holding Time(2)**
Cyanide	Water	250 ml plastic	NaOH	14 days to analysis
	Soil	8 oz. glass jar	Cool ≤6ºC	
Soil Vapor	Vapor	Pre-cleaned passivated stainless steel SUMMA canisters	Ambient temperature; near atmospheric pressure	14 days from collection

(1) Container types and sizes listed are for guidance only. Laboratories may use different containers or combine analyses into larger volume containers.

(2) Holding time starts from date of collection unless otherwise noted.

Note: Laboratory standard operating procedures (SOPs) are retained at each laboratory's place of business and are available upon request for review.

16.0 QAPP WORKSHEET #20 – FIELD QUALITY CONTROL SUMMARY

The site-specific work plans may provide additional detail on the sample type, parameter, frequency, and sampling methods of field QC samples. Internal laboratory quality control checks will be those specified in EPA Methods or in the most recent NYSDEC ASP for the analytical method performed.

The laboratory will be responsible for performing what is necessary for complying with appropriate standards and certifications of the selected EPA method and NYSDEC ASP requirements. The laboratory quality control acceptance criterion is method specific and will be the laboratory's responsibility to meet the most recent NYSDEC ASP criteria.

At a minimum the following field quality control samples will be collected.

Matrix	**Analytical Group**	**No. of Field Duplicate Pairs**	**No. of MS/MSD**	**No. of Laboratory Field Blanks**	**No. of Laboratory Trip Blanks**	**No. of Equip. Blanks**
Soil	All analytical groups	1 per 20 samples	1 per 20 samples	None	None	1 per 20 samples
Groundwater	All analytical groups	1 per 20 samples	1 per 20 samples	1 per 20 samples for PFAS only	1 per each for VOC and PFAS analyses per cooler per day	1 per 20 samples
Soil Vapor	All analytical groups	1 per 20 samples	None	None	None	None

17.0 QAPP WORKSHEET #21 – PROJECT SAMPLING SOP REFERENCES

The field activities for this Site will include collecting fill/soil, groundwater and soil vapor samples for laboratory analysis. The procedures relative to implementing these field activities are included in the RI Work Plan and FSP.

18.0 QAPP WORKSHEET #22 – FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

The field equipment calibration, maintenance, testing, and inspection information are included in the FSP.

19.0 QAPP WORKSHEET #23 – ANALYTICAL AND VALIDATION SOPS

The laboratory’s SOPs and the data validation SOPs are retained at each place of business and are available upon request for review.

20.0 QAPP WORKSHEET #24 – ANALYTICAL INSTRUMENT CALIBRATION

The analytical instrument calibration information is included in the laboratory QAM and/or the appropriate SOP. These documents are retained at each laboratory's place of business and are available upon request for review.

21.0 QAPP WORKSHEET #25 – ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

The analytical instrument and equipment maintenance, testing, and inspection information are included in the laboratory QAM and/or the appropriate SOP. These documents are retained at each laboratory's place of business and are available upon request for review.

22.0 QAPP WORKSHEET #26 & 27 – SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Sampling Organization: C.T. Male Associates
Laboratory: Alpha of Westborough, MA
Method of sample delivery (shipper/carrier): Alpha provided courier
Number of days from reporting until sample disposal: As documented in laboratory QAM.

The FSP describes the various methods and techniques to be followed during the completion of the sampling activities, instrument operation and calibration, and chain of custody procedures.

23.0 QAPP WORKSHEET #28 –ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

The analytical quality control and corrective action information are included in the laboratory QAM and/or the appropriate SOP. These documents are retained at the laboratory's place of business and are available upon request for review. Corrective action may be requested of the laboratory if issues arise that affect the quality of the data.

24.0 QAPP WORKSHEET #29 – PROJECT DOCUMENTS AND RECORDS TABLE

The documents and records that will be generated for the project including, but not limited to, sample collection and field measurement, analysis, and data assessment, are noted below.

Sample Collection Documents and Records	Generation	Verification	Where Maintained
Field Documents Field Notes Field Sample Forms COC Records Field Instrument Calibration Logs Sampling Notes Photographs Health and Safety Plan	C.T. Male Field Staff	C.T. Male Project Manager	Field documents generated by C.T. Male field staff will be maintained in the project file located at C.T. Male offices until scanned and electronically filed.
Project Report Documents Project sign-off forms Project report submittals	C.T. Male Project Staff	C.T. Male Project Manager	Report documents will be maintained in the project file located at C.T. Male offices until scanned and electronically filed.
Laboratory Documents Sample receipt, custody, and tracking record Equipment calibration logs (electronically stored) Sample preparation logs (electronically stored) Analysis Run Logs (electronically stored) Raw data	Laboratory Project Manager	Laboratory Quality Assurance Manager	As detailed in the laboratory QAM(s), data is typically retained for a period of 5 years from the report date.
Correspondence	C.T. Male Project Staff	C.T. Male Project Manager	Project communications regarding the work plans, QAPP and schedule will be kept at C.T. Male offices.

Laboratory Record	**PFAS**	**VOCs**	**SVOCs**	**Pesticides**	**PCBs**	**Metals**	**Cyanide**
Narrative	X	X	X	X	X	X	X
COC and any additional receiving documentation	X	X	X	X	X	X	X
Sample Results	X	X	X	X	X	X	X
QC Results	X	X	X	X	X	X	X
Raw Data (including but not limited to the following where appropriate - preparation logs, tune checks, ICALs, DDT/Endrin breakdown, instrument logs, tailing factor, chromatograms)	X	X	X	X	X	X	X

25.0 QAPP WORKSHEET #31, 32, & 33 – ASSESSMENTS AND CORRECTIVE ACTION TABLE

Assessments:

Assessment Type	Responsible Party & Organization	Number/ Frequency	Estimated Dates	Assessment Deliverable	Deliverable due date
Review of field procedures	C.T. Male - QA Manager and/or Project Manager for work completed by C.T. Male	As warranted	As warranted	On-site audit	1 Month from completion
Review of field notes/deviations from work plans	C.T. Male – QA Manager and/or Project Manager for work completed by C.T. Male	Every event/report	Ongoing	Documentation of review	Ongoing
Review of COCs	C.T. Male - QA Manager / Laboratory for samples collected by C.T. Male	Every event/report	Within 5 days of receipt	Documentation of review	Ongoing
Review/validation analytical reports	EDS	Level IIA (NYSDEC ASP Category B) every event/report and Level IV (NYSDEC ASP Category B) determined on a case by case basis.	Ongoing	Documentation of review	Ongoing

Assessment Response and Corrective Action:

Assessment Type	Responsibility for responding to assessment findings	Assessment Response Documentation	Timeframe for Response	Responsibility for Implementing Corrective Action	Responsible for monitoring
Review of field procedures	C.T. Male - QA Manager and/or Project Manager	Written report	30 days	Project Manager and/or QA Manager, C.T. Male	Project Manager and/or QA Manager, C.T. Male
Review of field notes/deviations from work plans	C.T. Male – Project Manager	Note in field notes, project file, retained in correspondence	Immediately to within 3 days of deviation	Project Manager and/or QA Manager, C.T. Male	QA Manager, C.T. Male
Review of COCs	C.T. Male - QA Manager / Laboratory	Note on COC	Immediately to within 3 days of discrepancy	QA Manager, C.T. Male	QA Manager, C.T. Male
Review analytical reports	C.T. Male – QA Manager	QA/QC Summary Sheet	Immediately to within 3 days of discrepancy	QA Manager, C.T. Male Project Manager, Laboratory	QA Manager, C.T. Male Project Manager, Laboratory
Review Validation Analytical Reports	Laboratory / EDS	QA/QC Summary Sheet	Immediately to within 3 days of discrepancy	QA Manager, C.T. Male Project Manager, Laboratory	QA Manager, C.T. Male Project Manager, Laboratory

26.0 QAPP WORKSHEET #34 – DATA VERIFICATION AND VALIDATION INPUTS TABLE

The following worksheets define the data verification and validation process. This worksheet describes how each item will be verified. Worksheets #35 and #36 describe when specific activities will occur, what documentation is necessary and identifies the person(s) responsible for field and analytical data respectively.

Item	Description	Verification (completeness)	Validation (conformance to specifications)
Planning Documents/Records			
1	Approved QAPP	X	
2	Contract	X	
3	Field SOPs	X	
4	Laboratory SOPs	X	
Field Records			
5	Field notes	X	X
6	Equipment calibration records	X	X
7	COC forms	X	X
8	Sampling diagrams/surveys	X	X
9	Relevant correspondence	X	X
10	Change orders/deviations	X	X
Analytical Data Package (Verified by the Laboratory QA Officer)			
13	Cover sheet (laboratory identifying information)	X	X
14	Case narrative	X	X
15	Internal laboratory COC	X	X
16	Sample receipt records	X	X
17	Sample chronology (i.e., dates and times of receipt, preparation, and analysis)	X	X
18	Definition of laboratory qualifiers	X	X
19	Results reporting forms	X	X
20	QC sample results	X	X
21	Compound(s) identified and reported in proper units	X	X
22	Labeled sample chromatograms (organics)	X	X
23	Electronic data deliverable	X	X
24	Communication records	X	X
25	MDL/RL establishment and verification	X	X

Item	Description	Verification (completeness)	Validation (conformance to specifications)
26	Standards traceability	X	X
27	Instrument calibration records	X	X
28	Corrective action reports	X	X
29	Raw data	X	X

27.0 QAPP WORKSHEET #35 – DATA VERIFICATION PROCEDURES TABLE

Described below are the processes that will be followed to validate project field data.

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field notes and forms	QAPP, Field SOPs	Verify that records are present and complete for each day of field activities. Verify that planned samples were collected and that sample collection locations are documented. Verify that changes/exceptions are documented and reported in accordance with requirements. Verify that required field monitoring was performed and results are documented.	C.T. Male Project Manager for work completed by C.T. Male field staff.
COC forms	QAPP, Field SOPs	Verify the completeness of COC records. Examine entries for consistency with the field notes. Verify that required signatures and dates are present. Check for transcription errors.	C.T. Male Project Manager for work completed by C.T. Male field staff.

28.0 QAPP WORKSHEET #36 – DATA VALIDATION PROCEDURES

The data validator is responsible for review of the analytical data generated for this Site. The data validator will review analytical data and prepare a report documenting if the analytical data is valid and usable. The report will also present data rejection and qualification, where necessary, based on laboratory performance. The data validation will conform to NYSDEC DER-10, Appendix 2B, Data Usability Summary Reports (DUSR).

External data validation will be performed by an independent data validator who will utilize the applicable analytical method, standard laboratory practices and where applicable, NYSDEC ASP Category B Data Deliverable, the USEPA National and Regional Validation Guidelines/Procedures to determine the applicable qualifications of the data. This will include an evaluation of the laboratory raw data which may include but is not limited to the following:

- Analytical holding times
- Instrument performance checks
- Initial and continuing calibration
- Blanks
- Laboratory control samples
- Deuterated/surrogate compounds
- Matrix spike and spike duplicate samples
- Internal standards
- Target compound identification
- Target compound quantitation
- System performance
- Overall assessment of data

The validator will then prepare a DUSR of the review. The data validation company for this project is Environmental Data Services, Inc.

29.0 QAPP WORKSHEET #37 – DATA USABILITY ASSESSMENT

Described below are the procedures / methods / activities that will be used to determine whether data are of the right type, quality, and quantity to support environmental decision making for the project. Also noted are how data quality issues will be addressed and how limitations on the use of the data will be handled.

Personnel (organization and position/title) responsible for participating in the data usability assessment:

For work completed by C.T. Male - C.T. Male Project Manager, C.T. Male QA Manager

The usability of the data will be assessed based on a review of the field measurements and laboratory results. The laboratory results will be reviewed by the laboratory prior to submittal and by the C.T. Male QA Manager upon receipt.

Step 1	**Review the project's objectives and sampling design** Review the key outputs defined during systematic planning (i.e., DQOs) to make sure they are still applicable. Review the sampling design for consistency with stated objectives. This step provides the context for interpreting the data in subsequent steps.
Step 2	**Review the data verification and data validation outputs** Review available QA reports, including the data verification and/or data validation reports. Perform basic calculations and summarize the data (using graphs, maps, tables, etc.). Look for patterns, trends, and anomalies (i.e., unexpected results). Review deviations from planned activities (e.g., number and locations of samples, holding time exceedances, damaged samples, and SOP deviations) and determine their impacts on the data usability. Evaluate implications of unacceptable QC sample results.

Step 3	**Verify the assumptions of the selected statistical method** Verify whether underlying assumptions for selected statistical methods (if documented in the QAPP) are valid. Common assumptions include the distributional form of the data, independence of the data, dispersion characteristics, homogeneity, etc. Depending on the robustness of the statistical method, minor deviations from assumptions usually are not critical to statistical analysis and data interpretation. If serious deviations from assumptions are discovered, then another statistical method may need to be selected.
Step 4	**Implement the statistical method** Implement the specified statistical procedures for analyzing the data and review underlying assumptions. For decision projects that involve hypothesis testing (e.g., "concentrations of lead in groundwater are below the action level") consider the consequences for selecting the incorrect alternative; for estimation projects (e.g., establishing a boundary for surface soil contamination), consider the tolerance for uncertainty in measurements.
Step 5	**Document data usability and draw conclusions** Determine if the data can be used as intended, considering implications of deviations and corrective actions. Discuss data quality indicators. Assess the performance of the sampling design and identify limitations on data use. Update the conceptual site model and document conclusions in the remedial investigation report.

30.0 REFERENCES

Intergovernmental Data Quality Task Force Uniform Federal Policy (UFP), 2012. *Uniform Federal Policy for Quality Assurance Project Plans – Part 2A (Revised).* EPA-505-B-04-900C. March 2012.

United States Environmental Protection Agency (USEPA), 2006. *EPA Requirements for Quality Assurance Project Plans.* EPA QA/R-5. 2006

United States Environmental Protection Agency (USEPA). *USEPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review.*

New York State Department of Environmental Conservation (NYSDEC), May 2010. *DER-10, Technical Guidance for Site Investigation and Remediation.*

TABLES

Table 1
Laboratory Analyses
Hamilton Hill II – Target Area 1 Site, City of Schenectady,
Schenectady County, New York

Alpha Analytical, Inc. (Alpha) 8 Walkup Drive Westborough, MA 01581	Matrices PFAS (water) – EPA 537 modified TCL VOCs (soil and water) – EPA 8260 TCL SVOCs (soil and water) – EPA 8270 TCL Pesticides (soil and water) – EPA 8081 TCL PCBs (soil and water) – EPA 8082 Metals (soil and water) – EPA 6010 / EPA 7471 Hexavalent Chromium (soil) – EPA 7196 Cyanide (soil and water) – EPA 9010 / EPA 9012 % moisture (soil) – SM 2540 G

TABLE 2A: PARAMETERS - METHODS, LIMITS, ACCURACY, AND PRECISION (SOIL)
HAMILTON HILL II - TARGET AREA 1 SITE, CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)										
Methylene chloride	75-09-2	10	1.65	ug/kg	70-130	30	70-130	30	30	
1,1-Dichloroethane	75-34-3	1.5	0.27	ug/kg	70-130	30	70-130	30	30	
Chloroform	67-66-3	1.5	0.37	ug/kg	70-130	30	70-130	30	30	
Carbon tetrachloride	56-23-5	1	0.345	ug/kg	70-130	30	70-130	30	30	
1,2-Dichloropropane	78-87-5	3.5	0.228	ug/kg	70-130	30	70-130	30	30	
Dibromochloromethane	124-48-1	1	0.176	ug/kg	70-130	30	70-130	30	30	
1,1,2-Trichloroethane	79-00-5	1.5	0.313	ug/kg	70-130	30	70-130	30	30	
Tetrachloroethene	127-18-4	1	0.302	ug/kg	70-130	30	70-130	30	30	
Chlorobenzene	108-90-7	1	0.348	ug/kg	70-130	30	70-130	30	30	
Trichlorofluoromethane	75-69-4	5	0.417	ug/kg	70-139	30	70-139	30	30	
1,2-Dichloroethane	107-06-2	1	0.246	ug/kg	70-130	30	70-130	30	30	
1,1,1-Trichloroethane	71-55-6	1	0.35	ug/kg	70-130	30	70-130	30	30	
Bromodichloromethane	75-27-4	1	0.308	ug/kg	70-130	30	70-130	30	30	
trans-1,3-Dichloropropene	10061-02-6	1	0.208	ug/kg	70-130	30	70-130	30	30	
cis-1,3-Dichloropropene	10061-01-5	1	0.231	ug/kg	70-130	30	70-130	30	30	
1,3-Dichloropropene, Total	542-75-6	1	0.208	ug/kg				30	30	
1,3-Dichloropropene, Total	542-75-6	1	0.208	ug/kg				30	30	
Bromoform	75-25-2	4	0.237	ug/kg	70-130	30	70-130	30	30	
1,1,2,2-Tetrachloroethane	79-34-5	1	0.298	ug/kg	70-130	30	70-130	30	30	
Benzene	71-43-2	1	0.193	ug/kg	70-130	30	70-130	30	30	
Toluene	108-88-3	1.5	0.195	ug/kg	70-130	30	70-130	30	30	
Ethylbenzene	100-41-4	1	0.17	ug/kg	70-130	30	70-130	30	30	
Chloromethane	74-87-3	5	0.436	ug/kg	52-130	30	52-130	30	30	
Bromomethane	74-83-9	2	0.338	ug/kg	57-147	30	57-147	30	30	
Vinyl chloride	75-01-4	2	0.315	ug/kg	67-130	30	67-130	30	30	
Chloroethane	75-00-3	2	0.316	ug/kg	50-151	30	50-151	30	30	
1,1-Dichloroethene	75-35-4	1	0.372	ug/kg	65-135	30	65-135	30	30	
trans-1,2-Dichloroethene	156-60-5	1.5	0.241	ug/kg	70-130	30	70-130	30	30	
Trichloroethene	79-01-6	1	0.302	ug/kg	70-130	30	70-130	30	30	
1,2-Dichlorobenzene	95-50-1	5	0.182	ug/kg	70-130	30	70-130	30	30	
1,3-Dichlorobenzene	541-73-1	5	0.218	ug/kg	70-130	30	70-130	30	30	
1,4-Dichlorobenzene	106-46-7	5	0.182	ug/kg	70-130	30	70-130	30	30	
Methyl tert butyl ether	1634-04-4	2	0.153	ug/kg	66-130	30	66-130	30	30	
p/m-Xylene	179601-23-1	2	0.351	ug/kg	70-130	30	70-130	30	30	
o-Xylene	95-47-6	2	0.338	ug/kg	70-130	30	70-130	30	30	
Xylene (Total)	1330-20-7	2	0.338	ug/kg				30	30	
Xylene (Total)	1330-20-7	2	0.338	ug/kg				30	30	
cis-1,2-Dichloroethene	156-59-2	1	0.342	ug/kg	70-130	30	70-130	30	30	
1,2-Dichloroethene (total)	540-59-0	1	0.241	ug/kg				30	30	
1,2-Dichloroethene (total)	540-59-0	1	0.241	ug/kg				30	30	
Styrene	100-42-5	2	0.401	ug/kg	70-130	30	70-130	30	30	
Dichlorodifluoromethane	75-71-8	10	0.5	ug/kg	30-146	30	30-146	30	30	
Acetone	67-64-1	10	2.29	ug/kg	54-140	30	54-140	30	30	

TABLE 2A: PARAMETERS - METHODS, LIMITS, ACCURACY, AND PRECISION (SOIL)
HAMILTON HILL II - TARGET AREA 1 SITE, CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Volatiles - EPA 8260C/5035 High&Low (SOIL)										
Carbon disulfide	75-15-0	10	1.1	ug/kg	59-130	30	59-130	30	30	
2-Butanone	78-93-3	10	0.69	ug/kg	70-130	30	70-130	30	30	
4-Methyl-2-pentanone	108-10-1	10	0.244	ug/kg	70-130	30	70-130	30	30	
2-Hexanone	591-78-6	10	0.666	ug/kg	70-130	30	70-130	30	30	
Bromochloromethane	74-97-5	5	0.357	ug/kg	70-130	30	70-130	30	30	
1,2-Dibromoethane	106-93-4	4	0.199	ug/kg	70-130	30	70-130	30	30	
n-Butylbenzene	104-51-8	1	0.228	ug/kg	70-130	30	70-130	30	30	
sec-Butylbenzene	135-98-8	1	0.217	ug/kg	70-130	30	70-130	30	30	
tert-Butylbenzene	98-06-6	5	0.247	ug/kg	70-130	30	70-130	30	30	
1,2-Dibromo-3-chloropropane	96-12-8	5	0.396	ug/kg	68-130	30	68-130	30	30	
Isopropylbenzene	98-82-8	1	0.194	ug/kg	70-130	30	70-130	30	30	
p-Isopropyltoluene	99-87-6	1	0.202	ug/kg	70-130	30	70-130	30	30	
Naphthalene	91-20-3	5	0.138	ug/kg	70-130	30	70-130	30	30	
n-Propylbenzene	103-65-1	1	0.215	ug/kg	70-130	30	70-130	30	30	
1,2,3-Trichlorobenzene	87-61-6	5	0.251	ug/kg	70-130	30	70-130	30	30	
1,2,4-Trichlorobenzene	120-82-1	5	0.215	ug/kg	70-130	30	70-130	30	30	
1,3,5-Trimethylbenzene	108-67-8	5	0.161	ug/kg	70-130	30	70-130	30	30	
1,2,4-Trimethylbenzene	95-63-6	5	0.186	ug/kg	70-130	30	70-130	30	30	
Methyl Acetate	79-20-9	20	0.463	ug/kg	51-146	30	51-146	30	30	
Cyclohexane	110-82-7	20	0.433	ug/kg	59-142	30	59-142	30	30	
1,4-Dioxane	123-91-1	40	14.4	ug/kg	65-136	30	65-136	30	30	
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	20	0.514	ug/kg	50-139	30	50-139	30	30	
Methyl cyclohexane	108-87-2	4	0.24	ug/kg	70-130	30	70-130	30	30	
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*
Toluene-d8	*2037-26-5*									*70-130*
4-Bromofluorobenzene	*460-00-4*									*70-130*
Dibromofluoromethane	*1868-53-7*									*70-130*
TCL Semivolatiles - EPA 8270D (SOIL)										
Acenaphthene	83-32-9	133.6	17.3012	ug/kg	31-137	50	31-137	50	50	
1,2,4-Trichlorobenzene	120-82-1	167	19.1048	ug/kg	38-107	50	38-107	50	50	
Hexachlorobenzene	118-74-1	100.2	18.704	ug/kg	40-140	50	40-140	50	50	
Bis(2-chloroethyl)ether	111-44-4	150.3	22.6452	ug/kg	40-140	50	40-140	50	50	
2-Chloronaphthalene	91-58-7	167	16.5664	ug/kg	40-140	50	40-140	50	50	
1,2-Dichlorobenzene	95-50-1	167	29.9932	ug/kg	40-140	50	40-140	50	50	
1,3-Dichlorobenzene	541-73-1	167	28.724	ug/kg	40-140	50	40-140	50	50	
1,4-Dichlorobenzene	106-46-7	167	29.1582	ug/kg	28-104	50	28-104	50	50	
3,3'-Dichlorobenzidine	91-94-1	167	44.422	ug/kg	40-140	50	40-140	50	50	
2,4-Dinitrotoluene	121-14-2	167	33.4	ug/kg	40-132	50	40-132	50	50	
2,6-Dinitrotoluene	606-20-2	167	28.6572	ug/kg	40-140	50	40-140	50	50	
Fluoranthene	206-44-0	100.2	19.1716	ug/kg	40-140	50	40-140	50	50	
4-Chlorophenyl phenyl ether	7005-72-3	167	17.869	ug/kg	40-140	50	40-140	50	50	
4-Bromophenyl phenyl ether	101-55-3	167	25.4842	ug/kg	40-140	50	40-140	50	50	
Bis(2-chloroisopropyl)ether	108-60-1	200.4	28.5236	ug/kg	40-140	50	40-140	50	50	

TABLE 2A: PARAMETERS - METHODS, LIMITS, ACCURACY, AND PRECISION (SOIL)
HAMILTON HILL II - TARGET AREA 1 SITE, CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Semivolatiles - EPA 8270D (SOIL)										
Bis(2-chloroethoxy)methane	111-91-1	180.36	16.7334	ug/kg	40-117	50	40-117	50	50	
Hexachlorobutadiene	87-68-3	167	24.4488	ug/kg	40-140	50	40-140	50	50	
Hexachlorocyclopentadiene	77-47-4	477.62	151.302	ug/kg	40-140	50	40-140	50	50	
Hexachloroethane	67-72-1	133.6	27.0206	ug/kg	40-140	50	40-140	50	50	
Isophorone	78-59-1	150.3	21.6766	ug/kg	40-140	50	40-140	50	50	
Naphthalene	91-20-3	167	20.3406	ug/kg	40-140	50	40-140	50	50	
Nitrobenzene	98-95-3	150.3	24.716	ug/kg	40-140	50	40-140	50	50	
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	133.6	19.0046	ug/kg	36-157	50	36-157	50	50	
n-Nitrosodi-n-propylamine	621-64-7	167	25.7848	ug/kg	32-121	50	32-121	50	50	
Bis(2-Ethylhexyl)phthalate	117-81-7	167	57.782	ug/kg	40-140	50	40-140	50	50	
Butyl benzyl phthalate	85-68-7	167	42.084	ug/kg	40-140	50	40-140	50	50	
Di-n-butylphthalate	84-74-2	167	31.6632	ug/kg	40-140	50	40-140	50	50	
Di-n-octylphthalate	117-84-0	167	56.78	ug/kg	40-140	50	40-140	50	50	
Diethyl phthalate	84-66-2	167	15.4642	ug/kg	40-140	50	40-140	50	50	
Dimethyl phthalate	131-11-3	167	35.07	ug/kg	40-140	50	40-140	50	50	
Benzo(a)anthracene	56-55-3	100.2	18.8042	ug/kg	40-140	50	40-140	50	50	
Benzo(a)pyrene	50-32-8	133.6	40.748	ug/kg	40-140	50	40-140	50	50	
Benzo(b)fluoranthene	205-99-2	100.2	28.1228	ug/kg	40-140	50	40-140	50	50	
Benzo(k)fluoranthene	207-08-9	100.2	26.72	ug/kg	40-140	50	40-140	50	50	
Chrysene	218-01-9	100.2	17.368	ug/kg	40-140	50	40-140	50	50	
Acenaphthylene	208-96-8	133.6	25.7848	ug/kg	40-140	50	40-140	50	50	
Anthracene	120-12-7	100.2	32.565	ug/kg	40-140	50	40-140	50	50	
Benzo(ghi)perylene	191-24-2	133.6	19.6392	ug/kg	40-140	50	40-140	50	50	
Fluorene	86-73-7	167	16.2324	ug/kg	40-140	50	40-140	50	50	
Phenanthrene	85-01-8	100.2	20.3072	ug/kg	40-140	50	40-140	50	50	
Dibenzo(a,h)anthracene	53-70-3	100.2	19.3052	ug/kg	40-140	50	40-140	50	50	
Indeno(1,2,3-cd)Pyrene	193-39-5	133.6	23.2798	ug/kg	40-140	50	40-140	50	50	
Pyrene	129-00-0	100.2	16.5998	ug/kg	35-142	50	35-142	50	50	
Biphenyl	92-52-4	380.76	38.744	ug/kg	54-104	50	54-104	50	50	
4-Chloroaniline	106-47-8	167	30.394	ug/kg	40-140	50	40-140	50	50	
2-Nitroaniline	88-74-4	167	32.1976	ug/kg	47-134	50	47-134	50	50	
3-Nitroaniline	99-09-2	167	31.4962	ug/kg	26-129	50	26-129	50	50	
4-Nitroaniline	100-01-6	167	69.138	ug/kg	41-125	50	41-125	50	50	
Dibenzofuran	132-64-9	167	15.7982	ug/kg	40-140	50	40-140	50	50	
2-Methylnaphthalene	91-57-6	200.4	20.1736	ug/kg	40-140	50	40-140	50	50	
Acetophenone	98-86-2	167	20.6746	ug/kg	14-144	50	14-144	50	50	
2,4,6-Trichlorophenol	88-06-2	100.2	31.6632	ug/kg	30-130	50	30-130	50	50	
P-Chloro-M-Cresol	59-50-7	167	24.883	ug/kg	26-103	50	26-103	50	50	
2-Chlorophenol	95-57-8	167	19.7394	ug/kg	25-102	50	25-102	50	50	
2,4-Dichlorophenol	120-83-2	150.3	26.8536	ug/kg	30-130	50	30-130	50	50	
2,4-Dimethylphenol	105-67-9	167	55.11	ug/kg	30-130	50	30-130	50	50	
2-Nitrophenol	88-75-5	360.72	62.792	ug/kg	30-130	50	30-130	50	50	
4-Nitrophenol	100-02-7	233.8	68.136	ug/kg	11-114	50	11-114	50	50	

TABLE 2A: PARAMETERS - METHODS, LIMITS, ACCURACY, AND PRECISION (SOIL)
HAMILTON HILL II - TARGET AREA 1 SITE, CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Semivolatiles - EPA 8270D (SOIL)										
2,4-Dinitrophenol	51-28-5	801.6	77.822	ug/kg	4-130	50	4-130	50	50	
4,6-Dinitro-o-cresol	534-52-1	434.2	80.16	ug/kg	10-130	50	10-130	50	50	
Pentachlorophenol	87-86-5	133.6	36.74	ug/kg	17-109	50	17-109	50	50	
Phenol	108-95-2	167	25.217	ug/kg	26-90	50	26-90	50	50	
2-Methylphenol	95-48-7	167	25.885	ug/kg	30-130.	50	30-130.	50	50	
3-Methylphenol/4-Methylphenol	106-44-5	240.48	26.1522	ug/kg	30-130	50	30-130	50	50	
2,4,5-Trichlorophenol	95-95-4	167	31.9972	ug/kg	30-130	50	30-130	50	50	
Benzoic Acid	65-85-0	541.08	169.004	ug/kg	10-110	50	10-110	50	50	
Benzyl Alcohol	100-51-6	167	51.102	ug/kg	40-140	50	40-140	50	50	
Carbazole	86-74-8	167	16.2324	ug/kg	54-128	50	54-128	50	50	
2-Fluorophenol	*367-12-4*									*25-120*
Phenol-d6	*13127-88-3*									*10-120*
Nitrobenzene-d5	*4165-60-0*									*23-120*
2-Fluorobiphenyl	*321-60-8*									*30-120*
2,4,6-Tribromophenol	*118-79-6*									*10-136*
4-Terphenyl-d14	*1718-51-0*									*18-120*
TCL Pesticides - EPA 8081B (SOIL)										
Delta-BHC	319-86-8	7.992	1.5651	ug/kg	30-150	30	30-150	50	50	
Lindane	58-89-9	3.33	1.48851	ug/kg	30-150	30	30-150	50	50	
Alpha-BHC	319-84-6	3.33	0.94572	ug/kg	30-150	30	30-150	50	50	
Beta-BHC	319-85-7	7.992	3.0303	ug/kg	30-150	30	30-150	50	50	
Heptachlor	76-44-8	3.996	1.79154	ug/kg	30-150	30	30-150	50	50	
Aldrin	309-00-2	7.992	2.81385	ug/kg	30-150	30	30-150	50	50	
Heptachlor epoxide	1024-57-3	14.985	4.4955	ug/kg	30-150	30	30-150	50	50	
Endrin	72-20-8	3.33	1.3653	ug/kg	30-150	30	30-150	50	50	
Endrin aldehyde	7421-93-4	9.99	3.4965	ug/kg	30-150	30	30-150	50	50	
Endrin ketone	53494-70-5	7.992	2.05794	ug/kg	30-150	30	30-150	50	50	
Dieldrin	60-57-1	4.995	2.4975	ug/kg	30-150	30	30-150	50	50	
4,4'-DDE	72-55-9	7.992	1.84815	ug/kg	30-150	30	30-150	50	50	
4,4'-DDD	72-54-8	7.992	2.85048	ug/kg	30-150	30	30-150	50	50	
4,4'-DDT	50-29-3	14.985	6.4269	ug/kg	30-150	30	30-150	50	50	
Endosulfan I	959-98-8	7.992	1.88811	ug/kg	30-150	30	30-150	50	50	
Endosulfan II	33213-65-9	7.992	2.67066	ug/kg	30-150	30	30-150	50	50	
Endosulfan sulfate	1031-07-8	3.33	1.58508	ug/kg	30-150	30	30-150	50	50	
Methoxychlor	72-43-5	14.985	4.662	ug/kg	30-150	30	30-150	50	50	
Toxaphene	8001-35-2	149.85	41.958	ug/kg	30-150	30	30-150	50	50	
cis-Chlordane	5103-71-9	9.99	2.78388	ug/kg	30-150	30	30-150	50	50	
trans-Chlordane	5103-74-2	9.99	2.63736	ug/kg	30-150	30	30-150	50	50	
Chlordane	57-74-9	64.935	26.4735	ug/kg	30-150	30	30-150	50	50	
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*
Decachlorobiphenyl	*2051-24-3*									*30-150*

TABLE 2A: PARAMETERS - METHODS, LIMITS, ACCURACY, AND PRECISION (SOIL)
HAMILTON HILL II - TARGET AREA 1 SITE, CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL PCBs - EPA 8082A (SOIL)										
Aroclor 1016	12674-11-2	33.5	3.7989	ug/kg	40-140	50	40-140	50	50	
Aroclor 1221	11104-28-2	33.5	5.0987	ug/kg	40-140	50	40-140	50	50	
Aroclor 1232	11141-16-5	33.5	3.2964	ug/kg	40-140	50	40-140	50	50	
Aroclor 1242	53469-21-9	33.5	4.1004	ug/kg	40-140	50	40-140	50	50	
Aroclor 1248	12672-29-6	33.5	3.7587	ug/kg	40-140	50	40-140	50	50	
Aroclor 1254	11097-69-1	33.5	2.7336	ug/kg	40-140	50	40-140	50	50	
Aroclor 1260	11096-82-5	33.5	3.4974	ug/kg	40-140	50	40-140	50	50	
Aroclor 1262	37324-23-5	33.5	2.7537	ug/kg	40-140	50	40-140	50	50	
Aroclor 1268	11100-14-4	33.5	2.3718	ug/kg	40-140	50	40-140	50	50	
PCBs, Total	1336-36-3	33.5	1.541	ug/kg				50	50	
PCBs, Total	1336-36-3	33.5	1.541	ug/kg				50	50	
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*
Decachlorobiphenyl	*2051-24-3*									*30-150*
METALS by 6010C/7471B (SOIL)										
Aluminum, Total	7429-90-5	4	1.08	mg/kg	48-151		75-125	20	20	
Antimony, Total	7440-36-0	2	0.152	mg/kg	1-208		75-125	20	20	
Arsenic, Total	7440-38-2	0.4	0.0832	mg/kg	79-121		75-125	20	20	
Barium, Total	7440-39-3	0.4	0.0696	mg/kg	83-117		75-125	20	20	
Beryllium, Total	7440-41-7	0.2	0.0132	mg/kg	83-117		75-125	20	20	
Cadmium, Total	7440-43-9	0.4	0.0392	mg/kg	83-117		75-125	20	20	
Calcium, Total	7440-70-2	4	1.4	mg/kg	81-119		75-125	20	20	
Chromium, Total	7440-47-3	0.4	0.0384	mg/kg	80-120		75-125	20	20	
Cobalt, Total	7440-48-4	0.8	0.0664	mg/kg	84-115		75-125	20	20	
Copper, Total	7440-50-8	0.4	0.1032	mg/kg	81-118		75-125	20	20	
Iron, Total	7439-89-6	2	0.3612	mg/kg	45-155		75-125	20	20	
Lead, Total	7439-92-1	2	0.1072	mg/kg	81-117		75-125	20	20	
Magnesium, Total	7439-95-4	4	0.616	mg/kg	76-124		75-125	20	20	
Manganese, Total	7439-96-5	0.4	0.0636	mg/kg	81-117		75-125	20	20	
Mercury, Total	7439-97-6	0.08	0.016896	mg/kg	72-128		80-120	20	20	
Nickel, Total	7440-02-0	1	0.0968	mg/kg	83-117		75-125	20	20	
Potassium, Total	7440-09-7	100	5.76	mg/kg	71-129		75-125	20	20	
Selenium, Total	7782-49-2	0.8	0.1032	mg/kg	78-122		75-125	20	20	
Silver, Total	7440-22-4	0.4	0.1132	mg/kg	75-124		75-125	20	20	
Sodium, Total	7440-23-5	80	1.26	mg/kg	72-127		75-125	20	20	
Thallium, Total	7440-28-0	0.8	0.126	mg/kg	80-120		75-125	20	20	
Vanadium, Total	7440-62-2	0.4	0.0812	mg/kg	78-122		75-125	20	20	
Zinc, Total	7440-66-6	2	0.1172	mg/kg	82-118		75-125	20	20	
CYANIDE by 9010C/9012B (SOIL)										
Cyanide, Total	57-12-5	1	0.212	mg/kg	80-120	35	75-125	35	35	

TABLE 2B: PARAMETERS - METHODS, LIMITS, ACCURACY AND PRECISION (WATER)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
PFAS - EPA 537(M)-Isotope Dilution (WATER)										
Perfluorobutanoic Acid (PFBA)	375-22-4	2	0.1312	ng/l	50-150	30	50-150	30	30	
Perfluoropentanoic Acid (PFPeA)	2706-90-3	2	0.0856	ng/l	50-150	30	50-150	30	30	
Perfluorobutanesulfonic Acid (PFBS)	375-73-5	2	0.11	ng/l	50-150	30	50-150	30	30	
Perfluorohexanoic Acid (PFHxA)	307-24-4	2	0.1264	ng/l	50-150	30	50-150	30	30	
Perfluoroheptanoic Acid (PFHpA)	375-85-9	2	0.0924	ng/l	50-150	30	50-150	30	30	
Perfluorohexanesulfonic Acid (PFHxS)	355-46-4	2	0.1076	ng/l	50-150	30	50-150	30	30	
Perfluorooctanoic Acid (PFOA)	335-67-1	2	0.0504	ng/l	50-150	30	50-150	30	30	
Perfluorononanoic Acid (PFNA)	375-95-1	2	0.1008	ng/l	50-150	30	50-150	30	30	
Perfluorooctanesulfonic Acid (PFOS)	1763-23-1	2	0.1116	ng/l	50-150	30	50-150	30	30	
Perfluorodecanoic Acid (PFDA)	335-76-2	2	0.1904	ng/l	50-150	30	50-150	30	30	
1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2FTS)	39108-34-4	2	0.2908	ng/l	50-150	30	50-150	30	30	
N-Methyl Perfluorooctanesulfonamidoacetic Acid (NMeFOSAA	2355-31-9	2	0.2504	ng/l	50-150	30	50-150	30	30	
Perfluoroundecanoic Acid (PFUnA)	2058-94-8	2	0.1912	ng/l	50-150	30	50-150	30	30	
Perfluorodecanesulfonic Acid (PFDS)	335-77-3	2	0.2224	ng/l	50-150	30	50-150	30	30	
Perfluorooctanesulfonamide (FOSA)	754-91-6	2	0.2268	ng/l	50-150	30	50-150	30	30	
N-Ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	2991-50-6	2	0.3728	ng/l	50-150	30	50-150	30	30	
Perfluorododecanoic Acid (PFDoA)	307-55-1	2	0.0916	ng/l	50-150	30	50-150	30	30	
Perfluorotridecanoic Acid (PFTrDA)	72629-94-8	2	0.0904	ng/l	50-150	30	50-150	30	30	
Perfluorotetradecanoic Acid (PFTA)	376-06-7	2	0.072	ng/l	50-150	30	50-150	30	30	
1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)		2	0.194	ng/l	50-150	30	50-150	30	30	
Perfluoroheptanesulfonic Acid (PFHpS)		2	0.155	ng/l	50-150	30	50-150	30	30	
Perfluoro[13C4]Butanoic Acid (MPFBA)	*NONE*									*50-150*
Perfluoro[13C5]Pentanoic Acid (M5PFPEA)	*NONE*									*50-150*
Perfluoro[2,3,4-13C3]Butanesulfonic Acid (M3PFBS)	*NONE*									*50-150*
Perfluoro[1,2,3,4,6-13C5]Hexanoic Acid (M5PFHxA)	*NONE*									*50-150*
Perfluoro[1,2,3,4-13C4]Heptanoic Acid (M4PFHpA)	*NONE*									*50-150*
Perfluoro[1,2,3-13C3]Hexanesulfonic Acid (M3PFHxS)	*NONE*									*50-150*
Perfluoro[13C8]Octanoic Acid (M8PFOA)	*NONE*									*50-150*
1H,1H,2H,2H-Perfluoro[1,2-13C2]Octanesulfonic Acid (M2-6	*NONE*									*50-150*
Perfluoro[13C9]Nonanoic Acid (M9PFNA)	*NONE*									*50-150*
Perfluoro[13C8]Octanesulfonic Acid (M8PFOS)	*NONE*									*50-150*
Perfluoro[1,2,3,4,5,6-13C6]Decanoic Acid (M6PFDA)	*NONE*									*50-150*
1H,1H,2H,2H-Perfluoro[1,2-13C2]Decanesulfonic Acid (M2-8	*NONE*									*50-150*
N-Deuteriomethylperfluoro-1-octanesulfonamidoacetic Acid (	*NONE*									*50-150*
Perfluoro[1,2,3,4,5,6,7-13C7]Undecanoic Acid (M7-PFUDA)	*NONE*									*50-150*
Perfluoro[13C8]Octanesulfonamide (M8FOSA)	*NONE*									*50-150*
N-Deuterioethylperfluoro-1-octanesulfonamidoacetic Acid (d	*NONE*									*50-150*
Perfluoro[1,2-13C2]Dodecanoic Acid (MPFDOA)	*NONE*									*50-150*
Perfluoro[1,2-13C2]Tetradecanoic Acid (M2PFTEDA)	*NONE*									*50-150*
TCL Volatiles - EPA 8260C (WATER)										
Methylene chloride	75-09-2	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,1-Dichloroethane	75-34-3	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Chloroform	67-66-3	2.5	0.7	ug/l	70-130	20	70-130	20	20	

TABLE 2B: PARAMETERS - METHODS, LIMITS, ACCURACY AND PRECISION (WATER)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Volatiles - EPA 8260C (WATER)										
Carbon tetrachloride	56-23-5	0.5	0.134	ug/l	63-132	20	63-132	20	20	
1,2-Dichloropropane	78-87-5	1	0.137	ug/l	70-130	20	70-130	20	20	
Dibromochloromethane	124-48-1	0.5	0.149	ug/l	63-130	20	63-130	20	20	
1,1,2-Trichloroethane	79-00-5	1.5	0.5	ug/l	70-130	20	70-130	20	20	
Tetrachloroethene	127-18-4	0.5	0.181	ug/l	70-130	20	70-130	20	20	
Chlorobenzene	108-90-7	2.5	0.7	ug/l	75-130	20	75-130	20	20	
Trichlorofluoromethane	75-69-4	2.5	0.7	ug/l	62-150	20	62-150	20	20	
1,2-Dichloroethane	107-06-2	0.5	0.132	ug/l	70-130	20	70-130	20	20	
1,1,1-Trichloroethane	71-55-6	2.5	0.7	ug/l	67-130	20	67-130	20	20	
Bromodichloromethane	75-27-4	0.5	0.192	ug/l	67-130	20	67-130	20	20	
trans-1,3-Dichloropropene	10061-02-6	0.5	0.164	ug/l	70-130	20	70-130	20	20	
cis-1,3-Dichloropropene	10061-01-5	0.5	0.144	ug/l	70-130	20	70-130	20	20	
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20	
1,3-Dichloropropene, Total	542-75-6	0.5	0.144	ug/l				20	20	
Bromoform	75-25-2	2	0.65	ug/l	54-136	20	54-136	20	20	
1,1,2,2-Tetrachloroethane	79-34-5	0.5	0.167	ug/l	67-130	20	67-130	20	20	
Benzene	71-43-2	0.5	0.159	ug/l	70-130	20	70-130	20	20	
Toluene	108-88-3	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Ethylbenzene	100-41-4	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Chloromethane	74-87-3	2.5	0.7	ug/l	64-130	20	64-130	20	20	
Bromomethane	74-83-9	2.5	0.7	ug/l	39-139	20	39-139	20	20	
Vinyl chloride	75-01-4	1	0.0714	ug/l	55-140	20	55-140	20	20	
Chloroethane	75-00-3	2.5	0.7	ug/l	55-138	20	55-138	20	20	
1,1-Dichloroethene	75-35-4	0.5	0.169	ug/l	61-145	20	61-145	20	20	
trans-1,2-Dichloroethene	156-60-5	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Trichloroethene	79-01-6	0.5	0.175	ug/l	70-130	20	70-130	20	20	
1,2-Dichlorobenzene	95-50-1	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,3-Dichlorobenzene	541-73-1	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,4-Dichlorobenzene	106-46-7	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Methyl tert butyl ether	1634-04-4	2.5	0.7	ug/l	63-130	20	63-130	20	20	
p/m-Xylene	179601-23-1	2.5	0.7	ug/l	70-130	20	70-130	20	20	
o-Xylene	95-47-6	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20	
Xylene (Total)	1330-20-7	2.5	0.7	ug/l				20	20	
cis-1,2-Dichloroethene	156-59-2	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20	
1,2-Dichloroethene (total)	540-59-0	2.5	0.7	ug/l				20	20	
Styrene	100-42-5	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Dichlorodifluoromethane	75-71-8	5	1	ug/l	36-147	20	36-147	20	20	
Acetone	67-64-1	5	1.46	ug/l	58-148	20	58-148	20	20	
Carbon disulfide	75-15-0	5	1	ug/l	51-130	20	51-130	20	20	
2-Butanone	78-93-3	5	1.94	ug/l	63-138	20	63-138	20	20	
4-Methyl-2-pentanone	108-10-1	5	1	ug/l	59-130	20	59-130	20	20	

TABLE 2B: PARAMETERS - METHODS, LIMITS, ACCURACY AND PRECISION (WATER)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Volatiles - EPA 8260C (WATER)										
2-Hexanone	591-78-6	5	1	ug/l	57-130	20	57-130	20	20	
Bromochloromethane	74-97-5	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,2-Dibromoethane	106-93-4	2	0.65	ug/l	70-130	20	70-130	20	20	
n-Butylbenzene	104-51-8	2.5	0.7	ug/l	53-136	20	53-136	20	20	
sec-Butylbenzene	135-98-8	2.5	0.7	ug/l	70-130	20	70-130	20	20	
tert-Butylbenzene	98-06-6	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,2-Dibromo-3-chloropropane	96-12-8	2.5	0.7	ug/l	41-144	20	41-144	20	20	
Isopropylbenzene	98-82-8	2.5	0.7	ug/l	70-130	20	70-130	20	20	
p-Isopropyltoluene	99-87-6	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Naphthalene	91-20-3	2.5	0.7	ug/l	70-130	20	70-130	20	20	
n-Propylbenzene	103-65-1	2.5	0.7	ug/l	69-130	20	69-130	20	20	
1,2,3-Trichlorobenzene	87-61-6	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,2,4-Trichlorobenzene	120-82-1	2.5	0.7	ug/l	70-130	20	70-130	20	20	
1,3,5-Trimethylbenzene	108-67-8	2.5	0.7	ug/l	64-130	20	64-130	20	20	
1,2,4-Trimethylbenzene	95-63-6	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Methyl Acetate	79-20-9	2	0.234	ug/l	70-130	20	70-130	20	20	
Cyclohexane	110-82-7	10	0.271	ug/l	70-130	20	70-130	20	20	
1,4-Dioxane	123-91-1	250	60.8	ug/l	56-162	20	56-162	20	20	
1,1,2-Trichloro-1,2,2-Trifluoroethane	76-13-1	2.5	0.7	ug/l	70-130	20	70-130	20	20	
Methyl cyclohexane	108-87-2	10	0.396	ug/l	70-130	20	70-130	20	20	
1,2-Dichloroethane-d4	*17060-07-0*									*70-130*
Toluene-d8	*2037-26-5*									*70-130*
4-Bromofluorobenzene	*460-00-4*									*70-130*
Dibromofluoromethane	*1868-53-7*									*70-130*
TCL Semivolatiles - EPA 8270D (WATER)										
Acenaphthene	83-32-9	2	0.591	ug/l	37-111	30	37-111	30	30	
1,2,4-Trichlorobenzene	120-82-1	5	0.661	ug/l	39-98	30	39-98	30	30	
Hexachlorobenzene	118-74-1	2	0.579	ug/l	40-140	30	40-140	30	30	
Bis(2-chloroethyl)ether	111-44-4	2	0.669	ug/l	40-140	30	40-140	30	30	
2-Chloronaphthalene	91-58-7	2	0.64	ug/l	40-140	30	40-140	30	30	
1,2-Dichlorobenzene	95-50-1	2	0.732	ug/l	40-140	30	40-140	30	30	
1,3-Dichlorobenzene	541-73-1	2	0.688	ug/l	40-140	30	40-140	30	30	
1,4-Dichlorobenzene	106-46-7	2	0.708	ug/l	36-97	30	36-97	30	30	
3,3'-Dichlorobenzidine	91-94-1	5	1.39	ug/l	40-140	30	40-140	30	30	
2,4-Dinitrotoluene	121-14-2	5	0.845	ug/l	48-143	30	48-143	30	30	
2,6-Dinitrotoluene	606-20-2	5	1.12	ug/l	40-140	30	40-140	30	30	
Fluoranthene	206-44-0	2	0.568	ug/l	40-140	30	40-140	30	30	
4-Chlorophenyl phenyl ether	7005-72-3	2	0.625	ug/l	40-140	30	40-140	30	30	
4-Bromophenyl phenyl ether	101-55-3	2	0.731	ug/l	40-140	30	40-140	30	30	
Bis(2-chloroisopropyl)ether	108-60-1	2	0.696	ug/l	40-140	30	40-140	30	30	
Bis(2-chloroethoxy)methane	111-91-1	5	0.626	ug/l	40-140	30	40-140	30	30	
Hexachlorobutadiene	87-68-3	2	0.717	ug/l	40-140	30	40-140	30	30	
Hexachlorocyclopentadiene	77-47-4	20	7.84	ug/l	40-140	30	40-140	30	30	

TABLE 2B: PARAMETERS - METHODS, LIMITS, ACCURACY AND PRECISION (WATER)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Semivolatiles - EPA 8270D (WATER)										
Hexachloroethane	67-72-1	2	0.682	ug/l	40-140	30	40-140	30	30	
Isophorone	78-59-1	5	0.601	ug/l	40-140	30	40-140	30	30	
Naphthalene	91-20-3	2	0.68	ug/l	40-140	30	40-140	30	30	
Nitrobenzene	98-95-3	2	0.753	ug/l	40-140	30	40-140	30	30	
NitrosoDiPhenylAmine(NDPA)/DPA	86-30-6	2	0.644	ug/l	40-140	30	40-140	30	30	
n-Nitrosodi-n-propylamine	621-64-7	5	0.7	ug/l	29-132	30	29-132	30	30	
Bis(2-Ethylhexyl)phthalate	117-81-7	3	0.91	ug/l	40-140	30	40-140	30	30	
Butyl benzyl phthalate	85-68-7	5	1.26	ug/l	40-140	30	40-140	30	30	
Di-n-butylphthalate	84-74-2	5	0.689	ug/l	40-140	30	40-140	30	30	
Di-n-octylphthalate	117-84-0	5	1.14	ug/l	40-140	30	40-140	30	30	
Diethyl phthalate	84-66-2	5	0.628	ug/l	40-140	30	40-140	30	30	
Dimethyl phthalate	131-11-3	5	0.65	ug/l	40-140	30	40-140	30	30	
Benzo(a)anthracene	56-55-3	2	0.61	ug/l	40-140	30	40-140	30	30	
Benzo(a)pyrene	50-32-8	2	0.539	ug/l	40-140	30	40-140	30	30	
Benzo(b)fluoranthene	205-99-2	2	0.635	ug/l	40-140	30	40-140	30	30	
Benzo(k)fluoranthene	207-08-9	2	0.597	ug/l	40-140	30	40-140	30	30	
Chrysene	218-01-9	2	0.543	ug/l	40-140	30	40-140	30	30	
Acenaphthylene	208-96-8	2	0.658	ug/l	45-123	30	45-123	30	30	
Anthracene	120-12-7	2	0.645	ug/l	40-140	30	40-140	30	30	
Benzo(ghi)perylene	191-24-2	2	0.611	ug/l	40-140	30	40-140	30	30	
Fluorene	86-73-7	2	0.619	ug/l	40-140	30	40-140	30	30	
Phenanthrene	85-01-8	2	0.613	ug/l	40-140	30	40-140	30	30	
Dibenzo(a,h)anthracene	53-70-3	2	0.548	ug/l	40-140	30	40-140	30	30	
Indeno(1,2,3-cd)Pyrene	193-39-5	2	0.707	ug/l	40-140	30	40-140	30	30	
Pyrene	129-00-0	2	0.569	ug/l	26-127	30	26-127	30	30	
Biphenyl	92-52-4	2	0.757	ug/l	40-140	30	40-140	30	30	
4-Chloroaniline	106-47-8	5	0.632	ug/l	40-140	30	40-140	30	30	
2-Nitroaniline	88-74-4	5	1.14	ug/l	52-143	30	52-143	30	30	
3-Nitroaniline	99-09-2	5	1.22	ug/l	25-145	30	25-145	30	30	
4-Nitroaniline	100-01-6	5	1.3	ug/l	51-143	30	51-143	30	30	
Dibenzofuran	132-64-9	2	0.656	ug/l	40-140	30	40-140	30	30	
2-Methylnaphthalene	91-57-6	2	0.72	ug/l	40-140	30	40-140	30	30	
Acetophenone	98-86-2	5	0.847	ug/l	39-129	30	39-129	30	30	
2,4,6-Trichlorophenol	88-06-2	5	0.681	ug/l	30-130	30	30-130	30	30	
P-Chloro-M-Cresol	59-50-7	2	0.617	ug/l	23-97	30	23-97	30	30	
2-Chlorophenol	95-57-8	2	0.631	ug/l	27-123	30	27-123	30	30	
2,4-Dichlorophenol	120-83-2	5	0.769	ug/l	30-130	30	30-130	30	30	
2,4-Dimethylphenol	105-67-9	5	1.64	ug/l	30-130	30	30-130	30	30	
2-Nitrophenol	88-75-5	10	1.52	ug/l	30-130	30	30-130	30	30	
4-Nitrophenol	100-02-7	10	1.77	ug/l	10-80	30	10-80	30	30	
2,4-Dinitrophenol	51-28-5	20	5.47	ug/l	20-130	30	20-130	30	30	
4,6-Dinitro-o-cresol	534-52-1	10	2.1	ug/l	20-164	30	20-164	30	30	
Pentachlorophenol	87-86-5	10	3.43	ug/l	9-103	30	9-103	30	30	

TABLE 2B: PARAMETERS - METHODS, LIMITS, ACCURACY AND PRECISION (WATER)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL Semivolatiles - EPA 8270D (WATER)										
Phenol	108-95-2	5	1.89	ug/l	12-110	30	12-110	30	30	
2-Methylphenol	95-48-7	5	1.02	ug/l	30-130	30	30-130	30	30	
3-Methylphenol/4-Methylphenol	106-44-5	5	1.11	ug/l	30-130	30	30-130	30	30	
2,4,5-Trichlorophenol	95-95-4	5	0.715	ug/l	30-130	30	30-130	30	30	
Benzoic Acid	65-85-0	50	12.9	ug/l	10-164	30	10-164	30	30	
Benzyl Alcohol	100-51-6	2	0.725	ug/l	26-116	30	26-116	30	30	
Carbazole	86-74-8	2	0.627	ug/l	55-144	30	55-144	30	30	
2-Fluorophenol	*367-12-4*									*21-120*
Phenol-d6	*13127-88-3*									*10-120*
Nitrobenzene-d5	*4165-60-0*									*23-120*
2-Fluorobiphenyl	*321-60-8*									*15-120*
2,4,6-Tribromophenol	*118-79-6*									*10-120*
4-Terphenyl-d14	*1718-51-0*									*41-149*
1,4 Dioxane - EPA 8270D-SIM (ug/L) (WATER)										
1,4-Dioxane	123-91-1	0.15	0.075	ug/l	40-140	30	40-140	30	30	
1,4-Dioxane-d8	*17647-74-4*									*15-110*
1,4-Dioxane-d8 (IS)	17647-74-4			ug/l						
TCL Pesticides - EPA 8081B (WATER)										
Delta-BHC	319-86-8	0.02	0.00467	ug/l	30-150	20	30-150	30	30	
Lindane	58-89-9	0.02	0.00434	ug/l	30-150	20	30-150	30	30	
Alpha-BHC	319-84-6	0.02	0.00439	ug/l	30-150	20	30-150	30	30	
Beta-BHC	319-85-7	0.02	0.0056	ug/l	30-150	20	30-150	30	30	
Heptachlor	76-44-8	0.02	0.0031	ug/l	30-150	20	30-150	30	30	
Aldrin	309-00-2	0.02	0.00216	ug/l	30-150	20	30-150	30	30	
Heptachlor epoxide	1024-57-3	0.02	0.00415	ug/l	30-150	20	30-150	30	30	
Endrin	72-20-8	0.04	0.00429	ug/l	30-150	20	30-150	30	30	
Endrin aldehyde	7421-93-4	0.04	0.0081	ug/l	30-150	20	30-150	30	30	
Endrin ketone	53494-70-5	0.04	0.00477	ug/l	30-150	20	30-150	30	30	
Dieldrin	60-57-1	0.04	0.00429	ug/l	30-150	20	30-150	30	30	
4,4'-DDE	72-55-9	0.04	0.00381	ug/l	30-150	20	30-150	30	30	
4,4'-DDD	72-54-8	0.04	0.00464	ug/l	30-150	20	30-150	30	30	
4,4'-DDT	50-29-3	0.04	0.00432	ug/l	30-150	20	30-150	30	30	
Endosulfan I	959-98-8	0.02	0.00345	ug/l	30-150	20	30-150	30	30	
Endosulfan II	33213-65-9	0.04	0.00519	ug/l	30-150	20	30-150	30	30	
Endosulfan sulfate	1031-07-8	0.04	0.00481	ug/l	30-150	20	30-150	30	30	
Methoxychlor	72-43-5	0.2	0.00684	ug/l	30-150	20	30-150	30	30	
Toxaphene	8001-35-2	0.2	0.0627	ug/l	30-150	20	30-150	30	30	
cis-Chlordane	5103-71-9	0.02	0.00666	ug/l	30-150	20	30-150	30	30	
trans-Chlordane	5103-74-2	0.02	0.00627	ug/l	30-150	20	30-150	30	30	
Chlordane	57-74-9	0.2	0.0463	ug/l	30-150	20	30-150	30	30	
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*
Decachlorobiphenyl	*2051-24-3*									*30-150*

TABLE 2B: PARAMETERS - METHODS, LIMITS, ACCURACY AND PRECISION (WATER)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Analyte	CAS #	RL	MDL	Units	LCS Criteria	LCS RPD	MS Criteria	MS RPD	Duplicate RPD	Surrogate Criteria
TCL PCBs - EPA 8082A (WATER)										
Aroclor 1016	12674-11-2	0.083	0.019588	ug/l	40-140	50	40-140	50	50	
Aroclor 1221	11104-28-2	0.083	0.031872	ug/l	40-140	50	40-140	50	50	
Aroclor 1232	11141-16-5	0.083	0.027058	ug/l	40-140	50	40-140	50	50	
Aroclor 1242	53469-21-9	0.083	0.029548	ug/l	40-140	50	40-140	50	50	
Aroclor 1248	12672-29-6	0.083	0.022576	ug/l	40-140	50	40-140	50	50	
Aroclor 1254	11097-69-1	0.083	0.034611	ug/l	40-140	50	40-140	50	50	
Aroclor 1260	11096-82-5	0.083	0.01992	ug/l	40-140	50	40-140	50	50	
Aroclor 1262	37324-23-5	0.083	0.017098	ug/l	40-140	50	40-140	50	50	
Aroclor 1268	11100-14-4	0.083	0.027058	ug/l	40-140	50	40-140	50	50	
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50	
PCBs, Total	1336-36-3	0.083	0.017098	ug/l				50	50	
2,4,5,6-Tetrachloro-m-xylene	*877-09-8*									*30-150*
Decachlorobiphenyl	*2051-24-3*									*30-150*
METALS by 6020A/7471B (WATER)										
Aluminum, Total	7429-90-5	0.01	0.00327	mg/l	80-120		75-125	20	20	
Antimony, Total	7440-36-0	0.004	0.000429	mg/l	80-120		75-125	20	20	
Arsenic, Total	7440-38-2	0.0005	0.000165	mg/l	80-120		75-125	20	20	
Barium, Total	7440-39-3	0.0005	0.000173	mg/l	80-120		75-125	20	20	
Beryllium, Total	7440-41-7	0.0005	0.000107	mg/l	80-120		75-125	20	20	
Cadmium, Total	7440-43-9	0.0002	0.0000599	mg/l	80-120		75-125	20	20	
Calcium, Total	7440-70-2	0.1	0.0394	mg/l	80-120		75-125	20	20	
Chromium, Total	7440-47-3	0.001	0.000178	mg/l	80-120		75-125	20	20	
Cobalt, Total	7440-48-4	0.0005	0.000163	mg/l	80-120		75-125	20	20	
Copper, Total	7440-50-8	0.001	0.000384	mg/l	80-120		75-125	20	20	
Iron, Total	7439-89-6	0.05	0.0191	mg/l	80-120		75-125	20	20	
Lead, Total	7439-92-1	0.001	0.000343	mg/l	80-120		75-125	20	20	
Magnesium, Total	7439-95-4	0.07	0.0242	mg/l	80-120		75-125	20	20	
Manganese, Total	7439-96-5	0.001	0.00044	mg/l	80-120		75-125	20	20	
Mercury, Total	7439-97-6	0.0002	0.000066	mg/l	80-120		75-125	20	20	
Nickel, Total	7440-02-0	0.002	0.000556	mg/l	80-120		75-125	20	20	
Potassium, Total	7440-09-7	0.1	0.0309	mg/l	80-120		75-125	20	20	
Selenium, Total	7782-49-2	0.005	0.00173	mg/l	80-120		75-125	20	20	
Silver, Total	7440-22-4	0.0004	0.000163	mg/l	80-120		75-125	20	20	
Sodium, Total	7440-23-5	0.1	0.0293	mg/l	80-120		75-125	20	20	
Thallium, Total	7440-28-0	0.0005	0.000143	mg/l	80-120		75-125	20	20	
Vanadium, Total	7440-62-2	0.005	0.00157	mg/l	80-120		75-125	20	20	
Zinc, Total	7440-66-6	0.01	0.00341	mg/l	80-120		75-125	20	20	
CYANIDE by 9010c/9012B (WATER)										
Cyanide, Total	57-12-5	0.005	0.0018	mg/l	85-115	20	80-120	20	20	

TABLE 2C: LABORATORY PARAMETERS (SOIL VAPOR)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Method	Analyte	Units	Reporting Limit		Method	Analyte	Units	Reporting Limit
TO15	Dichlorodifluoromethane	0.989	ug/m3		TO15	Dichlorodifluoromethane	0.2	ppbV
TO15	Chloromethane	0.413	ug/m3		TO15	Chloromethane	0.2	ppbV
TO15	Freon-114	1.4	ug/m3		TO15	Freon-114	0.2	ppbV
TO15	Vinyl chloride	0.511	ug/m3		TO15	Vinyl chloride	0.2	ppbV
TO15	1,3-Butadiene	0.442	ug/m3		TO15	1,3-Butadiene	0.2	ppbV
TO15	Bromomethane	0.777	ug/m3		TO15	Bromomethane	0.2	ppbV
TO15	Chloroethane	0.528	ug/m3		TO15	Chloroethane	0.2	ppbV
TO15	Ethanol	9.42	ug/m3		TO15	Ethanol	5	ppbV
TO15	Vinyl bromide	0.874	ug/m3		TO15	Vinyl bromide	0.2	ppbV
TO15	Acetone	2.38	ug/m3		TO15	Acetone	1	ppbV
TO15	Trichlorofluoromethane	1.12	ug/m3		TO15	Trichlorofluoromethane	0.2	ppbV
TO15	Isopropanol	1.23	ug/m3		TO15	Isopropanol	0.5	ppbV
TO15	1,1-Dichloroethene	0.793	ug/m3		TO15	1,1-Dichloroethene	0.2	ppbV
TO15	Tertiary butyl Alcohol	1.52	ug/m3		TO15	Tertiary butyl Alcohol	0.5	ppbV
TO15	Methylene chloride	1.74	ug/m3		TO15	Methylene chloride	0.5	ppbV
TO15	3-Chloropropene	0.626	ug/m3		TO15	3-Chloropropene	0.2	ppbV
TO15	Carbon disulfide	0.623	ug/m3		TO15	Carbon disulfide	0.2	ppbV
TO15	Freon-113	1.53	ug/m3		TO15	Freon-113	0.2	ppbV
TO15	trans-1,2-Dichloroethene	0.793	ug/m3		TO15	trans-1,2-Dichloroethene	0.2	ppbV
TO15	1,1-Dichloroethane	0.809	ug/m3		TO15	1,1-Dichloroethane	0.2	ppbV
TO15	Methyl tert butyl ether	0.721	ug/m3		TO15	Methyl tert butyl ether	0.2	ppbV
TO15	2-Butanone	1.47	ug/m3		TO15	2-Butanone	0.5	ppbV
TO15	cis-1,2-Dichloroethene	0.793	ug/m3		TO15	cis-1,2-Dichloroethene	0.2	ppbV
TO15	Ethyl Acetate	1.8	ug/m3		TO15	Ethyl Acetate	0.5	ppbV
TO15	Chloroform	0.977	ug/m3		TO15	Chloroform	0.2	ppbV
TO15	Tetrahydrofuran	1.47	ug/m3		TO15	Tetrahydrofuran	0.5	ppbV
TO15	1,2-Dichloroethane	0.809	ug/m3		TO15	1,2-Dichloroethane	0.2	ppbV
TO15	n-Hexane	0.705	ug/m3		TO15	n-Hexane	0.2	ppbV
TO15	1,1,1-Trichloroethane	1.09	ug/m3		TO15	1,1,1-Trichloroethane	0.2	ppbV
TO15	Benzene	0.639	ug/m3		TO15	Benzene	0.2	ppbV
TO15	Carbon tetrachloride	1.26	ug/m3		TO15	Carbon tetrachloride	0.2	ppbV
TO15	Cyclohexane	0.688	ug/m3		TO15	Cyclohexane	0.2	ppbV

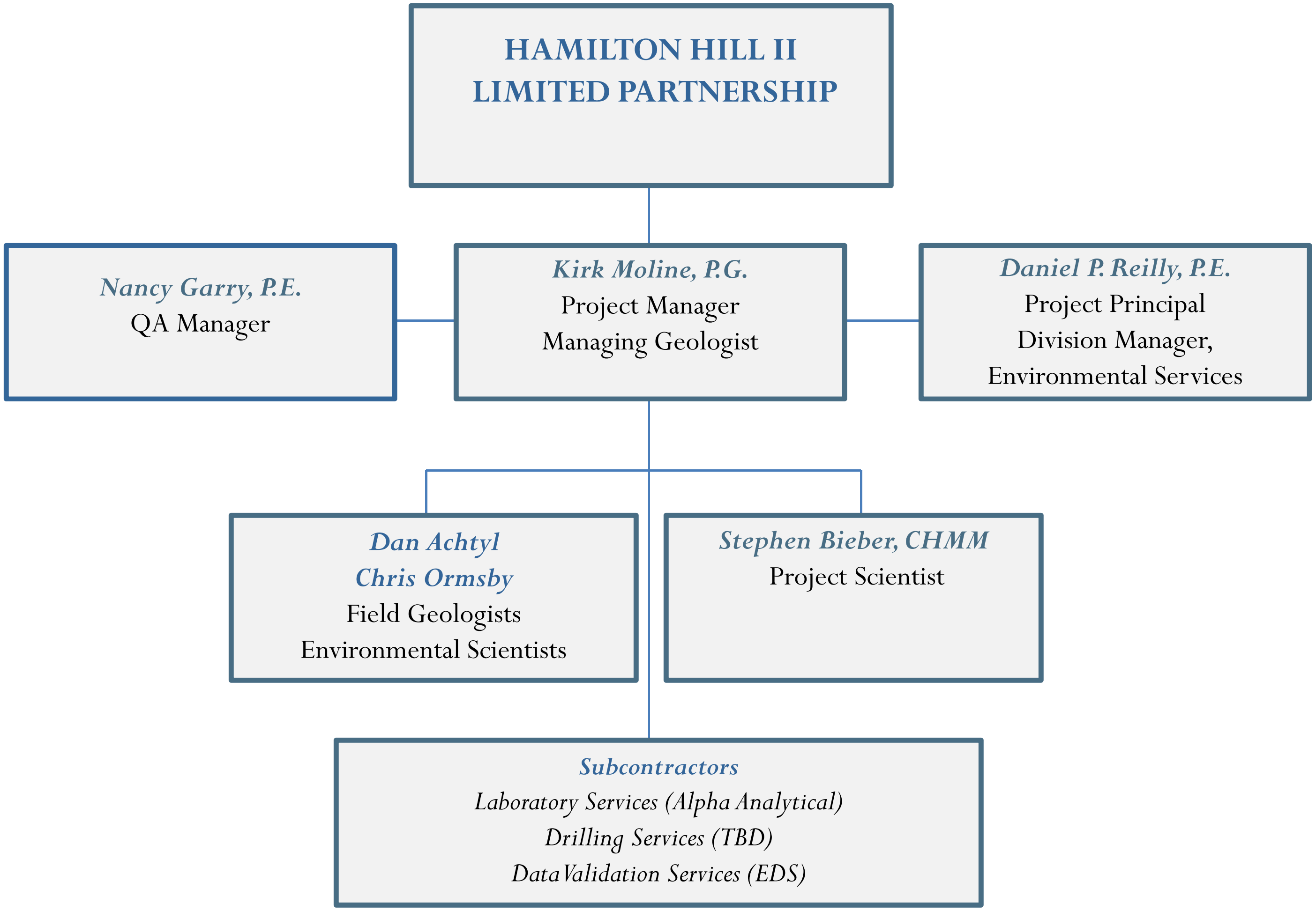
TABLE 2C: LABORATORY PARAMETERS (SOIL VAPOR)
HAMILTON HILL II - TARGET AREA 1 SITE
CITY OF SCHENECTADY, SCHENECTADY COUNTY

Method	Analyte	Units	Reporting Limit		Method	Analyte	Units	Reporting Limit
TO15	1,2-Dichloropropane	0.924	ug/m3		TO15	1,2-Dichloropropane	0.2	ppbV
TO15	Bromodichloromethane	1.34	ug/m3		TO15	Bromodichloromethane	0.2	ppbV
TO15	1,4-Dioxane	0.721	ug/m3		TO15	1,4-Dioxane	0.2	ppbV
TO15	Trichloroethene	1.07	ug/m3		TO15	Trichloroethene	0.2	ppbV
TO15	2,2,4-Trimethylpentane	0.934	ug/m3		TO15	2,2,4-Trimethylpentane	0.2	ppbV
TO15	Heptane	0.82	ug/m3		TO15	Heptane	0.2	ppbV
TO15	cis-1,3-Dichloropropene	0.908	ug/m3		TO15	cis-1,3-Dichloropropene	0.2	ppbV
TO15	4-Methyl-2-pentanone	2.05	ug/m3		TO15	4-Methyl-2-pentanone	0.5	ppbV
TO15	trans-1,3-Dichloropropene	0.908	ug/m3		TO15	trans-1,3-Dichloropropene	0.2	ppbV
TO15	1,1,2-Trichloroethane	1.09	ug/m3		TO15	1,1,2-Trichloroethane	0.2	ppbV
TO15	Toluene	0.754	ug/m3		TO15	Toluene	0.2	ppbV
TO15	2-Hexanone	0.82	ug/m3		TO15	2-Hexanone	0.2	ppbV
TO15	Dibromochloromethane	1.7	ug/m3		TO15	Dibromochloromethane	0.2	ppbV
TO15	1,2-Dibromoethane	1.54	ug/m3		TO15	1,2-Dibromoethane	0.2	ppbV
TO15	Tetrachloroethene	1.36	ug/m3		TO15	Tetrachloroethene	0.2	ppbV
TO15	Chlorobenzene	0.921	ug/m3		TO15	Chlorobenzene	0.2	ppbV
TO15	Ethylbenzene	0.869	ug/m3		TO15	Ethylbenzene	0.2	ppbV
TO15	p/m-Xylene	1.74	ug/m3		TO15	p/m-Xylene	0.4	ppbV
TO15	Bromoform	2.07	ug/m3		TO15	Bromoform	0.2	ppbV
TO15	Styrene	0.852	ug/m3		TO15	Styrene	0.2	ppbV
TO15	1,1,2,2-Tetrachloroethane	1.37	ug/m3		TO15	1,1,2,2-Tetrachloroethane	0.2	ppbV
TO15	o-Xylene	0.869	ug/m3		TO15	o-Xylene	0.2	ppbV
TO15	4-Ethyltoluene	0.983	ug/m3		TO15	4-Ethyltoluene	0.2	ppbV
TO15	1,3,5-Trimethylbenzene	0.983	ug/m3		TO15	1,3,5-Trimethylbenzene	0.2	ppbV
TO15	1,2,4-Trimethylbenzene	0.983	ug/m3		TO15	1,2,4-Trimethylbenzene	0.2	ppbV
TO15	Benzyl chloride	1.04	ug/m3		TO15	Benzyl chloride	0.2	ppbV
TO15	1,3-Dichlorobenzene	1.2	ug/m3		TO15	1,3-Dichlorobenzene	0.2	ppbV
TO15	1,4-Dichlorobenzene	1.2	ug/m3		TO15	1,4-Dichlorobenzene	0.2	ppbV
TO15	1,2-Dichlorobenzene	1.2	ug/m3		TO15	1,2-Dichlorobenzene	0.2	ppbV
TO15	1,2,4-Trichlorobenzene	1.48	ug/m3		TO15	1,2,4-Trichlorobenzene	0.2	ppbV
TO15	Hexachlorobutadiene	2.13	ug/m3		TO15	Hexachlorobutadiene	0.2	ppbV

ATTACHMENT A

ORGANIZATIONAL CHART

C.T. MALE PROJECT ORGANIZATION – HAMILTON HILL II – TARGET AREA 1 SITE



HAMILTON HILL II
LIMITED PARTNERSHIP

Nancy Garry, P.E.
QA Manager

Kirk Moline, P.G.
Project Manager
Managing Geologist

Daniel P. Reilly, P.E.
Project Principal
Division Manager,
Environmental Services

Dan Achtyl
Chris Ormsby
Field Geologists
Environmental Scientists

Stephen Bieber, CHMM
Project Scientist

Subcontractors
Laboratory Services (Alpha Analytical)
Drilling Services (TBD)
Data Validation Services (EDS)

ATTACHMENT B

PERSONNEL RESUMES

C. T. Male Associates

Kirk Moline, P.G., CEI, CES

Managing Geologist/Principal

Education:
Bachelor of Arts, Geological Science, SUNY Potsdam, Potsdam, NY

Professional Background:
Licensed Professional Geologist – NY

Environmental Assessment Association
- Certified Environmental Inspector
- Certified Environmental Specialist

Professional Affiliations:
Board Member, Town of Wilton Zoning Board of Appeals, 2005-2006

Vice Chair, Town of Wilton Water & Sewer Authority, 2006-Present

Continuing Education:

ASTM 1527-05 Phase I ESA Training and Certification

ASTM Risk Based Corrective Action Certification

Environmental Due Diligence in Real Estate and Commercial Transactions

Principals and Practice of Forced Air Remediation

Groundwater Pollution and Hydrology

REI Site Assessment of Real Estate for Hazardous Waste

OSHA 1910.120 HAZWOPER and Annual 8 Hour Certification

Hazardous Waste Management, Environmental Law, RPI

Mr. Moline has been with C. T. Male for over 20 years serving as a Senior Project Manager/Hydrogeologist. His experience is broad and has primarily focused on hazardous waste and petroleum spill site investigation and remediation, environmental site assessments, and exploration and development of municipal and private water supplies. With the passing of the 1996 NYS Clean Air Clean Water Environmental Bond Act, Mr. Moline has served as the Project Manager on many Environmental Restoration Program Projects, and several Brownfield Cleanup Program project sites. His experience also includes management of over 1,000 environmental site assessments, nearly 200 Phase II environmental site assessments, vapor intrusion assessments solid waste landfill closure hydrogeologic investigations, mineral resource evaluations, geophysical surveying, and expert witness testimony.

Notable Project Experience:

NYSDEC ERP & BCP Projects
- 188 Warburton & 33 Ashburton BCPs, Yonkers, NY
- Former Grand Union BCP, Fort Edward, NY
- Long Energy Site BCP Application, Albany, NY
- 312 Broadway & 314 Clinton Street, Schenectady, NY
- Pan American Tannery, Independent Leather & Risedorph Tannery, Gloversville, NY
- Durkee Street Parking Lot, Plattsburgh, NY
- South Troy Industrial Park, Troy, NY
- 99 North Main Street, 104 & 107 South Main Street, Dolgeville, NY
- 400 Broadway, Saranac Lake, NY
- Former Dix Avenue Drive-In Theater, Kingsbury, NY
- Former CP Rail Yard, Plattsburgh, NY
- South Troy Industrial Park, Troy, NY
- Public School #6, Yonkers, NY

Environmental Site Assessment Phase I & II
- Managed and performed over 3,000 assessments
- Land Reutilization Corp. of the Capital Region – Phase I ESAs & NEPA Reviews
- Albany County Land Bank, Multiple Phase I ESAs
- Petroleum Spill Investigation, Johnstown, NY
- Burgess Terminal, Scotia, NY
- Former YMCA, Saratoga Springs, NY
- Former IGA Supermarket, Greenwich, NY
- Former Texaco Terminal, Bethlehem, NY

C. T. Male Associates

Daniel P. Reilly, P.E.

Division Manager - Environmental Services
Director of Operations

Professional Background:
Licensed Professional Engineer – New York

Education:
Bachelor of Science, Environmental Engineering, Rensselaer Polytechnic Institute, Troy, NY

Professional Affiliations:
Eastern NY Chapter Air & Waste Management Association

Specialized Training:
OSHA 40-Hour Health & Safety Training

Mr. Reilly joined C.T. Male Associates in 1993 as an Environmental Engineer. He was subsequently offered and accepted responsibilities as an Owner and Principal, which includes the responsibility of representing the firm at many community and professional functions. In 2012 Mr. Reilly was promoted to Operations Manager of the Environmental Services Division, and was subsequently promoted to Division Manager of Environmental Services and the firm's Director of Operations. Mr. Reilly is responsible for the personnel, production and operations of the Environmental Services Group and for coordinating similar functions within the other Divisions. He manages and supervises a staff of 22 employees consisting of licensed professional engineers, certified geologists/hydro-geologists, industrial hygienists, scientists, and support staff. He is responsible for aligning appropriate staff to accommodate the production demands of many active projects within the Group. He also prepares and reviews proposals, budgets and contract documents, and performs quality reviews of project deliverables.

Mr. Reilly has managed two NYSOGS Term Contracts. Projects under these contracts have included:

- Renovation of a Historic Rest Area Building as the First Taste NY Facility, Todd Hill Rest Area
- Water System Improvements, Bedford Hills Correctional Facility
- WWTP, I684 Rest Area
- Replace Water Main, Clinton Correctional Facility
- Clean Waste Water Treatment Plant Building 44 Lagoons, Green Haven Correctional Facility
- Provide Lead Abatement of Water Storage Tank, Bedford Hill Correctional Facility
- Study to Evaluate Leach Field, Region 1 Duanesburg MSH
- Install Water Meters and Water Meter Pits, Hudson Correctional Facility
- Replace Water Distribution System, Elmira Correctional Facility
- Asbestos, Lead and Bird Dropping Sampling & Design Services, Eastern Correctional Facility

C. T. Male Associates

Nancy E. Garry, P.E., C.S.P.

Senior Environmental Engineer

Professional Background:
Licensed Professional Engineer – New York

Certified Safety Professional

Education:
Master of Arts, Environmental Engineering, Rensselaer Polytechnic Institute, Troy, NY

Bachelor of Arts, Chemistry/Biology, College of St. Rose, Albany, NY

Professional Affiliations:
NYS Society of Professional Engineers

Capital District Chapter, NYS Society of Professional Engineers, Director 2017-2019

Specialized Training:
OSHA 40-Hour Health & Safety Training

OSHA 10-Hour Construction Safety & Health

Ms. Garry joined C.T. Male in 2017 as a Senior Environmental Engineer. She has over 20 years experience in site investigation and remediation projects and environmental compliance. Ms. Garry also has extensive experience in OSHA and environmental, health and safety on-site compliance for industrial and government clients.

Ms. Garry is responsible for projects including Clean Air Act assessments and compliance; Risk Management Plans; chemical and petroleum bulk storage assessments and compliance; environmental audits; Phase 1 & 2 environmental site assessments; and various environmental engineering projects.

Notable Project Experience:

NYSDEC ERP & BCP

- Former Stevens & Thompson Paper Mill, Greenwich, NY, BCP
- Scolite Site, City of Troy, NY, ERP
- South Troy Waterfront, Troy, NY, NYS BOA (Brownfield Opportunity Assessment)
- Sawmill Place Remediation Area A, B, and C, Wallkill, NY, BCP
- Mechanicville Light Industrial Park, City of Mechanicville, NY, ERP
- 37 Commonwealth Drive, Wyandanch, NY, ERP

Ms. Garry has managed a three year NYSOGS and a seven year NYSDEC Term Contract. Projects under these contracts have included:

- Tank design packages for the removal and installation of ASTs for back up fuel sources and fueling stations at numerous Department of Corrections and Community Supervision facilities throughout NYS.
- Three NYSDOT former spills sites that required remediation, ongoing monitoring, and spill closure.
- Managed approx. twenty five projects under the NYSDEC contract that included site characterizations, remedial investigations, feasibility studies, and site management throughout NYS.

Nancy Weaver

Education

B.S., Chemistry, University of Colorado, Denver, Colorado

Certifications and Training

State of New York Department of Environmental Conservation certified Asbestos Inspector

40-Hour OSHA Hazardous Waste Training

8-Hour Health and Safety Supervisor Training for Hazardous Waste Operations

Relevant Experience

- More than 20 years combined laboratory, data validation and project management experience
- Experienced in writing Quality Assurance Project Plans (QAPPs), managing subcontracted analytical laboratories, performing laboratory audits, and analyzing samples in a laboratory.

Experience Overview

Ms. Weaver has over twenty years combined laboratory, data validation and project management experience. She is the President and co-founder of EDS and is responsible for the technical data review and validation of laboratory data. Ms. Weaver has performed data validation on thousands of data validation projects. She has extensive knowledge in applying the various regional and project specific data validation guidelines and QAPPs. Her experience also includes writing Quality Assurance Project Plans (QAPPs), managing subcontracted analytical laboratories, performing laboratory audits, participating in field sampling activities and analyzing samples in a laboratory.

Relevant Project Experience

Principal/Senior Chemist, Environmental Data Services, Inc., Williamsburg, Virginia, August 1994 - Present. As the Principal Chemist at Environmental Data Services, Inc., Ms. Weaver has provided Level IV data review on more than 6000 Sample Delivery Groups (SDGs) generated through site investigations and/or remediations. These SDGs have included every analytical fraction possible including VOC, SVOC, pesticides, PCBs, herbicides, DRO, GRO, dioxin/furans, PCB congeners, metals, wet chemistry and radiological parameters. Sample matrices include water, soil, sediment, wipe, concrete and air. The SDGs have included CLP data packages produced under the CLP SOWs and CLP-like data packages with samples analyzed under SW-864 methodologies. Sample quantities validated may reach upwards of 120,000 per fraction over the past 20 years. Ms. Weaver has been using the USEPA National Functional Data Validation Guidelines since 1993 and has provided Level IV (full) and Level III (cursory) validation. Specifically validated PCB congeners by EPA Method 1668 and dioxin/furans by EPA Method 1613 using the USEPA National Functional Guidelines, USEPA Region I and USEPA Region III data validation guidelines. Validated radiological parameters analyzed by alpha and gamma spectrometry using the USACE Kansas City and St. Louis District Radionuclide Data Quality Evaluation Guidance.

Chemist-Analyst Specialist, City & County of Denver, Denver, Colorado, June 1992 - August 1994. As a Chemist-Analyst Specialist for the City and County of Denver, Ms. Weaver supervised performance and compliance sampling for O & M requirements at groundwater treatment facility. She provided assessment of analytical data for quarterly reports to local regulatory agencies. She also acted as liaison between the technical group and laboratory to coordinate sampling events and resolve problems with analyses. While in this capacity, she performed data validation for organic, inorganic and radiological analyses. Ms. Weaver reviewed over 2000 VOC, SVOC, pesticide, PCB, TPH, metals and wet chemistry samples. Ms. Weaver managed the database for groundwater and treatment plant sampling events and performed environmental site assessments for commercial and residential properties. She provided technical review and recommendations of Phase I and Phase II site investigations performed by outside consultants. She also analyzed policy and interpreted city, state and federal environmental regulations.

Data Validation Specialist, C.C. Johnson & Malhotra, Lakewood, Colorado, January 1990 to June 1992. While a Data Validation Specialist at C.C. Johnson & Malhorta, Ms. Weaver performed data validation and interpretation of organic analytical data generated from the EPA Contract Laboratory Program (CLP). Data analysis included VOC, SVOC, pesticides, PCBs, metals and wet chemistry. Ms. Weaver reviewed more than 600 SDGs and 9000 samples. She interpreted gas chromatograms, gas chromatography/mass spectral data and verified mathematical calculations.

Environmental Chemist, The Anschutz Corporation - SP Environmental Systems, Inc., Denver, Colorado, July 1990 to January 1992. As an Environmental Chemist for The Anschutz Corporation - SP Environmental Systems, Inc., Ms. Weaver assisted in the management of site investigations and remediation for Southern Pacific Transportation Company properties. In this capacity, she performed environmental audits and site assessments and conducted site investigations at potential Superfund sites with state and federal agencies. She researched and prepared responses to regulatory agencies for non-compliant sites and defined the needs for hazardous waste disposal including the analysis required and disposal. Ms. Weaver also supervised the removal of underground storage tanks and remediation. She prepared closure reports for UST removals, as well as annual waste summary forms for TSD facilities throughout the state of Texas. She also constructed, developed, and sampled groundwater monitoring wells.

Environmental Specialist, Martin Marietta Astronautics Group, Denver, Colorado, January 1988 to January 1990. While with Martin Marietta Astronautics Group as an Environmental Specialist, Ms. Weaver performed organic analysis and sampling of wastewater, groundwater, and drinking water in support of NPDES permit. She operated and maintained laboratory instrumentation including GC and GC/MS for volatile, semi-volatile, and pesticide/PCB analysis. Ms. Weaver also coordinated sample collection and preparation activities, developed and authored standard operating procedures for laboratory analysis, and followed EPA protocol for QA/QC requirements for analysis. She calculated and interpreted data and reported results.

Environmental Chemist, Camp, Dresser, & McKee, Boston, Massachusetts, April 1986 to October 1987. As an Environmental Chemist with Camp, Dresser, & McKee, Ms. Weaver analyzed water/wastewater for organic compounds. She operated and maintained laboratory instrumentation including GC and infrared spectrophotometer for volatile, pesticide/PCB, and petroleum hydrocarbon analysis. She also calculated and interpreted data and reported results. Ms. Weaver analyzed more than 2000 samples.

Employment History

Environmental Data Services, Inc.	Principal/Senior Chemist	1994–Present
City & County of Denver	Chemist-Analyst Specialist	1992–1994
C.C. Johnson & Malhorta	Contractor/Data Validation Specialist	1990–1992
The Anschutz Corporation - SP Environmental Systems, Inc.	Environmental Chemist	1990–1992
Martin Marietta Astronautics Group	Environmental Specialist	1988–1990
Camp, Dresser, & McKee	Environmental Chemist	1986–1987

ENVIRONMENTAL
Data Services, Inc.

Nancy Weaver

Education

B.S., Chemistry, University of Colorado, Denver, Colorado

Certifications and Training

State of New York Department of Environmental Conservation certified Asbestos Inspector

40-Hour OSHA Hazardous Waste Training

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Martin Marietta Astronautics Group	Environmental Specialist	1988–1990
Camp, Dresser, & McKee	Environmental Chemist	1986–1987

ATTACHMENT C

CERTIFICATIONS

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Lead on Air Filter	EPA 40 CFR Part 50 App. G	AE	x	Y	
NY	PCBs and Aroclors	EPA TO-10A	AE	x	Y	
NY	Acenaphthene	EPA TO-13A Full Scan	AE	x	Y	
NY	Acenaphthylene	EPA TO-13A Full Scan	AE	x	Y	
NY	Anthracene	EPA TO-13A Full Scan	AE	x	Y	
NY	Benzo(a)anthracene	EPA TO-13A Full Scan	AE	x	Y	
NY	Benzo(a)pyrene	EPA TO-13A Full Scan	AE	x	Y	
NY	Benzo(b)fluoranthene	EPA TO-13A Full Scan	AE	x	Y	
NY	Benzo(ghi)perylene	EPA TO-13A Full Scan	AE	x	Y	
NY	Benzo(k)fluoranthene	EPA TO-13A Full Scan	AE	x	Y	
NY	Chrysene	EPA TO-13A Full Scan	AE	x	Y	
NY	Dibenzo(a,h)anthracene	EPA TO-13A Full Scan	AE	x	Y	
NY	Fluoranthene	EPA TO-13A Full Scan	AE	x	Y	
NY	Fluorene	EPA TO-13A Full Scan	AE	x	Y	
NY	Indeno(1,2,3-cd)pyrene	EPA TO-13A Full Scan	AE	x	Y	
NY	Naphthalene	EPA TO-13A Full Scan	AE	x	Y	
NY	Phenanthrene	EPA TO-13A Full Scan	AE	x	Y	
NY	Pyrene	EPA TO-13A Full Scan	AE	x	Y	
NY	1,1,1-Trichloroethane	EPA TO-15	AE	x	Y	
NY	1,1,2,2-Tetrachloroethane	EPA TO-15	AE	x	Y	
NY	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA TO-15	AE	x	Y	
NY	1,1,2-Trichloroethane	EPA TO-15	AE	x	Y	
NY	1,1-Dichloroethane	EPA TO-15	AE	x	Y	
NY	1,1-Dichloroethene	EPA TO-15	AE	x	Y	
NY	1,2,4-Trichlorobenzene	EPA TO-15	AE	x	Y	
NY	1,2,4-Trimethylbenzene	EPA TO-15	AE	x	Y	
NY	1,2-Dibromo-3-Chloropropane (DBCP)	EPA TO-15	AE	x	Y	
NY	1,2-Dibromoethane (EDB)	EPA TO-15	AE	x	Y	
NY	1,2-Dichlorobenzene	EPA TO-15	AE	x	Y	
NY	1,2-Dichloroethane	EPA TO-15	AE	x	Y	
NY	1,2-Dichloropropane	EPA TO-15	AE	x	Y	
NY	1,2-Dichlorotetrafluoroethane	EPA TO-15	AE	x	Y	
NY	1,3,5-Trimethylbenzene	EPA TO-15	AE	x	Y	
NY	1,3-Butadiene	EPA TO-15	AE	x	Y	
NY	1,3-Dichlorobenzene	EPA TO-15	AE	x	Y	
NY	1,4-Dichlorobenzene	EPA TO-15	AE	x	Y	
NY	1,4-Dioxane	EPA TO-15	AE	x	Y	
NY	2,2,4-Trimethylpentane	EPA TO-15	AE	x	Y	
NY	2-Butanone	EPA TO-15	AE	x	Y	
NY	2-Chlorotoluene	EPA TO-15	AE	x	Y	
NY	3-Chloropropene	EPA TO-15	AE	x	Y	
NY	4-Methyl-2-Pentanone	EPA TO-15	AE	x	Y	
NY	Acetaldehyde	EPA TO-15	AE	x	Y	
NY	Acetone	EPA TO-15	AE	x	Y	
NY	Acetonitrile	EPA TO-15	AE	x	Y	
NY	Acrolein	EPA TO-15	AE	x	Y	
NY	Acrylonitrile	EPA TO-15	AE	x	Y	
NY	Benzene	EPA TO-15	AE	x	Y	
NY	Benzyl Chloride	EPA TO-15	AE	x	Y	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Bromodichloromethane	EPA TO-15	AE	x	Y	
NY	Bromoform	EPA TO-15	AE	x	Y	
NY	Bromomethane	EPA TO-15	AE	x	Y	
NY	Carbon Disulfide	EPA TO-15	AE	x	Y	
NY	Carbon Tetrachloride	EPA TO-15	AE	x	Y	
NY	Chlorobenzene	EPA TO-15	AE	x	Y	
NY	Chloroethane	EPA TO-15	AE	x	Y	
NY	Chloroform	EPA TO-15	AE	x	Y	
NY	Chloromethane	EPA TO-15	AE	x	Y	
NY	cis-1,2-Dichloroethene	EPA TO-15	AE	x	Y	
NY	cis-1,3-Dichloropropene	EPA TO-15	AE	x	Y	
NY	Cyclohexane	EPA TO-15	AE	x	Y	
NY	Dibromochloromethane	EPA TO-15	AE	x	Y	
NY	Dichlorodifluoromethane	EPA TO-15	AE	x	Y	
NY	Ethylbenzene	EPA TO-15	AE	x	Y	
NY	Hexachlorobutadiene	EPA TO-15	AE	x	Y	
NY	Isopropyl Alcohol	EPA TO-15	AE	x	Y	
NY	Isopropylbenzene	EPA TO-15	AE	x	Y	
NY	m+p-Xylene	EPA TO-15	AE	x	Y	
NY	Methyl Alcohol (methanol)	EPA TO-15	AE	x	Y	
NY	Methyl Methacrylate	EPA TO-15	AE	x	Y	
NY	Methyl tert-butyl ether	EPA TO-15	AE	x	Y	
NY	Methylene Chloride	EPA TO-15	AE	x	Y	
NY	Naphthalene	EPA TO-15	AE	x	Y	
NY	n-Heptane	EPA TO-15	AE	x	Y	
NY	n-Hexane	EPA TO-15	AE	x	Y	
NY	o-Xylene	EPA TO-15	AE	x	Y	
NY	Styrene	EPA TO-15	AE	x	Y	
NY	Tert-Butyl Alcohol	EPA TO-15	AE	x	Y	
NY	Tetrachloroethene	EPA TO-15	AE	x	Y	
NY	Toluene	EPA TO-15	AE	x	Y	
NY	Total Xylenes	EPA TO-15	AE	x	Y	
NY	Trans-1,2-Dichloroethene	EPA TO-15	AE	x	Y	
NY	Trans-1,3-Dichloropropene	EPA TO-15	AE	x	Y	
NY	Trichloroethene	EPA TO-15	AE	x	Y	
NY	Trichlorofluoromethane	EPA TO-15	AE	x	Y	
NY	Vinyl acetate	EPA TO-15	AE	x	Y	
NY	Vinyl Bromide	EPA TO-15	AE	x	Y	
NY	Vinyl Chloride	EPA TO-15	AE	x	Y	
NY	Turbidity	EPA 180.1	DW	Y	x	
NY	Aluminum	EPA 200.7	DW	x	Y	
NY	Barium	EPA 200.7	DW	x	Y	
NY	Beryllium	EPA 200.7	DW	x	Y	
Ny	Boron	EPA 200.7	DW	x	Y	
NY	Cadmium	EPA 200.7	DW	x	Y	
NY	Calcium	EPA 200.7	DW	x	Y	
NY	Calcium Hardness	EPA 200.7	DW	x	Y	
NY	Chromium	EPA 200.7	DW	x	Y	
NY	Copper	EPA 200.7	DW	x	Y	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Iron	EPA 200.7	DW	x	Y	
NY	Magnesium	EPA 200.7	DW	x	Y	
NY	Manganese	EPA 200.7	DW	x	Y	
NY	Nickel	EPA 200.7	DW	x	Y	
NY	Potassium	EPA 200.7	DW	x	Y	
NY	Silver	EPA 200.7	DW	x	Y	
NY	Sodium	EPA 200.7	DW	x	Y	
Ny	Vanadium	EPA 200.7	DW	x	Y	
NY	Zinc	EPA 200.7	DW	x	Y	
NY	Aluminum	EPA 200.8	DW	x	Y	
NY	Antimony	EPA 200.8	DW	x	Y	
NY	Arsenic	EPA 200.8	DW	x	Y	
NY	Barium	EPA 200.8	DW	x	Y	
NY	Beryllium	EPA 200.8	DW	x	Y	
NY	Cadmium	EPA 200.8	DW	x	Y	
NY	Copper	EPA 200.8	DW	x	Y	
NY	Lead	EPA 200.8	DW	x	Y	
Ny	Manganese	EPA 200.8	DW	x	Y	
NY	Nickel	EPA 200.8	DW	x	Y	
NY	Selenium	EPA 200.8	DW	x	Y	
NY	Silver	EPA 200.8	DW	x	Y	
NY	Thallium	EPA 200.8	DW	x	Y	
NY	Vanadium	EPA 200.8	DW	x	Y	
NY	Zinc	EPA 200.8	DW	x	Y	
NY	Mercury	EPA 245.1	DW	x	Y	
NY	Chloride	EPA 300.0	DW	Y	x	
NY	Fluoride	EPA 300.0	DW	Y	x	
NY	Sulfate	EPA 300.0	DW	Y	x	
NY	Perchlorate	EPA 332.0	DW	Y	x	
NY	1,2-Dibromo-3-Chloropropane (DBCP)	EPA 504.1	DW	Y	x	
NY	1,2-Dibromoethane (EDB)	EPA 504.1	DW	Y	x	
NY	1,1,1,2-Tetrachloroethane	EPA 524.2	DW	Y	x	
NY	1,1,1-Trichloroethane	EPA 524.2	DW	Y	x	
NY	1,1,2,2-Tetrachloroethane	EPA 524.2	DW	Y	x	
NY	1,1,2-Trichloroethane	EPA 524.2	DW	Y	x	
NY	1,1-Dichloroethane	EPA 524.2	DW	Y	x	
NY	1,1-Dichloroethene	EPA 524.2	DW	Y	x	
NY	1,1-Dichloropropene	EPA 524.2	DW	Y	x	
NY	1,2,3-Trichlorobenzene	EPA 524.2	DW	Y	x	
NY	1,2,3-Trichloropropane	EPA 524.2	DW	Y	x	
NY	1,2,4-Trichlorobenzene	EPA 524.2	DW	Y	x	
NY	1,2,4-Trimethylbenzene	EPA 524.2	DW	Y	x	
NY	1,2-Dichlorobenzene	EPA 524.2	DW	Y	x	
NY	1,2-Dichloroethane	EPA 524.2	DW	Y	x	
NY	1,2-Dichloropropane	EPA 524.2	DW	Y	x	
NY	1,3,5-Trimethylbenzene	EPA 524.2	DW	Y	x	
NY	1,3-Dichlorobenzene	EPA 524.2	DW	Y	x	
NY	1,3-Dichloropropane	EPA 524.2	DW	Y	x	
NY	1,4-Dichlorobenzene	EPA 524.2	DW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	2,2-Dichloropropane	EPA 524.2	DW	Y	x	
NY	2-Chlorotoluene	EPA 524.2	DW	Y	x	
NY	4-Chlorotoluene	EPA 524.2	DW	Y	x	
NY	Benzene	EPA 524.2	DW	Y	x	
NY	Bromobenzene	EPA 524.2	DW	Y	x	
NY	Bromochloromethane	EPA 524.2	DW	Y	x	
NY	Bromodichloromethane	EPA 524.2	DW	Y	x	
NY	Bromoform	EPA 524.2	DW	Y	x	
NY	Bromomethane	EPA 524.2	DW	Y	x	
NY	Carbon Tetrachloride	EPA 524.2	DW	Y	x	
NY	Chlorobenzene	EPA 524.2	DW	Y	x	
NY	Chloroethane	EPA 524.2	DW	Y	x	
NY	Chloroform	EPA 524.2	DW	Y	x	
NY	Chloromethane	EPA 524.2	DW	Y	x	
NY	cis-1,2-Dichloroethene	EPA 524.2	DW	Y	x	
NY	cis-1,3-Dichloropropene	EPA 524.2	DW	Y	x	
NY	Dibromochloromethane	EPA 524.2	DW	Y	x	
NY	Dibromomethane	EPA 524.2	DW	Y	x	
NY	Dichlorodifluoromethane	EPA 524.2	DW	Y	x	
NY	Ethylbenzene	EPA 524.2	DW	Y	x	
NY	Hexachlorobutadiene	EPA 524.2	DW	Y	x	
NY	Isopropylbenzene	EPA 524.2	DW	Y	x	
NY	Methyl tert-butyl ether	EPA 524.2	DW	Y	x	
NY	Methylene chloride	EPA 524.2	DW	Y	x	
NY	Naphthalene	EPA 524.2	DW	Y	x	
NY	n-Butylbenzene	EPA 524.2	DW	Y	x	
NY	n-Propylbenzene	EPA 524.2	DW	Y	x	
NY	p-Isopropyltoluene	EPA 524.2	DW	Y	x	
NY	sec-Butylbenzene	EPA 524.2	DW	Y	x	
NY	Styrene	EPA 524.2	DW	Y	x	
NY	Tert-Butylbenzene	EPA 524.2	DW	Y	x	
NY	Tetrachloroethene	EPA 524.2	DW	Y	x	
NY	Toluene	EPA 524.2	DW	Y	x	
NY	Total Trihalomethanes	EPA 524.2	DW	Y	x	
NY	Total Xylenes	EPA 524.2	DW	Y	x	
NY	Trans-1,2-Dichloroethene	EPA 524.2	DW	Y	x	
NY	Trans-1,3-Dichloropropene	EPA 524.2	DW	Y	x	
NY	Trichloroethene	EPA 524.2	DW	Y	x	
NY	Trichlorofluoromethane	EPA 524.2	DW	Y	x	
NY	Vinyl chloride	EPA 524.2	DW	Y	x	
NY	Perfluoro-n-octanoic acid (PFOA)	EPA 537	DW	x	Y	
NY	Perfluorooctanesulfonic acid (PFOS)	EPA 537	DW	x	Y	
NY	Color	SM 2120B	DW	Y	x	
NY	Turbidity	SM 2130B	DW	Y	x	
NY	Odor	SM 2150B	DW	Y	x	
NY	Alkalinity	SM 2320B	DW	Y	x	
NY	Specific Conductance	SM 2510B	DW	Y	x	
NY	Total Dissolved Solids	SM 2540C	DW	Y	x	
NY	Cyanide, Distillation	SM 4500 CN C	DW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Cyanide, Total	SM 4500 CN E	DW	Y	x	
NY	Fluoride	SM 4500 F-C	DW	Y	x	
NY	Nitrate-N	SM 4500 NO3-F	DW	Y	x	
NY	Nitrite-N	SM 4500 NO3-F	DW	Y	x	
NY	Total Organic Carbon	SM 5310C	DW	Y	x	
NY	Heterotrophic Plate Count	SM 9215B	DW	Y	x	
NY	Coliform, Total	SM 9223B	DW	Y	x	
NY	E. Coli	SM 9223B	DW	Y	x	P/A
NY	E. Coli	SM 9223B	DW	Y	x	Enumeration
NY	Specific Conductance	EPA 120.1	NPW	Y	x	
NY	Mercury	EPA 1631E	NPW	x	Y	
NY	Oil & Grease	EPA 1664A	NPW	Y	x	
NY	Oil & Grease (TPH)	EPA 1664A	NPW	Y	x	
NY	Turbidity	EPA 180.1	NPW	Y	x	
NY	Aluminum	EPA 200.7	NPW	x	Y	
NY	Antimony	EPA 200.7	NPW	x	Y	
NY	Arsenic	EPA 200.7	NPW	x	Y	
NY	Barium	EPA 200.7	NPW	x	Y	
NY	Beryllium	EPA 200.7	NPW	x	Y	
NY	Boron	EPA 200.7	NPW	x	Y	
NY	Cadmium	EPA 200.7	NPW	x	Y	
NY	Calcium	EPA 200.7	NPW	x	Y	
NY	Chromium	EPA 200.7	NPW	x	Y	
NY	Cobalt	EPA 200.7	NPW	x	Y	
NY	Copper	EPA 200.7	NPW	x	Y	
NY	Iron	EPA 200.7	NPW	x	Y	
NY	Lead	EPA 200.7	NPW	x	Y	
NY	Magnesium	EPA 200.7	NPW	x	Y	
NY	Manganese	EPA 200.7	NPW	x	Y	
NY	Molybdenum	EPA 200.7	NPW	x	Y	
NY	Nickel	EPA 200.7	NPW	x	Y	
NY	Potassium	EPA 200.7	NPW	x	Y	
NY	Selenium	EPA 200.7	NPW	x	Y	
NY	Silica, Dissolved	EPA 200.7	NPW	x	Y	
NY	Silver	EPA 200.7	NPW	x	Y	
NY	Sodium	EPA 200.7	NPW	x	Y	
NY	Strontium	EPA 200.7	NPW	x	Y	
NY	Thallium	EPA 200.7	NPW	x	Y	
NY	Tin	EPA 200.7	NPW	x	Y	
NY	Titanium	EPA 200.7	NPW	x	Y	
NY	Total Hardness (CaCO3)	EPA 200.7	NPW	x	Y	
NY	Vanadium	EPA 200.7	NPW	x	Y	
NY	Zinc	EPA 200.7	NPW	x	Y	
NY	Aluminum	EPA 200.8	NPW	x	Y	
NY	Antimony	EPA 200.8	NPW	x	Y	
NY	Arsenic	EPA 200.8	NPW	x	Y	
NY	Barium	EPA 200.8	NPW	x	Y	
NY	Beryllium	EPA 200.8	NPW	x	Y	
NY	Cadmium	EPA 200.8	NPW	x	Y	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Chromium	EPA 200.8	NPW	x	Y	
NY	Cobalt	EPA 200.8	NPW	x	Y	
NY	Copper	EPA 200.8	NPW	x	Y	
NY	Lead	EPA 200.8	NPW	x	Y	
NY	Manganese	EPA 200.8	NPW	x	Y	
NY	Molybdenum	EPA 200.8	NPW	x	Y	
NY	Nickel	EPA 200.8	NPW	x	Y	
NY	Selenium	EPA 200.8	NPW	x	Y	
NY	Silver	EPA 200.8	NPW	x	Y	
NY	Thallium	EPA 200.8	NPW	x	Y	
NY	Vanadium	EPA 200.8	NPW	x	Y	
NY	Zinc	EPA 200.8	NPW	x	Y	
NY	Mercury	EPA 245.1	NPW	x	Y	
NY	Bromide	EPA 300.0	NPW	Y	x	
NY	Chloride	EPA 300.0	NPW	Y	x	
NY	Fluoride	EPA 300.0	NPW	Y	x	
NY	Nitrate-N	EPA 300.0	NPW	Y	x	
NY	Sulfate	EPA 300.0	NPW	Y	x	
NY	Acid Digestion of Waters	EPA 3005A	NPW	x	**Y**	
NY	Microwave Acid Digestion	EPA 3015A	NPW	x	**Y**	
NY	Acid Digestion of Waters	EPA 3020A	NPW	x	**Y**	
NY	Ammonia	EPA 350.1	NPW	Y	x	
NY	Nitrogen, Total Kjeldahl	EPA 351.1	NPW	Y	x	
NY	Separatory Funnel Extraction	EPA 3510C	NPW	Y	**Y**	
NY	Nitrate-N	EPA 353.2	NPW	Y	x	
NY	Nitrate-Nitrite	EPA 353.2	NPW	Y	x	
NY	Chemical Oxygen Demand	EPA 410.4	NPW	Y	x	
NY	Total Phenolics	EPA 420.1	NPW	Y	x	
NY	Purge & Trap Aqueous	EPA 5030C	NPW	Y	x	
NY	Aluminum	EPA 6010C	NPW	x	Y	
NY	Antimony	EPA 6010C	NPW	x	Y	
NY	Arsenic	EPA 6010C	NPW	x	Y	
NY	Barium	EPA 6010C	NPW	x	Y	
NY	Beryllium	EPA 6010C	NPW	x	Y	
NY	Boron	EPA 6010C	NPW	x	Y	
NY	Cadmium	EPA 6010C	NPW	x	Y	
NY	Calcium	EPA 6010C	NPW	x	Y	
NY	Chromium	EPA 6010C	NPW	x	Y	
NY	Cobalt	EPA 6010C	NPW	x	Y	
NY	Copper	EPA 6010C	NPW	x	Y	
NY	Iron	EPA 6010C	NPW	x	Y	
NY	Lead	EPA 6010C	NPW	x	Y	
NY	Magnesium	EPA 6010C	NPW	x	Y	
NY	Manganese	EPA 6010C	NPW	x	Y	
NY	Molybdenum	EPA 6010C	NPW	x	Y	
NY	Nickel	EPA 6010C	NPW	x	Y	
NY	Potassium	EPA 6010C	NPW	x	Y	
NY	Selenium	EPA 6010C	NPW	x	Y	
NY	Silver	EPA 6010C	NPW	x	Y	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Sodium	EPA 6010C	NPW	x	Y	
NY	Strontium	EPA 6010C	NPW	x	Y	
NY	Thallium	EPA 6010C	NPW	x	Y	
NY	Tin	EPA 6010C	NPW	x	Y	
NY	Vanadium	EPA 6010C	NPW	x	Y	
NY	Zinc	EPA 6010C	NPW	x	Y	
NY	Aluminum	EPA 6020A	NPW	x	Y	
NY	Antimony	EPA 6020A	NPW	x	Y	
NY	Arsenic	EPA 6020A	NPW	x	Y	
NY	Barium	EPA 6020A	NPW	x	Y	
NY	Beryllium	EPA 6020A	NPW	x	Y	
NY	Boron	EPA 6020A	NPW	x	Y	
NY	Cadmium	EPA 6020A	NPW	x	Y	
NY	Calcium	EPA 6020A	NPW	x	Y	
NY	Chromium	EPA 6020A	NPW	x	Y	
NY	Cobalt	EPA 6020A	NPW	x	Y	
NY	Copper	EPA 6020A	NPW	x	Y	
NY	Iron	EPA 6020A	NPW	x	Y	
NY	Lead	EPA 6020A	NPW	x	Y	
NY	Magnesium	EPA 6020A	NPW	x	Y	
NY	Manganese	EPA 6020A	NPW	x	Y	
NY	Molybdenum	EPA 6020A	NPW	x	Y	
NY	Nickel	EPA 6020A	NPW	x	Y	
NY	Potassium	EPA 6020A	NPW	x	Y	
NY	Selenium	EPA 6020A	NPW	x	Y	
NY	Silver	EPA 6020A	NPW	x	Y	
NY	Strontium	EPA 6020A	NPW	x	Y	
NY	Thallium	EPA 6020A	NPW	x	Y	
NY	Tin	EPA 6020A	NPW	x	Y	
NY	Titanium	EPA 6020A	NPW	x	Y	
NY	Vanadium	EPA 6020A	NPW	x	Y	
NY	Zinc	EPA 6020A	NPW	x	Y	
NY	4,4'-DDD	EPA 608	NPW	Y	x	
NY	4,4'-DDE	EPA 608	NPW	Y	x	
NY	4,4'-DDT	EPA 608	NPW	Y	x	
NY	Aldrin	EPA 608	NPW	Y	x	
NY	Alpha-BHC	EPA 608	NPW	Y	x	
NY	Beta-BHC	EPA 608	NPW	Y	x	
NY	Chlordane	EPA 608	NPW	Y	x	
NY	Delta-BHC	EPA 608	NPW	Y	x	
NY	Dieldrin	EPA 608	NPW	Y	x	
NY	Endosulfan I	EPA 608	NPW	Y	x	
NY	Endosulfan II	EPA 608	NPW	Y	x	
NY	Endosulfan Sulfate	EPA 608	NPW	Y	x	
NY	Endrin	EPA 608	NPW	Y	x	
NY	Endrin Aldehyde	EPA 608	NPW	Y	x	
NY	Heptachlor	EPA 608	NPW	Y	x	
NY	Heptachlor Epoxide	EPA 608	NPW	Y	x	
NY	Lindane (gamma-BHC)	EPA 608	NPW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Methoxychlor	EPA 608	NPW	Y	x	
NY	PCB-1016	EPA 608	NPW	Y	x	
NY	PCB-1221	EPA 608	NPW	Y	x	
NY	PCB-1232	EPA 608	NPW	Y	x	
NY	PCB-1242	EPA 608	NPW	Y	x	
NY	PCB-1248	EPA 608	NPW	Y	x	
NY	PCB-1254	EPA 608	NPW	Y	x	
NY	PCB-1260	EPA 608	NPW	Y	x	
NY	Toxaphene	EPA 608	NPW	Y	x	
NY	1,1,1-Trichloroethane	EPA 624	NPW	Y	x	
NY	1,1,2,2-Tetrachloroethane	EPA 624	NPW	Y	x	
NY	1,1,2-Trichloroethane	EPA 624	NPW	Y	x	
NY	1,1-Dichloroethane	EPA 624	NPW	Y	x	
NY	1,1-Dichloroethene	EPA 624	NPW	Y	x	
NY	1,2-Dichlorobenzene	EPA 624	NPW	Y	x	
NY	1,2-Dichloroethane	EPA 624	NPW	Y	x	
NY	1,2-Dichloropropane	EPA 624	NPW	Y	x	
NY	1,3-Dichlorobenzene	EPA 624	NPW	Y	x	
NY	1,4-Dichlorobenzene	EPA 624	NPW	Y	x	
NY	2-Chloroethyl Vinyl ether	EPA 624	NPW	Y	x	
NY	Acetone	EPA 624	NPW	Y	x	
NY	Acrolein	EPA 624	NPW	Y	x	
NY	Acrylonitrile	EPA 624	NPW	Y	x	
NY	Benzene	EPA 624	NPW	Y	x	
NY	Bromodichloromethane	EPA 624	NPW	Y	x	
NY	Bromoform	EPA 624	NPW	Y	x	
NY	Bromomethane	EPA 624	NPW	Y	x	
NY	Carbon Tetrachloride	EPA 624	NPW	Y	x	
NY	Chlorobenzene	EPA 624	NPW	Y	x	
NY	Chloroethane	EPA 624	NPW	Y	x	
NY	Chloroform	EPA 624	NPW	Y	x	
NY	Chloromethane	EPA 624	NPW	Y	x	
NY	cis-1,2-Dichloroethene	EPA 624	NPW	Y	x	
NY	cis-1,3-Dichloropropene	EPA 624	NPW	Y	x	
NY	Dibromochloromethane	EPA 624	NPW	Y	x	
NY	Dichlorodifluoromethane	EPA 624	NPW	Y	x	
NY	Ethylbenzene	EPA 624	NPW	Y	x	
NY	Methylene Chloride	EPA 624	NPW	Y	x	
NY	Methyl tert-butyl ether	EPA 624	NPW	Y	x	
NY	Styrene	EPA 624	NPW	Y	x	
NY	Tert-Butyl Alcohol	EPA 624	NPW	Y	x	
NY	Tetrachloroethene	EPA 624	NPW	Y	x	
NY	Toluene	EPA 624	NPW	Y	x	
NY	Total Xylenes	EPA 624	NPW	Y	x	
NY	Trans-1,2-Dichloroethene	EPA 624	NPW	Y	x	
NY	Trans-1,3-Dichloropropene	EPA 624	NPW	Y	x	
NY	Trichloroethene	EPA 624	NPW	Y	x	
NY	Trichlorofluoromethane	EPA 624	NPW	Y	x	
NY	Vinyl Acetate	EPA 624	NPW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Vinyl Chloride	EPA 624	NPW	Y	x	
NY	1,2,4-Trichlorobenzene	EPA 625	NPW	Y	x	
NY	2,4,5-Trichlorophenol	EPA 625	NPW	Y	x	
NY	2,4,6-Trichlorophenol	EPA 625	NPW	Y	x	
NY	2,4-Dichlorophenol	EPA 625	NPW	Y	x	
NY	2,4-Dimethylphenol	EPA 625	NPW	Y	x	
NY	2,4-Dinitrophenol	EPA 625	NPW	Y	x	
NY	2,4-Dinitrotoluene (2,4-DNT)	EPA 625	NPW	Y	x	
NY	2,6-Dinitrotoluene (2,6-DNT)	EPA 625	NPW	Y	x	
NY	2-Chloronaphthalene	EPA 625	NPW	Y	x	
NY	2-Chlorophenol	EPA 625	NPW	Y	x	
NY	2-Methyl-4,6-dinitrophenol	EPA 625	NPW	Y	x	
NY	2-Methylphenol	EPA 625	NPW	Y	x	
NY	2-Nitrophenol	EPA 625	NPW	Y	x	
NY	3,3-Dichlorobenzidine	EPA 625	NPW	Y	x	
NY	3-Methylphenol	EPA 625	NPW	Y	x	
NY	4-Bromophenyl phenyl ether	EPA 625	NPW	Y	x	
NY	4-Chloro-3-methylphenol	EPA 625	NPW	Y	x	
NY	4-Chlorophenyl phenyl ether	EPA 625	NPW	Y	x	
NY	4-Methylphenol	EPA 625	NPW	Y	x	
NY	4-Nitrophenol	EPA 625	NPW	Y	x	
NY	Acenaphthene	EPA 625	NPW	Y	x	
NY	Acenaphthylene	EPA 625	NPW	Y	x	
NY	Acetophenone	EPA 625	NPW	Y	x	
NY	Aniline	EPA 625	NPW	Y	x	
NY	Anthracene	EPA 625	NPW	Y	x	
NY	Benzidine	EPA 625	NPW	Y	x	
NY	Benzo(a)anthracene	EPA 625	NPW	Y	x	
NY	Benzo(a)pyrene	EPA 625	NPW	Y	x	
NY	Benzo(b)fluoranthene	EPA 625	NPW	Y	x	
NY	Benzo(ghi)perylene	EPA 625	NPW	Y	x	
NY	Benzo(k)fluoranthene	EPA 625	NPW	Y	x	
NY	Bis(2-chloroethoxy) methane	EPA 625	NPW	Y	x	
NY	Bis(2-chloroethyl) ether	EPA 625	NPW	Y	x	
NY	Bis(2-chloroisopropyl) ether	EPA 625	NPW	Y	x	
NY	Bis(2-ethylhexyl) phthalate	EPA 625	NPW	Y	x	
NY	Butyl Benzyl phthalate	EPA 625	NPW	Y	x	
NY	Carbazole	EPA 625	NPW	Y	x	
NY	Chrysene	EPA 625	NPW	Y	x	
NY	Dibenzo(a,h)anthracene	EPA 625	NPW	Y	x	
NY	Diethyl phthalate	EPA 625	NPW	Y	x	
NY	Dimethyl phthalate	EPA 625	NPW	Y	x	
NY	Di-n-butyl phthalate	EPA 625	NPW	Y	x	
NY	Di-n-octyl phthalate	EPA 625	NPW	Y	x	
NY	Fluoranthene	EPA 625	NPW	Y	x	
NY	Fluorene	EPA 625	NPW	Y	x	
NY	Hexachlorobenzene	EPA 625	NPW	Y	x	
NY	Hexachlorobutadiene	EPA 625	NPW	Y	x	
NY	Hexachlorocyclopentadiene	EPA 625	NPW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Hexachloroethane	EPA 625	NPW	Y	x	
NY	Indeno(1,2,3-cd)pyrene	EPA 625	NPW	Y	x	
NY	Isophorone	EPA 625	NPW	Y	x	
NY	Naphthalene	EPA 625	NPW	Y	x	
NY	N-Decane	EPA 625	NPW	Y	x	
NY	Nitrobenzene	EPA 625	NPW	Y	x	
NY	N-Nitrosodimethylamine	EPA 625	NPW	Y	x	
NY	N-Nitrosodi-n-propylamine	EPA 625	NPW	Y	x	
NY	N-Nitrosodiphenylamine	EPA 625	NPW	Y	x	
NY	N-Octadecane	EPA 625	NPW	Y	x	
NY	Pentachlorophenol	EPA 625	NPW	Y	x	
NY	Phenanthrene	EPA 625	NPW	Y	x	
NY	Phenol	EPA 625	NPW	Y	x	
NY	Pyrene	EPA 625	NPW	Y	x	
NY	Pyridine	EPA 625	NPW	Y	x	
NY	Chromium VI	EPA 7196A	NPW	Y	x	
NY	Mercury	EPA 7470A	NPW	x	Y	
NY	1,2-Dibromoethane (EDB)	EPA 8011	NPW	Y	x	
NY	1,2-Dibromo-3-Chloropropane (DBCP)	EPA 8011	NPW	Y	x	
NY	Diesel Range Organics	EPA 8015C	NPW	Y	x	
NY	Gasoline Range Organics	EPA 8015C	NPW	Y	x	
NY	Amyl alcohol	EPA 8015D	NPW	x	Y	
NY	Diesel Range Organics	EPA 8015D	NPW	x	Y	
NY	Ethyl alcohol	EPA 8015D	NPW	x	Y	
NY	Ethylene glycol	EPA 8015D	NPW	x	Y	
NY	Gasoline Range Organics	EPA 8015D	NPW	x	Y	
NY	Iso-butyl Alcohol	EPA 8015D	NPW	x	Y	
NY	Methyl Alcohol (methanol)	EPA 8015D	NPW	x	Y	
NY	Tert-Butyl Alcohol	EPA 8015D	NPW	x	Y	
NY	4,4'-DDD	EPA 8081B	NPW	Y	Y	
NY	4,4'-DDE	EPA 8081B	NPW	Y	Y	
NY	4,4'-DDT	EPA 8081B	NPW	Y	Y	
NY	Aldrin	EPA 8081B	NPW	Y	Y	
NY	alpha-BHC	EPA 8081B	NPW	Y	Y	
NY	alpha-Chlordane	EPA 8081B	NPW	Y	Y	
NY	beta-BHC	EPA 8081B	NPW	Y	Y	
NY	Chlordane	EPA 8081B	NPW	Y	Y	
NY	delta-BHC	EPA 8081B	NPW	Y	Y	
NY	Dieldrin	EPA 8081B	NPW	Y	Y	
NY	Endosulfan I	EPA 8081B	NPW	Y	Y	
NY	Endosulfan II	EPA 8081B	NPW	Y	Y	
NY	Endosulfan Sulfate	EPA 8081B	NPW	Y	Y	
NY	Endrin	EPA 8081B	NPW	Y	Y	
NY	Endrin Aldehyde	EPA 8081B	NPW	Y	Y	
NY	Endrin Ketone	EPA 8081B	NPW	Y	Y	
NY	gamma-Chlordane	EPA 8081B	NPW	Y	Y	
NY	Heptachlor	EPA 8081B	NPW	Y	Y	
NY	Heptachlor Epoxide	EPA 8081B	NPW	Y	Y	
NY	Hexachlorobenzene	EPA 8081B	NPW	x	Y	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Lindane (gamma-BHC)	EPA 8081B	NPW	Y	Y	
NY	Methoxychlor	EPA 8081B	NPW	Y	Y	
NY	Mirex	EPA 8081B	NPW	x	Y	
NY	Toxaphene	EPA 8081B	NPW	Y	Y	
NY	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB	EPA 8082A	NPW	x	Y	
NY	2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)	EPA 8082A	NPW	x	Y	
NY	2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)	EPA 8082A	NPW	x	Y	
NY	2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)	EPA 8082A	NPW	x	Y	
NY	2,2',3,5'-Tetrachlorobiphenyl (PCB 44)	EPA 8082A	NPW	x	Y	
NY	2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	EPA 8082A	NPW	x	Y	
NY	2,2',5-Trichlorobiphenyl (PCB 18)	EPA 8082A	NPW	x	Y	
NY	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	EPA 8082A	NPW	x	Y	
NY	2,3',4,4'-Tetrachlorobiphenyl (PCB 66)	EPA 8082A	NPW	x	Y	
NY	PCB-1016	EPA 8082A	NPW	Y	Y	
NY	PCB-1221	EPA 8082A	NPW	Y	Y	
NY	PCB-1232	EPA 8082A	NPW	Y	Y	
NY	PCB-1242	EPA 8082A	NPW	Y	Y	
NY	PCB-1248	EPA 8082A	NPW	Y	Y	
NY	PCB-1254	EPA 8082A	NPW	Y	Y	
NY	PCB-1260	EPA 8082A	NPW	Y	Y	
NY	PCB-1262	EPA 8082A	NPW	Y	Y	
NY	PCB-1268	EPA 8082A	NPW	Y	Y	
NY	2,4,5-T	EPA 8151A	NPW	Y	x	
NY	2,4,5-TP (Silvex)	EPA 8151A	NPW	Y	x	
NY	2,4-D	EPA 8151A	NPW	Y	x	
NY	2,4-DB	EPA 8151A	NPW	Y	x	
NY	Dalapon	EPA 8151A	NPW	Y	x	
NY	Dicamba	EPA 8151A	NPW	Y	x	
NY	Dichloroprop	EPA 8151A	NPW	Y	x	
NY	Dinoseb	EPA 8151A	NPW	Y	x	
NY	1,1,1,2-Tetrachloroethane	EPA 8260C	NPW	Y	x	
NY	1,1,1-Trichloroethane	EPA 8260C	NPW	Y	x	
NY	1,1,2,2-Tetrachloroethane	EPA 8260C	NPW	Y	x	
NY	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C	NPW	Y	x	
NY	1,1,2-Trichloroethane	EPA 8260C	NPW	Y	x	
NY	1,1-Dichloroethane	EPA 8260C	NPW	Y	x	
NY	1,1-Dichloroethene	EPA 8260C	NPW	Y	x	
NY	1,1-Dichloropropene	EPA 8260C	NPW	Y	x	
NY	1,2,3-Trichlorobenzene	EPA 8260C	NPW	Y	x	
NY	1,2,3-Trichloropropane	EPA 8260C	NPW	Y	x	
NY	1,2,4-Trichlorobenzene	EPA 8260C	NPW	Y	x	
NY	1,2,4-Trimethylbenzene	EPA 8260C	NPW	Y	x	
NY	1,2-Dibromo-3-Chloropropane (DBCP)	EPA 8260C	NPW	Y	x	
NY	1,2-Dibromoethane (EDB)	EPA 8260C	NPW	Y	x	
NY	1,2-Dichlorobenzene	EPA 8260C	NPW	Y	x	
NY	1,2-Dichloroethane	EPA 8260C	NPW	Y	x	
NY	1,2-Dichloropropane	EPA 8260C	NPW	Y	x	
NY	1,3,5-Trimethylbenzene	EPA 8260C	NPW	Y	x	
NY	1,3-Dichlorobenzene	EPA 8260C	NPW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	1,3-Dichloropropane	EPA 8260C	NPW	Y	x	
NY	1,4-Dichlorobenzene	EPA 8260C	NPW	Y	x	
NY	1,4-Dioxane	EPA 8260C	NPW	Y	x	
NY	1-Butanol	EPA 8260C	NPW	Y	x	
NY	2,2-Dichloropropane	EPA 8260C	NPW	Y	x	
NY	2-Butanone	EPA 8260C	NPW	Y	x	
NY	2-Chloroethyl Vinyl ether	EPA 8260C	NPW	Y	x	
NY	2-Chlorotoluene	EPA 8260C	NPW	Y	x	
NY	2-Hexanone	EPA 8260C	NPW	Y	x	
NY	4-Chlorotoluene	EPA 8260C	NPW	Y	x	
NY	4-Methyl-2-Pentanone	EPA 8260C	NPW	Y	x	
NY	Acetone	EPA 8260C	NPW	Y	x	
NY	Acrolein	EPA 8260C	NPW	Y	x	
NY	Acrylonitrile	EPA 8260C	NPW	Y	x	
NY	Benzene	EPA 8260C	NPW	Y	x	
NY	Bromobenzene	EPA 8260C	NPW	Y	x	
NY	Bromochloromethane	EPA 8260C	NPW	Y	x	
NY	Bromodichloromethane	EPA 8260C	NPW	Y	x	
NY	Bromoform	EPA 8260C	NPW	Y	x	
NY	Bromomethane	EPA 8260C	NPW	Y	x	
NY	Carbon Disulfide	EPA 8260C	NPW	Y	x	
NY	Carbon Tetrachloride	EPA 8260C	NPW	Y	x	
NY	Chlorobenzene	EPA 8260C	NPW	Y	x	
NY	Chloroethane	EPA 8260C	NPW	Y	x	
NY	Chloroform	EPA 8260C	NPW	Y	x	
NY	Chloromethane	EPA 8260C	NPW	Y	x	
NY	cis-1,2-Dichloroethene	EPA 8260C	NPW	Y	x	
NY	cis-1,3-Dichloropropene	EPA 8260C	NPW	Y	x	
NY	Cyclohexane	EPA 8260C	NPW	Y	x	
NY	Dibromochloromethane	EPA 8260C	NPW	Y	x	
NY	Dibromomethane	EPA 8260C	NPW	Y	x	
NY	Dichlorodifluoromethane	EPA 8260C	NPW	Y	x	
NY	Diethyl ether	EPA 8260C	NPW	Y	x	
NY	Diisopropyl ether	EPA 8260C	NPW	Y	x	
NY	Ethanol	EPA 8260C	NPW	Y	x	
NY	Ethyl acetate	EPA 8260C	NPW	Y	x	
NY	Ethyl Methacrylate	EPA 8260C	NPW	Y	x	
NY	Ethylbenzene	EPA 8260C	NPW	Y	x	
NY	Hexachlorobutadiene	EPA 8260C	NPW	Y	x	
NY	Isopropyl Alcohol	EPA 8260C	NPW	Y	x	
NY	Isopropylbenzene	EPA 8260C	NPW	Y	x	
NY	m+p-Xylene	EPA 8260C	NPW	Y	x	
NY	Methyl Acetate	EPA 8260C	NPW	Y	x	
NY	Methyl Cyclohexane	EPA 8260C	NPW	Y	x	
NY	Iodomethane (Methyl Iodide)	EPA 8260C	NPW	Y	x	
NY	Methyl Methacrylate	EPA 8260C	NPW	Y	x	
NY	Methyl tert-butyl ether	EPA 8260C	NPW	Y	x	
NY	Methylene Chloride	EPA 8260C	NPW	Y	x	
NY	Naphthalene	EPA 8260C	NPW	Y	x	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	n-Butylbenzene	EPA 8260C	NPW	Y	x	
NY	n-Propylbenzene	EPA 8260C	NPW	Y	x	
NY	o-Xylene	EPA 8260C	NPW	Y	x	
NY	p-Isopropyltoluene	EPA 8260C	NPW	Y	x	
NY	sec-Butylbenzene	EPA 8260C	NPW	Y	x	
NY	Styrene	EPA 8260C	NPW	Y	x	
NY	Tert-Amyl Methyl Ether (TAME)	EPA 8260C	NPW	Y	x	
NY	Tert-Butyl Alcohol	EPA 8260C	NPW	Y	x	
NY	tert-butyl Ethyl Ether	EPA 8260C	NPW	Y	x	
NY	Tert-Butylbenzene	EPA 8260C	NPW	Y	x	
NY	Tetrachloroethene	EPA 8260C	NPW	Y	x	
NY	Tetrahydrofuran	EPA 8260C	NPW	Y	x	
NY	Toluene	EPA 8260C	NPW	Y	x	
NY	Total Xylenes	EPA 8260C	NPW	Y	x	
NY	Trans-1,2-Dichloroethene	EPA 8260C	NPW	Y	x	
NY	Trans-1,3-Dichloropropene	EPA 8260C	NPW	Y	x	
NY	Trans-1,4-Dichloro-2-butene	EPA 8260C	NPW	Y	x	
NY	Trichloroethene	EPA 8260C	NPW	Y	x	
NY	Trichlorofluoromethane	EPA 8260C	NPW	Y	x	
NY	Vinyl acetate	EPA 8260C	NPW	Y	x	
NY	Vinyl Chloride	EPA 8260C	NPW	Y	x	
NY	1,1'-Biphenyl	EPA 8270D	NPW	x	Y	
NY	1,2,4,5-Tetrachlorobenzene	EPA 8270D	NPW	Y	Y	
NY	1,2,4-Trichlorobenzene	EPA 8270D	NPW	Y	Y	
NY	1,2-Dichlorobenzene	EPA 8270D	NPW	Y	Y	
NY	1,2-Diphenylhydrazine	EPA 8270D	NPW	Y	Y	
NY	1,3-Dichlorobenzene	EPA 8270D	NPW	Y	Y	
NY	1,4-Dichlorobenzene	EPA 8270D	NPW	Y	Y	
NY	1,4-Dioxane	EPA 8270D	NPW	x	Y	
NY	2,3,4,6-Tetrachlorophenol	EPA 8270D	NPW	Y	Y	
NY	2,4,5-Trichlorophenol	EPA 8270D	NPW	Y	Y	
NY	2,4,6-Trichlorophenol	EPA 8270D	NPW	Y	Y	
NY	2,4-Dichlorophenol	EPA 8270D	NPW	Y	Y	
NY	2,4-Dimethylphenol	EPA 8270D	NPW	Y	Y	
NY	2,4-Dinitrophenol	EPA 8270D	NPW	Y	Y	
NY	2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D	NPW	Y	Y	
NY	2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D	NPW	Y	Y	
NY	2-Chloronaphthalene	EPA 8270D	NPW	Y	Y	
NY	2-Chlorophenol	EPA 8270D	NPW	Y	Y	
NY	2-Methyl-4,6-dinitrophenol	EPA 8270D	NPW	Y	Y	
NY	2-Methylnaphthalene	EPA 8270D	NPW	Y	Y	
NY	2-Methylphenol	EPA 8270D	NPW	Y	Y	
NY	2-Nitroaniline	EPA 8270D	NPW	Y	Y	
NY	2-Nitrophenol	EPA 8270D	NPW	Y	Y	
NY	3,3-Dichlorobenzidine	EPA 8270D	NPW	Y	Y	
NY	3-Methylphenol	EPA 8270D	NPW	Y	Y	
NY	3-Nitroaniline	EPA 8270D	NPW	Y	Y	
NY	4-Bromophenyl phenyl ether	EPA 8270D	NPW	Y	Y	
NY	4-Chloro-3-methylphenol	EPA 8270D	NPW	Y	Y	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	4-Chloroaniline	EPA 8270D	NPW	Y	Y	
NY	4-Chlorophenyl phenyl ether	EPA 8270D	NPW	Y	Y	
NY	4-Methylphenol	EPA 8270D	NPW	Y	Y	
NY	4-Nitroaniline	EPA 8270D	NPW	Y	Y	
NY	4-Nitrophenol	EPA 8270D	NPW	Y	Y	
NY	Acenaphthene	EPA 8270D	NPW	Y	Y	
NY	Acenaphthylene	EPA 8270D	NPW	Y	Y	
NY	Acetophenone	EPA 8270D	NPW	Y	x	
NY	Aniline	EPA 8270D	NPW	Y	Y	
NY	Anthracene	EPA 8270D	NPW	Y	Y	
NY	Atrazine	EPA 8270D	NPW	Y	x	
NY	Benzaldehyde	EPA 8270D	NPW	Y	Y	
NY	Benzidine	EPA 8270D	NPW	Y	Y	
NY	Benzo(a)anthracene	EPA 8270D	NPW	Y	Y	
NY	Benzo(a)pyrene	EPA 8270D	NPW	Y	Y	
NY	Benzo(b)fluoranthene	EPA 8270D	NPW	Y	Y	
NY	Benzo(ghi)perylene	EPA 8270D	NPW	Y	Y	
NY	Benzo(k)fluoranthene	EPA 8270D	NPW	Y	Y	
NY	Benzoic Acid	EPA 8270D	NPW	Y	Y	
NY	Benzyl alcohol	EPA 8270D	NPW	Y	Y	
NY	Biphenyl	EPA 8270D	NPW	Y	x	
NY	Bis(2-chloroethoxy) methane	EPA 8270D	NPW	Y	Y	
NY	Bis(2-chloroethyl) ether	EPA 8270D	NPW	Y	Y	
NY	Bis(2-chloroisopropyl) ether	EPA 8270D	NPW	Y	Y	
NY	Bis(2-ethylhexyl) phthalate	EPA 8270D	NPW	Y	Y	
NY	Butyl Benzyl phthalate	EPA 8270D	NPW	Y	Y	
NY	Caprolactam	EPA 8270D	NPW	Y	Y	
NY	Carbazole	EPA 8270D	NPW	Y	Y	
NY	Chrysene	EPA 8270D	NPW	Y	Y	
NY	Cresols, Total	EPA 8270D	NPW	Y	x	
NY	Dibenzo(a,h)anthracene	EPA 8270D	NPW	Y	Y	
NY	Dibenzofuran	EPA 8270D	NPW	Y	Y	
NY	Diethyl phthalate	EPA 8270D	NPW	Y	Y	
NY	Dimethyl phthalate	EPA 8270D	NPW	Y	Y	
NY	Di-n-butyl phthalate	EPA 8270D	NPW	Y	Y	
NY	Di-n-octyl phthalate	EPA 8270D	NPW	Y	Y	
NY	Diphenylamine	EPA 8270D	NPW	Y	x	
NY	Fluoranthene	EPA 8270D	NPW	Y	Y	
NY	Fluorene	EPA 8270D	NPW	Y	Y	
NY	Hexachlorobenzene	EPA 8270D	NPW	Y	Y	
NY	Hexachlorobutadiene	EPA 8270D	NPW	Y	Y	
NY	Hexachlorocyclopentadiene	EPA 8270D	NPW	Y	Y	
NY	Hexachloroethane	EPA 8270D	NPW	Y	Y	
NY	Indeno(1,2,3-cd)pyrene	EPA 8270D	NPW	Y	Y	
NY	Isophorone	EPA 8270D	NPW	Y	x	
NY	Naphthalene	EPA 8270D	NPW	Y	Y	
NY	Nitrobenzene	EPA 8270D	NPW	Y	Y	
NY	N-Nitrosodimethylamine	EPA 8270D	NPW	Y	Y	
NY	N-Nitrosodi-n-propylamine	EPA 8270D	NPW	Y	Y	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	N-Nitrosodiphenylamine	EPA 8270D	NPW	Y	Y	
NY	Parathion	EPA 8270D	NPW	Y	x	
NY	Pentachlorophenol	EPA 8270D	NPW	Y	Y	
NY	Phenanthrene	EPA 8270D	NPW	Y	Y	
NY	Phenol	EPA 8270D	NPW	Y	Y	
NY	Pyrene	EPA 8270D	NPW	Y	Y	
NY	Pyridine	EPA 8270D	NPW	Y	Y	
NY	Thionazin	EPA 8270D	NPW	Y	x	
NY	Acenaphthene	EPA 8270D-SIM	NPW	Y	Y	
NY	Acenaphthylene	EPA 8270D-SIM	NPW	Y	Y	
NY	Anthracene	EPA 8270D-SIM	NPW	Y	Y	
NY	Benzo(a)anthracene	EPA 8270D-SIM	NPW	Y	Y	
NY	Benzo(a)anthracene	EPA 8270D-SIM	NPW	Y	x	
NY	Benzo(a)pyrene	EPA 8270D-SIM	NPW	Y	Y	
NY	Benzo(a)pyrene	EPA 8270D-SIM	NPW	Y	x	
NY	Benzo(b)fluoranthene	EPA 8270D-SIM	NPW	Y	Y	
NY	Benzo(b)fluoranthene	EPA 8270D-SIM	NPW	Y	x	
NY	Benzo(ghi)perylene	EPA 8270D-SIM	NPW	Y	Y	
NY	Benzo(k)fluoranthene	EPA 8270D-SIM	NPW	Y	x	
NY	Benzo(k)fluoranthene	EPA 8270D-SIM	NPW	Y	Y	
NY	Chrysene	EPA 8270D-SIM	NPW	Y	Y	
NY	Dibenzo(a,h)anthracene	EPA 8270D-SIM	NPW	Y	Y	
NY	Dibenzo(a,h)anthracene	EPA 8270D-SIM	NPW	Y	x	
NY	Fluoranthene	EPA 8270D-SIM	NPW	Y	Y	
NY	Fluorene	EPA 8270D-SIM	NPW	Y	Y	
NY	Indeno(1,2,3-cd)pyrene	EPA 8270D-SIM	NPW	Y	Y	
NY	Indeno(1,2,3-cd)pyrene	EPA 8270D-SIM	NPW	Y	x	
NY	Naphthalene	EPA 8270D-SIM	NPW	Y	Y	
NY	Phenanthrene	EPA 8270D-SIM	NPW	Y	Y	
NY	Pyrene	EPA 8270D-SIM	NPW	Y	Y	
NY	Formaldehyde	EPA 8315A	NPW	Y	x	
NY	Cyanide - Amenable, Distillation	EPA 9010C	NPW	Y	x	
NY	Cyanide, Distillation	EPA 9010C	NPW	Y	x	
NY	Total Cyanide	EPA 9012B	NPW	Y	x	
NY	Total Cyanide	EPA 9014	NPW	Y	x	
NY	Sulfide	EPA 9030B	NPW	Y	x	
NY	Phenolics	EPA 9065	NPW	Y	x	
NY	Ethane	EPA RSK-175	NPW	x	Y	
NY	Ethene	EPA RSK-175	NPW	x	Y	
NY	Methane	EPA RSK-175	NPW	x	Y	
NY	Propane	EPA RSK-175	NPW	x	Y	
NY	Nitrogen, Total Kjeldahl	Lachat 10-107-06-2	NPW	Y	x	
NY	Cyanide, Total	Lachat 10-204-00-1-X	NPW	Y	x	
NY	Color	SM 2120B	NPW	Y	x	
NY	Turbidity	SM 2130B	NPW	Y	x	
NY	Acidity	SM 2310B	NPW	Y	x	
NY	Alkalinity	SM 2320B	NPW	Y	x	
NY	Total Hardness (CaCO3)	SM 2340B	NPW	x	Y	
NY	Specific Conductance	SM 2510B	NPW	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Total Residue	SM 2540B	NPW	Y	x	
NY	Total Dissolved Solids	SM 2540C	NPW	Y	x	
NY	Total Suspended Solids	SM 2540D	NPW	Y	x	
NY	Volatile Solids	SM 2540E	NPW	Y	x	
NY	Total Settleable Solids	SM 2540F	NPW	Y	x	
NY	Chromium VI	SM 3500 Cr B	NPW	Y	x	
NY	Sulfate	SM 4500 SO4-E	NPW	Y	x	
NY	Chloride	SM 4500 CL-E	NPW	Y	x	
NY	Cyanide, Total	SM 4500 CN E	NPW	Y	x	
NY	Fluoride Preliminary Distillation	SM 4500 F-B	NPW	Y	x	
NY	Fluoride	SM 4500 F-C	NPW	Y	x	
NY	Ammonia	SM 4500 NH3 B	NPW	Y	x	
NY	Ammonia	SM 4500 NH3-H	NPW	Y	x	
NY	Nitrogen, Total Kjeldahl	SM 4500 NH3-H	NPW	Y	x	
NY	Nitrogen, Total Kjeldahl (Distillation)	SM 4500Norg-C	NPW	Y	x	
NY	Nitrite-N	SM 4500 NO2-B	NPW	Y	x	
NY	Nitrate-N	SM 4500 NO3-F	NPW	Y	x	
NY	Nitrate-N	SM 4500 NO3-F	NPW	Y	x	
NY	Nitrate-Nitrite	SM 4500 NO3-F	NPW	Y	x	
NY	Orthophosphate	SM 4500 P-E	NPW	Y	x	
NY	Total Phosphorus (Digestion)	SM 4500 P-B	NPW	Y	x	
NY	Total Phosphorus	SM 4500 P-E	NPW	Y	x	
NY	Sulfide	SM 4500 S2-D	NPW	Y	x	
NY	Sulfate	SM 4500 SO4-E	NPW	Y	x	
NY	Biochemical Oxygen Demand	SM 5210B	NPW	Y	x	
NY	Biochemical Oxygen Demand - Carbonaceous	SM 5210B	NPW	Y	x	
NY	Chemical Oxygen Demand	SM 5220D	NPW	Y	x	
NY	Total Organic Carbon	SM 5310C	NPW	Y	x	
NY	Surfactants (MBAS)	SM 5540C	NPW	Y	x	
NY	Heterotrophic Plate Count	SM 9215B	NPW	Y	x	
NY	Coliform, Total MPN	SM 9221B	NPW	Y	x	
NY	Coliform, Fecal MPN	SM 9221C	NPW	Y	x	
NY	Coliform, Fecal MPN	SM 9221E	NPW	Y	x	
NY	Coliform, Total MF	SM 9222B	NPW	Y	x	
Ny	Titanium	EPA 6010C	NPW	x	Y	
NY	Flashpoint	EPA 1010A	SCM	Y	x	
NY	Ignitability	EPA 1030	SCM	Y	x	
NY	TCLP	EPA 1311	SCM	Y	Y	
NY	SPLP	EPA 1312	SCM	Y	x	
NY	Microwave Acid Digestion	EPA 3050B	SCM	Y	Y	
NY	Microwave Acid Digestion	EPA 3051A	SCM	Y	Y	
NY	Chromium VI Digestion	EPA 3060A	SCM	x	Y	
NY	Soxhlet Extraction	EPA 3540C	SCM	Y	Y	
NY	Microwave Acid Digestion	EPA 3546	SCM	Y	x	
NY	Microscale Solvent Extraction (MSE)	EPA 3570	SCM	x	Y	
NY	Waste Dilution	EPA 3580A	SCM	Y	Y	
NY	Purge & Trap Soil Low/High	EPA 5035A	SCM	Y	x	
NY	Aluminum	EPA 6010C	SCM	x	Y	
NY	Antimony	EPA 6010C	SCM	x	Y	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Arsenic	EPA 6010C	SCM	x	Y	
NY	Barium	EPA 6010C	SCM	x	Y	
NY	Beryllium	EPA 6010C	SCM	x	Y	
NY	Boron	EPA 6010C	SCM	x	Y	
NY	Cadmium	EPA 6010C	SCM	x	Y	
NY	Calcium	EPA 6010C	SCM	x	Y	
NY	Chromium	EPA 6010C	SCM	x	Y	
NY	Cobalt	EPA 6010C	SCM	x	Y	
NY	Copper	EPA 6010C	SCM	x	Y	
NY	Iron	EPA 6010C	SCM	x	Y	
NY	Lead	EPA 6010C	SCM	x	Y	
NY	Magnesium	EPA 6010C	SCM	x	Y	
NY	Manganese	EPA 6010C	SCM	x	Y	
NY	Molybdenum	EPA 6010C	SCM	x	Y	
NY	Nickel	EPA 6010C	SCM	x	Y	
NY	Potassium	EPA 6010C	SCM	x	Y	
NY	Selenium	EPA 6010C	SCM	x	Y	
NY	Silver	EPA 6010C	SCM	x	Y	
NY	Sodium	EPA 6010C	SCM	x	Y	
NY	Strontium	EPA 6010C	SCM	x	Y	
NY	Thallium	EPA 6010C	SCM	x	Y	
NY	Tin	EPA 6010C	SCM	x	Y	
NY	Titanium	EPA 6010C	SCM	x	Y	
NY	Vanadium	EPA 6010C	SCM	x	Y	
NY	Zinc	EPA 6010C	SCM	x	Y	
NY	Aluminum	EPA 6020A	SCM	x	Y	
NY	Antimony	EPA 6020A	SCM	x	Y	
NY	Arsenic	EPA 6020A	SCM	x	Y	
NY	Barium	EPA 6020A	SCM	x	Y	
NY	Beryllium	EPA 6020A	SCM	x	Y	
NY	Boron	EPA 6020A	SCM	x	Y	
NY	Cadmium	EPA 6020A	SCM	x	Y	
NY	Calcium	EPA 6020A	SCM	x	Y	
NY	Chromium	EPA 6020A	SCM	x	Y	
NY	Cobalt	EPA 6020A	SCM	x	Y	
NY	Copper	EPA 6020A	SCM	x	Y	
NY	Iron	EPA 6020A	SCM	x	Y	
NY	Lead	EPA 6020A	SCM	x	Y	
NY	Magnesium	EPA 6020A	SCM	x	Y	
NY	Manganese	EPA 6020A	SCM	x	Y	
NY	Molybdenum	EPA 6020A	SCM	x	Y	
NY	Nickel	EPA 6020A	SCM	x	Y	
NY	Potassium	EPA 6020A	SCM	x	Y	
NY	Selenium	EPA 6020A	SCM	x	Y	
NY	Silver	EPA 6020A	SCM	x	Y	
NY	Sodium	EPA 6020A	SCM	x	Y	
NY	Strontium	EPA 6020A	SCM	x	Y	
NY	Thallium	EPA 6020A	SCM	x	Y	
NY	Tin	EPA 6020A	SCM	x	Y	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Vanadium	EPA 6020A	SCM	x	Y	
NY	Zinc	EPA 6020A	SCM	x	Y	
NY	Chromium VI	EPA 7196A	SCM	Y	x	
NY	Mercury	EPA 7471B	SCM	x	Y	
NY	Mercury	EPA 7474	SCM	x	Y	
NY	Diesel Range Organics	EPA 8015C	SCM	Y	x	
NY	Gasoline Range Organics	EPA 8015C	SCM	Y	x	
NY	Diesel Range Organics	EPA 8015D	SCM	x	Y	
NY	Ethylene glycol	EPA 8015D	SCM	x	Y	
NY	Gasoline Range Organics	EPA 8015D	SCM	x	Y	
NY	Iso-butyl Alcohol	EPA 8015D	SCM	x	Y	
NY	Tert-Butyl Alcohol	EPA 8015D	SCM	x	Y	
NY	4,4'-DDD	EPA 8081B	SCM	Y	Y	
NY	4,4'-DDE	EPA 8081B	SCM	Y	Y	
NY	4,4'-DDT	EPA 8081B	SCM	Y	Y	
NY	Aldrin	EPA 8081B	SCM	Y	Y	
NY	alpha-BHC	EPA 8081B	SCM	Y	Y	
NY	alpha-Chlordane	EPA 8081B	SCM	Y	x	
NY	beta-BHC	EPA 8081B	SCM	Y	Y	
NY	Chlordane	EPA 8081B	SCM	Y	Y	
NY	delta-BHC	EPA 8081B	SCM	Y	Y	
NY	Dieldrin	EPA 8081B	SCM	Y	Y	
NY	Endosulfan I	EPA 8081B	SCM	Y	Y	
NY	Endosulfan II	EPA 8081B	SCM	Y	Y	
NY	Endosulfan Sulfate	EPA 8081B	SCM	Y	Y	
NY	Endrin	EPA 8081B	SCM	Y	Y	
NY	Endrin Aldehyde	EPA 8081B	SCM	Y	Y	
NY	Endrin Ketone	EPA 8081B	SCM	Y	Y	
NY	gamma-Chlordane	EPA 8081B	SCM	Y	Y	
NY	Heptachlor	EPA 8081B	SCM	Y	Y	
NY	Heptachlor Epoxide	EPA 8081B	SCM	Y	Y	
NY	Lindane (gamma-BHC)	EPA 8081B	SCM	Y	Y	
NY	Methoxychlor	EPA 8081B	SCM	Y	Y	
NY	Mirex	EPA 8081B	SCM	x	Y	
NY	Toxaphene	EPA 8081B	SCM	Y	Y	
NY	2,2',3,3',4,4',5,5',6-Nonachlorobiphenyl (PCB	EPA 8082A	SCM	x	Y	
NY	2,2',3,3',4,4',5-Heptachlorobiphenyl (PCB 170)	EPA 8082A	SCM	x	Y	
NY	2,2',3,3',4,4'-Hexachlorobiphenyl (PCB 128)	EPA 8082A	SCM	x	Y	
NY	2,2',3,4,4',5,5'-Heptacholorbiphenyl (PCB 180)	EPA 8082A	SCM	x	Y	
NY	2,2',3,4,4',5',6-Heptachlorobiphenyl (PCB 183)	EPA 8082A	SCM	x	Y	
NY	2,2',3,4,4',5'-Hexachlorobiphenyl (PCB 138)	EPA 8082A	SCM	x	Y	
NY	2,2',3,4',5,5',6-Heptachlorobiphenyl (PCB 187)	EPA 8082A	SCM	x	Y	
NY	2,2',3,4,5,5'-Hexachlorobiphenyl (PCB 141)	EPA 8082A	SCM	x	Y	
NY	2,2',3,4,5'-Pentachlorobiphenyl (PCB 87)	EPA 8082A	SCM	x	Y	
NY	2,2',3,5,5',6-Hexachlorobiphenyl (PCB 151)	EPA 8082A	SCM	x	Y	
NY	2,2',3,5'-Tetrachlorobiphenyl (PCB 44)	EPA 8082A	SCM	x	Y	
NY	2,2',4,4',5,5'-Hexachlorobiphenyl (PCB 153)	EPA 8082A	SCM	x	Y	
NY	2,2',4,5,5'-Pentachlorobiphenyl (PCB 101)	EPA 8082A	SCM	x	Y	
NY	2,2',5,5'-Tetrachlorobiphenyl (PCB 52)	EPA 8082A	SCM	x	Y	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	2,2',5-Trichlorobiphenyl (PCB 18)	EPA 8082A	SCM	x	Y	
NY	2,3',4,4',5-Pentachlorobiphenyl (PCB 118)	EPA 8082A	SCM	x	Y	
NY	2,3',4,4'-Tetrachlorobiphenyl (PCB 66)	EPA 8082A	SCM	x	Y	
NY	2,3-Dichlorobiphenyl (PCB 5)	EPA 8082A	SCM	x	Y	
NY	2,4'-Trichlorobiphenyl (PCB 31)	EPA 8082A	SCM	x	Y	
NY	2-Chlorobiphenyl (PCB 1)	EPA 8082A	SCM	x	Y	
NY	PCB-1016	EPA 8082A	SCM	Y	Y	
NY	PCB-1221	EPA 8082A	SCM	Y	Y	
NY	PCB-1232	EPA 8082A	SCM	Y	Y	
NY	PCB-1242	EPA 8082A	SCM	Y	Y	
NY	PCB-1248	EPA 8082A	SCM	Y	Y	
NY	PCB-1254	EPA 8082A	SCM	Y	Y	
NY	PCB-1260	EPA 8082A	SCM	Y	Y	
NY	PCB-1262	EPA 8082A	SCM	Y	Y	
NY	PCB-1268	EPA 8082A	SCM	Y	Y	
NY	PCBs in Oil	EPA 8082A	SCM	Y	x	
NY	2,4,5-T	EPA 8151A	SCM	Y	x	
NY	2,4,5-TP (Silvex)	EPA 8151A	SCM	Y	x	
NY	2,4-D	EPA 8151A	SCM	Y	x	
NY	2,4-DB	EPA 8151A	SCM	Y	x	
NY	Dalapon	EPA 8151A	SCM	Y	x	
NY	Dicamba	EPA 8151A	SCM	Y	x	
NY	Dichloroprop	EPA 8151A	SCM	Y	x	
NY	Dinoseb	EPA 8151A	SCM	Y	x	
NY	MCPA	EPA 8151A	SCM	Y	x	
NY	MCPP	EPA 8151A	SCM	Y	x	
NY	1,1,1,2-Tetrachloroethane	EPA 8260C	SCM	Y	x	
NY	1,1,1-Trichloroethane	EPA 8260C	SCM	Y	x	
NY	1,1,2,2-Tetrachloroethane	EPA 8260C	SCM	Y	x	
NY	1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260C	SCM	Y	x	
NY	1,1,2-Trichloroethane	EPA 8260C	SCM	Y	x	
NY	1,1-Dichloroethane	EPA 8260C	SCM	Y	x	
NY	1,1-Dichloroethene	EPA 8260C	SCM	Y	x	
NY	1,1-Dichloropropene	EPA 8260C	SCM	Y	x	
NY	1,2,3-Trichloropropane	EPA 8260C	SCM	Y	x	
NY	1,2,4-Trichlorobenzene	EPA 8260C	SCM	Y	x	
NY	1,2,4-Trimethylbenzene	EPA 8260C	SCM	Y	x	
NY	1,2-Dibromo-3-Chloropropane (DBCP)	EPA 8260C	SCM	Y	x	
NY	1,2-Dibromoethane (EDB)	EPA 8260C	SCM	Y	x	
NY	1,2-Dichlorobenzene	EPA 8260C	SCM	Y	x	
NY	1,2-Dichloroethane	EPA 8260C	SCM	Y	x	
NY	1,2-Dichloropropane	EPA 8260C	SCM	Y	x	
NY	1,3,5-Trimethylbenzene	EPA 8260C	SCM	Y	x	
NY	1,3-Dichlorobenzene	EPA 8260C	SCM	Y	x	
NY	1,3-Dichloropropane	EPA 8260C	SCM	Y	x	
NY	1,4-Dichlorobenzene	EPA 8260C	SCM	Y	x	
NY	1,4-Dioxane	EPA 8260C	SCM	Y	x	
NY	2,2-Dichloropropane	EPA 8260C	SCM	Y	x	
NY	2-Butanone	EPA 8260C	SCM	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	2-Chloroethyl Vinyl ether	EPA 8260C	SCM	Y	x	
NY	2-Chlorotoluene	EPA 8260C	SCM	Y	x	
NY	2-Hexanone	EPA 8260C	SCM	Y	x	
NY	4-Chlorotoluene	EPA 8260C	SCM	Y	x	
NY	4-Methyl-2-Pentanone	EPA 8260C	SCM	Y	x	
NY	Acetone	EPA 8260C	SCM	Y	x	
NY	Acrolein	EPA 8260C	SCM	Y	x	
NY	Acrylonitrile	EPA 8260C	SCM	Y	x	
NY	Benzene	EPA 8260C	SCM	Y	x	
NY	Bromobenzene	EPA 8260C	SCM	Y	x	
NY	Bromochloromethane	EPA 8260C	SCM	Y	x	
NY	Bromodichloromethane	EPA 8260C	SCM	Y	x	
NY	Bromoform	EPA 8260C	SCM	Y	x	
NY	Bromomethane	EPA 8260C	SCM	Y	x	
NY	Carbon Disulfide	EPA 8260C	SCM	Y	x	
NY	Carbon Tetrachloride	EPA 8260C	SCM	Y	x	
NY	Chlorobenzene	EPA 8260C	SCM	Y	x	
NY	Chloroethane	EPA 8260C	SCM	Y	x	
NY	Chloroform	EPA 8260C	SCM	Y	x	
NY	Chloromethane	EPA 8260C	SCM	Y	x	
NY	cis-1,2-Dichloroethene	EPA 8260C	SCM	Y	x	
NY	cis-1,3-Dichloropropene	EPA 8260C	SCM	Y	x	
NY	Cyclohexane	EPA 8260C	SCM	Y	x	
NY	Dibromochloromethane	EPA 8260C	SCM	Y	x	
NY	Dibromomethane	EPA 8260C	SCM	Y	x	
NY	Dichlorodifluoromethane	EPA 8260C	SCM	Y	x	
NY	Diethyl ether	EPA 8260C	SCM	Y	x	
NY	Ethyl acetate	EPA 8260C	SCM	Y	x	
NY	Ethyl Methacrylate	EPA 8260C	SCM	Y	x	
NY	Ethylbenzene	EPA 8260C	SCM	Y	x	
NY	Hexachlorobutadiene	EPA 8260C	SCM	Y	x	
NY	Isopropylbenzene	EPA 8260C	SCM	Y	x	
NY	m+p-Xylene	EPA 8260C	SCM	Y	x	
NY	Methyl Acetate	EPA 8260C	SCM	Y	x	
NY	Methyl Cyclohexane	EPA 8260C	SCM	Y	x	
NY	Methyl tert-butyl ether	EPA 8260C	SCM	Y	x	
NY	Methylene Chloride	EPA 8260C	SCM	Y	x	
NY	Naphthalene	EPA 8260C	SCM	Y	x	
NY	n-Butanol	EPA 8260C	SCM	Y	x	
NY	n-Butylbenzene	EPA 8260C	SCM	Y	x	
NY	n-Propylbenzene	EPA 8260C	SCM	Y	x	
NY	o-Xylene	EPA 8260C	SCM	Y	x	
NY	p-Isopropyltoluene	EPA 8260C	SCM	Y	x	
NY	sec-Butylbenzene	EPA 8260C	SCM	Y	x	
NY	Styrene	EPA 8260C	SCM	Y	x	
NY	Tert-Butyl Alcohol	EPA 8260C	SCM	Y	x	
NY	Tert-Butylbenzene	EPA 8260C	SCM	Y	x	
NY	Tetrachloroethene	EPA 8260C	SCM	Y	x	
NY	Toluene	EPA 8260C	SCM	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Total Xylenes	EPA 8260C	SCM	Y	x	
NY	Trans-1,2-Dichloroethene	EPA 8260C	SCM	Y	x	
NY	Trans-1,3-Dichloropropene	EPA 8260C	SCM	Y	x	
NY	Trans-1,4-Dichloro-2-butene	EPA 8260C	SCM	Y	x	
NY	Trichloroethene	EPA 8260C	SCM	Y	x	
NY	Trichlorofluoromethane	EPA 8260C	SCM	Y	x	
NY	Vinyl Acetate	EPA 8260C	SCM	Y	x	
NY	Vinyl Chloride	EPA 8260C	SCM	Y	x	
NY	1,1'-Biphenyl	EPA 8270D	SCM	x	Y	
NY	1,2,4,5-Tetrachlorobenzene	EPA 8270D	SCM	Y	Y	
NY	1,2,4-Trichlorobenzene	EPA 8270D	SCM	Y	Y	
NY	1,2-Dichlorobenzene	EPA 8270D	SCM	Y	Y	
NY	1,2-Diphenylhydrazine	EPA 8270D	SCM	Y	Y	
NY	1,3-Dichlorobenzene	EPA 8270D	SCM	Y	Y	
NY	1,4-Dichlorobenzene	EPA 8270D	SCM	Y	Y	
NY	2,3,4,6-Tetrachlorophenol	EPA 8270D	SCM	Y	Y	
NY	2,4,5-Trichlorophenol	EPA 8270D	SCM	Y	Y	
NY	2,4,6-Trichlorophenol	EPA 8270D	SCM	Y	Y	
NY	2,4-Dichlorophenol	EPA 8270D	SCM	Y	Y	
NY	2,4-Dimethylphenol	EPA 8270D	SCM	Y	Y	
NY	2,4-Dinitrophenol	EPA 8270D	SCM	Y	Y	
NY	2,4-Dinitrotoluene (2,4-DNT)	EPA 8270D	SCM	Y	x	
NY	2,6-Dinitrotoluene (2,6-DNT)	EPA 8270D	SCM	Y	x	
NY	2-Chloronaphthalene	EPA 8270D	SCM	Y	Y	
NY	2-Chlorophenol	EPA 8270D	SCM	Y	Y	
NY	2-Methyl-4,6-dinitrophenol	EPA 8270D	SCM	Y	Y	
NY	2-Methylnaphthalene	EPA 8270D	SCM	Y	Y	
NY	2-Methylphenol	EPA 8270D	SCM	Y	Y	
NY	2-Nitroaniline	EPA 8270D	SCM	Y	Y	
NY	2-Nitrophenol	EPA 8270D	SCM	Y	Y	
NY	3,3-Dichlorobenzidine	EPA 8270D	SCM	Y	Y	
NY	3-Methylphenol	EPA 8270D	SCM	Y	Y	
NY	3-Nitroaniline	EPA 8270D	SCM	Y	Y	
NY	4-Bromophenyl phenyl ether	EPA 8270D	SCM	Y	Y	
NY	4-Chloro-3-methylphenol	EPA 8270D	SCM	Y	Y	
NY	4-Chlorophenyl phenyl ether	EPA 8270D	SCM	Y	Y	
NY	4-Methylphenol	EPA 8270D	SCM	Y	Y	
NY	4-Nitroaniline	EPA 8270D	SCM	Y	Y	
NY	4-Nitrophenol	EPA 8270D	SCM	Y	Y	
NY	Acenaphthene	EPA 8270D	SCM	Y	Y	
NY	Acenaphthylene	EPA 8270D	SCM	Y	Y	
NY	Acetophenone	EPA 8270D	SCM	Y	Y	
NY	Aniline	EPA 8270D	SCM	Y	Y	
NY	Anthracene	EPA 8270D	SCM	Y	Y	
NY	Atrazine	EPA 8270D	SCM	Y	x	
NY	Benzaldehyde	EPA 8270D	SCM	Y	Y	
NY	Benzidine	EPA 8270D	SCM	Y	Y	
NY	Benzo(a)anthracene	EPA 8270D	SCM	Y	Y	
NY	Benzo(a)pyrene	EPA 8270D	SCM	Y	Y	

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Benzo(b)fluoranthene	EPA 8270D	SCM	Y	Y	
NY	Benzo(ghi)perylene	EPA 8270D	SCM	Y	Y	
NY	Benzo(k)fluoranthene	EPA 8270D	SCM	Y	Y	
NY	Benzoic Acid	EPA 8270D	SCM	Y	Y	
NY	Benzyl alcohol	EPA 8270D	SCM	Y	Y	
NY	Biphenyl	EPA 8270D	SCM	Y	x	
NY	Bis(2-chloroethoxy) methane	EPA 8270D	SCM	Y	Y	
NY	Bis(2-chloroethyl) ether	EPA 8270D	SCM	Y	Y	
NY	Bis(2-chloroisopropyl) ether	EPA 8270D	SCM	Y	Y	
NY	Bis(2-ethylhexyl) phthalate	EPA 8270D	SCM	Y	Y	
NY	Butyl Benzyl phthalate	EPA 8270D	SCM	Y	Y	
NY	Caprolactam	EPA 8270D	SCM	Y	Y	
NY	Carbazole	EPA 8270D	SCM	Y	Y	
NY	Chrysene	EPA 8270D	SCM	Y	Y	
NY	Dibenzo(a,h)anthracene	EPA 8270D	SCM	Y	Y	
NY	Dibenzofuran	EPA 8270D	SCM	Y	Y	
NY	Diethyl phthalate	EPA 8270D	SCM	Y	Y	
NY	Dimethyl phthalate	EPA 8270D	SCM	Y	Y	
NY	Di-n-butyl phthalate	EPA 8270D	SCM	Y	Y	
NY	Di-n-octyl phthalate	EPA 8270D	SCM	Y	Y	
NY	Diphenylamine	EPA 8270D	SCM	Y	x	
NY	Fluoranthene	EPA 8270D	SCM	Y	Y	
NY	Fluorene	EPA 8270D	SCM	Y	Y	
NY	Hexachlorobenzene	EPA 8270D	SCM	Y	Y	
NY	Hexachlorobutadiene	EPA 8270D	SCM	Y	x	
NY	Hexachlorocyclopentadiene	EPA 8270D	SCM	Y	Y	
NY	Hexachloroethane	EPA 8270D	SCM	Y	Y	
NY	Indeno(1,2,3-cd)pyrene	EPA 8270D	SCM	Y	Y	
NY	Isophorone	EPA 8270D	SCM	Y	Y	
NY	Naphthalene	EPA 8270D	SCM	Y	Y	
NY	Nitrobenzene	EPA 8270D	SCM	Y	Y	
NY	N-Nitrosodimethylamine	EPA 8270D	SCM	Y	Y	
NY	N-Nitrosodi-n-propylamine	EPA 8270D	SCM	Y	Y	
NY	N-Nitrosodiphenylamine	EPA 8270D	SCM	Y	Y	
NY	Parathion	EPA 8270D	SCM	Y	x	
NY	Pentachloronitrobenzene	EPA 8270D	SCM	Y	Y	
NY	Pentachlorophenol	EPA 8270D	SCM	Y	Y	
NY	Phenanthrene	EPA 8270D	SCM	Y	Y	
NY	Phenol	EPA 8270D	SCM	Y	Y	
NY	Pyrene	EPA 8270D	SCM	Y	Y	
NY	Pyridine	EPA 8270D	SCM	Y	Y	
NY	Acenaphthene	EPA 8270D-SIM	SCM	Y	x	
NY	Acenaphthylene	EPA 8270D-SIM	SCM	Y	x	
NY	Anthracene	EPA 8270D-SIM	SCM	Y	x	
NY	Benzo(a)anthracene	EPA 8270D-SIM	SCM	Y	x	
NY	Benzo(a)pyrene	EPA 8270D-SIM	SCM	Y	x	
NY	Benzo(b)fluoranthene	EPA 8270D-SIM	SCM	Y	x	
NY	Benzo(ghi)perylene	EPA 8270D-SIM	SCM	Y	x	
NY	Benzo(k)fluoranthene	EPA 8270D-SIM	SCM	Y	x	

Summary of Certification

State	Parameter	Method	Matrix	Alpha Westboro	Alpha Mansfield	Notes
NY	Chrysene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Dibenzo(a,h)anthracene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Fluoranthene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Fluorene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Indeno(1,2,3-cd)pyrene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Naphthalene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Phenanthrene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Pyrene	EPA 8270D-SIM	SCM	Y	**x**	
NY	Cyanide - Amenable, Distillation	EPA 9010C	SCM	Y	**x**	
NY	Cyanide, Distillation	EPA 9010C	SCM	Y	**x**	
NY	Cyanide, Total	EPA 9012B	SCM	Y	**x**	
NY	Cyanide, Total	EPA 9014	SCM	Y	**x**	
NY	Extractable Organic Halides (EOX)	EPA 9023	SCM	Y	**x**	
NY	Sulfate	EPA 9038	SCM	Y	**x**	
NY	pH	EPA 9040C	SCM	Y	**x**	
NY	pH	EPA 9045D	SCM	Y	**x**	
NY	Specific Conductance	EPA 9050A	SCM	Y	**x**	
NY	Total Organic Carbon	EPA 9060	SCM	**x**	**Y**	
NY	Total Phenolics	EPA 9065	SCM	Y	**x**	
NY	Oil & Grease	EPA 9071B	SCM	Y	**x**	
NY	Chloride	EPA 9251	SCM	Y	**x**	
NY	Total Organic Carbon	Lloyd Kahn	SCM	**x**	**Y**	

APPENDIX C

HEALTH AND SAFETY PLAN

December 2018

Site Specific
Health & Safety Plan

Hamilton Hill II – Target Area 1 Site
830 & 834 Albany Street
City of Schenectady
Schenectady County, New York
BCP Site #C447052

Prepared by:

C.T. MALE ASSOCIATES
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Latham, New York 12110
(518) 786-7400
FAX (518) 786-7299

C.T. Male Associates Project No: 16.6334

SITE SPECIFIC HEALTH & SAFETY PLAN
HAMILTON HILL II – TARGET AREA 1 SITE
830 & 834 ALBANY STREET
CITY OF SCHENECTADY, SCHENECTADY COUNTY, NEW YORK

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1.0 GENERAL

1.1 Overview

This Health and Safety Plan (HASP) has been prepared for use during implementation of a Remedial Investigation (RI) at the Hamilton Hill II – Target Area 1 BCP Site ("the Site") located at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York.

A designated Health and Safety Officer (HSO) will be responsible for implementing this HASP during the completion of the RI field work. All persons or parties who enter the work area (support zone, decontamination zone or exclusion zone) must review, sign and comply with this HASP. A partial list of individuals authorized to enter the exclusion zone at the Site is presented in Section 13.0 of this HASP. Others may be added to the list as needed. A copy of this HASP will be maintained at the Site throughout the duration of the project. A complete description of the RI work is presented in the RI Work Plan. A brief description of the proposed scope of work is outlined below:

<u>Remedial Investigation:</u>

- Oversee the drilling of soil borings and installation of groundwater monitoring wells and soil vapor probes;
- Collection of subsurface soil samples from the soil borings for classification and submission for laboratory analyses;
- Installation and development of newly installed monitoring wells;
- Groundwater purging and sampling for laboratory analyses from newly installed and existing temporary monitoring wells;
- Collection of soil vapor samples;
- Collection of field quality control samples of soil and groundwater for laboratory analysis;
- Survey sampling locations and monitoring well locations, and elevation survey; and
- Other unforeseen environmental conditions which may be encountered during the RI work.

1.2 Contact Names & Numbers

For this project, the following project contacts have been assigned.

<u>HAMILTON HILLS II LIMITED PARTNERSHIP CONTACTS:</u>

PROJ. MANAGER:	Jennica Huff	
	Hamilton Hill II Limited Partnership	
	90 State Street	
	Albany, New York 12207	518.795-3413 (O)

<u>CONSULTANT CONTACTS:</u>

CONSULTING ENGINEER:	C.T. Male Associates 50 Century Hill Drive Latham, New York 12110	518.786.7400 (O)
	Dan Reilly, Project Principal	518.786.7625 (O) 518.928.9792 (C)
	Kirk Moline, Project Manager	518.786.7502 (O) 518.265.1708 (C)
	Nancy Garry, Health & Safety Officer	518.786.7541 (O) 518.320.5783 (C)

<u>EMERGENCY PHONE NUMBERS:</u>

PERSONAL INJURY OR EMERGENCY:	Emergency	911
	Ellis Hospital	(Main Number) 518.243.4000
	1101 Nott Street Schenectady, New York 12308 (approx. 10 minutes)	(Emergency) 518.243.4121
FIRE DEPARTMENT:	Emergency	911
	City of Schenectady Fire Station #1 360 Veeder Avenue Schenectady, New York 12305	518.382.5141
POLICE:	Emergency	911
	City of Schenectady Police Department 531 Liberty Street Schenectady, New York 12305	518.382.5201

NYS Police	Emergency	911
	NYS Police Troop G 760 Troy Schenectady Road Latham, New York 12110	518.783.3211
UPSTATE NEW YORK REGIONAL POISON CONTROL CENTER:	University Hospital Upstate Medical University SUNY Health Science Center 750 East Adams Street Syracuse, New York 13201	800.222.1222
NATIONAL RESPONSE CENTER:	c/o United States Coast Guard (G-OPF) 2100 2nd Street, Southwest - Room 2611 Washington, DC 20593-0001	800.424.8802
NYSDEC SPILL HOTLINE:		800.457.7362

2.0 HEATLH AND SAFETY PERSONNEL

The Health and Safety Officer (HSO) will be responsible for implementation of the HASP and the delegation of health and safety duties. The HSO will coordinate the resolution of safety issues that arise during site work. When field operations require only Level D protection, it will not be necessary for the HSO to be present on-site at all times. When the HSO is not present on-site, a designee will be authorized to perform the duties of the HSO, and the designee will be responsible for implementation of the HASP.

The HSO or designee has authority to stop work upon their determination of an imminent safety hazard, emergency situation or other potentially dangerous situations (e.g. weather conditions). Authorization to resume work will be issued by the HSO.

3.0 SITE LOCATION AND DESCRIPTION

The Site is located at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York. The Site occupies the southwest and southeast corner of the intersection of Albany Street and Craig Street. The Site is comprised of vacant lots and dilapidated multi-family residential and commercial buildings. Dry cleaners formerly occupied the buildings located at the southeastern and southwestern corners of Albany and Craig Streets. Two (2) storage tanks are located in the basement of the building at the southwest corner of Albany and Craig Street. An underground storage tank is also located at the rear of this building. Nearby property usage is mixed use residential and commercial surrounding the Site.

The historical use of the Site dates to 1880s. The Site was historically occupied by single and multi-family dwellings, convenience stores, bakery, dry cleaners and commercial buildings. The Site was historically affiliated with dry cleaning operations.

Based upon the investigations conducted to date, the primary contaminants of concern at the Site include semi-volatile organic compounds (SVOCs) and metals in soil, and solvents, petroleum, acetone, SVOCs and metals in groundwater.

4.0 POTENTIAL SITE CONTAMINANTS

Contaminants that may be encountered during the RI include SVOCs and metals in soil, and solvents, petroleum, acetone, SVOCs and metals in groundwater.

5.0 HAZARD ASSESSMENT

5.1 General

The hazard assessment, use of specific protective equipment, and monitoring associated with each field work task of the RI to be conducted at the subject Site are presented in following subsections.

For this project, C.T. Male will be subcontracting portions of the RI activities. Each subcontractor will be responsible for developing and implementing a site specific health and safety plan for their activities, for protection of their employees, and use of personal protective equipment. The subcontractor will also be responsible for developing and following their own Respiratory Protection Program, as applicable.

5.2 Media Sampling

5.2.1 Soil, Soil Vapor and Groundwater Sampling

Soil, soil vapor and groundwater sampling are planned for the Site. The potential hazards to personnel during this work are dermal contact. Level D protection should be sufficient to protect against dermal contact during handling of soils and groundwater. If organic vapors are present at the action levels described in Section 5.4, on the basis of organic vapor monitoring of the area during the work, it may be necessary to upgrade to Level C respiratory protection.

5.3 Subsurface Work

Exploratory test borings (including the installation of monitoring wells and soil vapor probes) into soils are planned for the site. The potential hazards to personnel during this work are dermal contact. Level D protection should be sufficient to protect against dermal contact during drilling of and/or handling of the subsurface soils and groundwater. If organic vapors are present at the action levels described in Section 5.4, on the basis of organic vapor monitoring of the area during the work, it may be necessary to upgrade to Level C respiratory protection.

5.4 Air Monitoring

During ground intrusive activities, the ambient air in the work area will be monitored with a photoionization detection meter (total volatile compounds – MiniRAE 3000) prior to the start of work and periodically throughout work activities. If a concentration of 10 ppm (sustained for 5 minutes) of total volatile compounds is detected within the work area on the instrument, relative to an isobutylene standard (used to calibrate the instrument), work will cease immediately and the workers shall shut down equipment and leave the area immediately. The level of personal protective equipment (PPE) protection will be evaluated prior to continuing work. If a PPE upgrade to Level C is required, it will include: a half face air purifying respirator equipped with combination organic vapor and particulate cartridges for 10-15 ppm exposure levels; and a full-face air purifying respirator for greater than 15 ppm to less than 50 ppm exposure levels, prior to continuing work. If a concentration greater than 50 ppm is encountered, work will cease immediately and the situation will be evaluated prior to continuation of work. Table 1 summarizes the action levels relative to the required respiratory protection.

Table 1
C.T. Male Action Levels & Required Respiratory Protection

Action Level	Level of PPE	Type of Respiratory Protection
0-10 parts per million	Level D	No respiratory protection
10-15 parts per million	Level C	Negative pressure half-face respirator
15-50 parts per million	Level C	Positive pressure full-face respirator
Greater than 50	Cease Work	Evaluate work procedures

-Facial hair is not permitted while wearing most respirators.

-Workers required to wear a respirator must have a minimum of OSHA 40 Hour training with current medical monitoring and fit test documentation.

5.5 Community Air Monitoring Plan

A Community Air Monitoring Plan (CAMP) will be followed during ground intrusive remedial activities (i.e., soil borings, excavation, disturbance and handling of site fill/soil). The intent of the CAMP is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of the RI. The CAMP is not intended for use in establishing action levels for worker respiratory protection. The CAMP will monitor the air for dust (particulate air monitoring, see Section 5.5.1) and volatile organic compound vapors (VOC air monitoring, see Section 5.5.2) at the downwind perimeter of the work area. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. The CAMP is included in Appendix B.

5.5.1 Particulate Air Monitoring

Two (2) real-time particulate monitors capable of continuously measuring concentrations of particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) will be utilized. The instruments will be placed inside environmental enclosures at temporary monitoring stations based on the prevailing wind direction each work day, one (1) upwind and one (1) downwind of the designated work areas.

Each particulate monitor will be equipped with a telemetry unit capable of transmitting real-time particulate data to the Remediation Engineer and/or field representative. The particulate monitoring instruments will be capable of displaying and transmitting the short term exposure limit (STEL) or 15 minute averaging period, which will be compared to the NYSDOH Generic Community Air Monitoring Plan action levels for particulates, as listed below. The instruments are programmed to alarm at preset action levels. At the end of each day, the readings for each instrument will be downloaded to a PC and retained for future reference and reporting.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that the downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, the downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

In the event of poor weather such as heavy rain, particulate monitoring will not be performed for protection of instrumentation. These weather conditions would limit the effectiveness of the sensitive monitoring equipment and likely suppress particulate generation. Work activities will be halted if fugitive dust migration is visually observed for a sustained period of time during poor weather conditions.

5.5.2 Volatile Organic Compound Air Monitoring

C.T. Male will continuously monitor for volatile organic compounds (VOCs) at the downwind perimeter of the immediate work areas with a MiniRAE 3000 VOC monitor or equal. The VOC monitor will be placed in the downwind environmental enclosure containing a particulate monitor. The downwind VOC monitor will be equipped with a telemetry unit capable of transmitting real-time VOC data to the Remediation Engineer and/or field representative. The VOC monitoring instrument will be capable of displaying and transmitting the short term exposure limit (STEL) or 15 minute averaging period, which will be compared to the NYSDOH Generic Community Air Monitoring Plan action levels for VOCs, as listed below. The downwind VOC STEL readings will be downloaded to a PC and retained for future reference and reporting.

Upwind VOC STEL concentrations will be measured at the start of the work day and periodically thereafter employing a handheld MiniRae 3000 VOC monitor to evaluate the Site’s background conditions. The upwind VOC STEL readings will be manually recorded for future reference and reporting.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. Work activities will then be evaluated to determine the source of the organic vapors and the engineering controls required to reduce/eliminate the organic vapors.

5.6 Hazard Identification and Control

The following Table 2 presents generalized hazards potentially involved with the tasks to be completed on this project. The table identifies general procedures to follow to prevent or reduce accident, injury or illness. Any worker on-site who identifies a potential hazard must report the condition to the HSO or designee, and initiate control of the hazardous condition.

Table 2
Potential Hazards and Control

Potential Hazard	Control
Vehicular Traffic	1. Wear safety vest when vehicular hazards exist. 2. Use cones, flags, barricades, and caution tape to define work area. 3. Use vehicle to block work area. 4. Use vehicle caution lights in high traffic areas within the Site. 5. Contact local police for high traffic situations on public roadways

Table 2
Potential Hazards and Control

Potential Hazard	Control
Slip, Trip, and Fall Protection	1. Assess work area to determine if there is a potential for falling, tripping, or slippery surfaces (water, mud or condensation). 2. Make sure work area is neat and tools are staged in one general area. 3. Wear steel-toe boots with adequate tread and always watch where the individual is walking. Carry flashlight when walking in poorly lighted areas.
Inclement Weather	1. Stop outdoor work during electrical and thunder storms, high winds, blizzard conditions and other extreme weather conditions such as extreme heat or cold temperatures. 2. Take cover indoors or in vehicle. 3. Listen to local forecasts for warnings about specific weather hazards such as tornadoes, hurricanes, and flash floods.
Utility Lines Contact	1. Contact UFPO to have utility lines marked prior to a subsurface investigation, including but not limited to underground excavation, trenching or drilling. UFPO must be contacted at least 72 hours prior to work. 2. Conduct onsite utility mark out by a subcontractor, if needed. 3. Refer to site drawings for utility locations. 4. Manually dig 3 to 5 feet below grade and 5 feet on each side of utility marked to avoid breaking utility lines.
Noise	1. Wear hearing protection when exposed to noise levels above 85 decibels, which includes equipment such as a drill rig, excavator, jackhammer, boat motor, wood chipper, chainsaw, or other heavy equipment is operating on-site. 2. Wear hearing protection whenever you need to raise your voice above normal conversational speech due to a loud noise source; as this much noise indicates the need for protection. 3. Hearing protection is required when measured sound exceeds 85 decibels (dB) where employees stand or conduct work.
Electrical Shock	1. Maintain appropriate distance between heavy equipment and overhead utilities; 20 foot minimum clearance from power lines; and 10 foot

Table 2 Potential Hazards and Control	
Potential Hazard	**Control**
	minimum clearance from shielded power lines. 2. Contact local underground utility locating service prior to penetrating the ground surface.
Physical Injury	1. Wear hard hats, safety glasses, reflective orange safety vest at all times when on-site. Personnel to have hearing protection on them and in use when it is required. 2. Maintain visual contact with equipment operators and wear orange safety vest when heavy equipment is operating on-site. Be aware of pedestrians and other vehicle traffic while heavy machinery is operating onsite. 3. Avoid loose clothing, long hair, and jewelry when working around rotary equipment. 4. Keep hands and feet away from drilling augers, excavation equipment tracks/tires, and other onsite heavy equipment. 5. Test emergency shut-off switches on drill rigs and excavation equipment prior to daily use. 6. Wear life preserver in boats. 7. Do not enter manholes. 8. Be aware of openings into manholes and keep area clear of trip hazards. 9. Be aware of outside terrain – steep slopes and slip, trip hazards while working. 10. Be aware of biological hazards onsite such as insects (bees, mosquitoes, and flies), ticks, spiders, and snakes. 11. Be aware of botanical hazards such as poison ivy, poison sumac, and giant hogweed. 12. Be alert for discarded hypodermic needles on the ground surface.
Back Injury	1. Use a mechanical lifting device or a lifting aid where appropriate. 2. Ensure the route is free of obstructions. 3. Bend at the knees and use leg muscles when lifting. 4. Use the buddy system if lifting heavy or awkward objects. 5. Do not twist or jerk your body when lifting.

Table 2
Potential Hazards and Control

Potential Hazard	Control
Heat Stress	1. Increase water intake while working. 2. Avoid excessive alcohol intake the night before working in heat stress situations. 3. Increase number of rest breaks as necessary, and rest in a shaded area. 4. Watch for signs and symptoms of heat exhaustion and fatigue. 5. Rest in cool, dry areas. 6. In the event of heat stress or heat stroke, bring the victim to a cool environment and call 911.
Cold Stress	1. Wear cotton, wool or synthetic (polypropylene) undergarments to absorb perspiration from the body. 2. Wear additional layers of light clothing as needed for warmth. The layering effect holds in air, trapping body heat, and some layers could be removed as the temperature rises during the day. 3. Pay close attention to body signals and feelings (hypothermia symptoms), especially to the extremities. Correct any problem indicators by breaking from the work activity and moving to a rest area to warm up and add additional clothing. 4. Increase water intake while working. 5. Avoid excessive alcohol intake the night before working in cold conditions. 6. Increase the number of rest breaks as necessary, and rest in a warm area. 7. In the event of hypothermia or frost bite, bring the victim to a warm environment and call 911.
Fire Control	1. Smoking is not allowed on-site. 2. Keep flammable liquids in closed containers. 3. Isolate flammable and combustible materials from ignition sources. 4. Keep fire extinguisher nearby and use only if deemed safe.
Media Sampling (water, soil, etc.)	1. Wear appropriate PPE to avoid skin, eye, and inhalation contact with contaminated media. 2. Stand upwind to minimize possible inhalation exposure, especially when opening monitoring wells or closed containers/vessels.

Table 2 Potential Hazards and Control	
Potential Hazard	**Control**
	3. Conduct air monitoring, whenever necessary, to determine level of respiratory protection. 4. If necessary, employ engineering controls to assist in controlling chemical vapors. 5. When collecting samples on or near water bodies, wear a life jacket and employ the buddy system. 6. When collecting samples from water bodies, assess water conditions and the water current and ensure that the sampling vessel is stabilized.
Cleaning Equipment	1. Wear appropriate PPE to avoid skin and eye contact with Alconox or other cleaning materials. 2. Stand upwind to minimize possible inhalation exposure. 3. Properly dispose of spent chemical cleaning solutions and rinse accordingly.
Poor Structural Building Condition	1. Assess building and rooftop condition prior to accessing and note where exit points are at all times. 2. Be cautious when walking inside a building. Always look for holes in the floors or hanging debris which could cause injury. 3. Carry a high powered flashlight and use as necessary in low light areas. 4. If working in a building, ensure work area is neat and tools are staged in one general area. 5. If working on a rooftop, maintain a safe distance from the roof ledge and do not access sloped roof surfaces without proper safety controls. 6. Wear steel-toe boots with adequate tread. 7. Attempt to employ the buddy system so someone knows what part of the building individuals are in.
Deer Ticks	1. Wear pants and long sleeve shirts. 2. Wear tick repellant coated pants and long sleeve shirts. 3. Use tick repellent. 4. Perform personal body checks for the presence of ticks. 5. Notify the Health and Safety Officer immediately if you have been bitten by a tick and contact your physician.

Hand and Power Tools	1. Ensure cords to tools are not frayed and are properly grounded. 2. Ensure guards for power tools are in place (such as portable circular saw) as recommended by the manufacturer 3. Ensure tool cutting edges are kept in proper condition so the tool will operate properly. 4. Worn or bent tools are not to be used. Tool handles must be secure. 5. When not in use, tools are stored in a dry, secure location. 6. Ensure proper PPE use with hand and power tools. Cut or puncture resistant gloves, or work gloves to provide protection may be used. Check with HSO prior to use of the power tools. If a generator is used with the power tools, ensure there is proper ventilation for the generator.
Note: A first aid kit and fire extinguisher will be located in the C.T. Male company vehicle.	

Response actions to personal exposure from on-site contaminants include skin contact, eye contact, inhalation, ingestion, and puncture or laceration. The recommended response actions are presented in Section 11.2.

6.0 TRAINING

Site specific training of workers and personnel will be conducted and provided by the HSO or designee prior to any on-site activity. The training will specifically address the activities, procedures, monitoring and equipment for the site operations. It will include area and facility layout, hazards, emergency services (police, hospital, fire, etc.), and review of this HASP. Questions by workers, field personnel, etc. will be addressed at this time.

Workers and personnel conducting and/or supervising the project must have attended and successfully completed a 40 Hour Health and Safety Training Course for Hazardous Waste Operations and an annual 8 hour Refresher Course. Workers must take part in an employer medical surveillance program in accordance with OSHA 29 CFR 1910.120 requirements, including that prior to the date the employee begin Site work, they have an annual medical physical that is up to date and not past the prior year's annual physical date. In addition, the results of the annual physical must show that a worker has been cleared by a physician (as per 29 CFR 1910.120) to perform this type of work, and that they are physically able to wear a respirator.

Documentation of training and medical surveillance will be submitted to the HSO or designee prior to the start of any on-site work. A copy of the training certificates for C.T. Male personnel are maintained at C.T. Male's place of business and are available on demand.

7.0 SITE ACCESS

The RI will be conducted within and at the inside perimeter of the Site boundaries. Due to the site location, it is possible that the public or curious bystanders may be present at the time of the work. As such, the work area and exclusion zone will be considered as the following, dependent on the investigative tasks performed.

- Caution tape and/or tall cones (preferably weighted) will be used to delineate an approximate 30 foot square around each test boring location. All work and equipment will remain within the designated work area/exclusion zone until completion of the test boring and installation of the monitoring wells and soil vapor sampling points.

- Caution tape will be used to delineate an approximate 10 foot square around each soil sampling location not originating from a test boring. All work and equipment will remain within the designated work area/exclusion zone until completion of the sampling.

Only OSHA trained individuals who are qualified to do the work and have read and signed this Site specific HASP will be allowed within the work/exclusion zone. The HSO or designee will be responsible for limiting access to unauthorized individuals.

The Contamination Reduction Zone (decontamination area), and Support Zone (clean area, everywhere else) will be established outside the Exclusion Zone, as necessary. The exclusion, contamination reduction, and support zone during the RI work have been identified and designated as follows:

Work/Exclusion Zone - The location of the work/exclusion zone will be determined in the field prior to the start of work and will vary depending on the work activities conducted. For the most part, the work/exclusion zone is anticipated to be defined with caution tape and cones (see above). Only authorized persons with proper training and protective gear will be allowed to enter the work/exclusion zone.

Contamination Reduction Zone – If applicable, this zone will generally be a 30'± x 30'± area, marked off with stakes, colored flagging, cones, or equal method, containing the decontamination pad. The location will be determined in the field prior to the start of work and will vary depending on the area(s) the work is being conducted. This zone is where decontamination of personnel and equipment will take place, as necessary, on the basis of the work being performed.

Support Zone - Area outside of the contamination reduction zone; not including the work/exclusion zone. Unauthorized or untrained individuals must remain in this zone.

8.0 PERSONAL PROTECTION

8.1 Level of Protection

Based on an evaluation of the potential hazards, the minimum level of protection to be worn by workers during implementation of the RI activities is defined as Level D protection, and will be controlled by the HSO or designee.

The minimum level D protective equipment will consist of field clothes, rubber gloves, hard hats, safety glasses, and safety boots (steel-toe preferred). As appropriate, this level of protection may be modified to include protective suits, coveralls, leg chaps, or face shield for additional protection.

If required, level C protective equipment will consist of the items listed for Level D protection with the added protection of half-face or full-face, air purifying (organic vapor and particulate) respirator, chemical resistant clothing, inner and outer chemically resistant gloves (i.e. nitrile and/or PVC), and chemical resistant safety over boots.

Both full-face and half-face air purifying respirators should be readily available. Appropriate combination organic vapor and particulate cartridge filters will be available at the Site to use, if necessary, with the air purifying respirators.

Level B is not anticipated, but if required, level B protective equipment will consist of the items listed for Level D protection except a self-contained breathing apparatus (SCBA) will be worn dependent on the level of contaminants present in the work zone, and protective suits will be required. When Site conditions warrant the need for level B protective equipment, work will cease and the project will be re-evaluated to determine the necessity for employing engineering controls to reduce or eliminate the potential contaminants of concern. C.T. Male employees are not trained in SCBA use, and will not don SCBA during site investigation activities.

8.2 Safety Equipment

Basic emergency and first aid equipment will be available at an area within the Support Zone clearly marked and available or within C.T. Male's company vehicle. This shall include a first aid kit, fire extinguisher, supply of potable water, soap and paper towels. The HSO or designee shall be equipped with a cellular phone in case of emergencies.

9.0 COMMUNICATIONS

The HSO or designee will be equipped with a cellular phone in case of emergencies. The HSO or designee shall notify the C.T. Male Project Manager as soon as safely possible in the event of an accident, injury or emergency action.

Hand signals for certain work tasks will be employed, as necessary, and the buddy system will be employed, if feasible, during drilling and installation of monitoring wells and soil vapor sampling equipment.

10.0 DECONTAMINATION PROCEDURES

10.1 Personnel Decontamination Procedures

Decontamination procedures will be carried out by all personnel leaving the Work/Exclusion Zone (except under emergency evacuation). The amount of decontamination performed will be dependent on the level of personal protection currently being worn within the exclusion zone.

1. Do not remove respiratory protection until all steps have been completed.
2. Clean outer protective gloves and outer boots, if worn, with water (preferably with a pressurized washer) over designated wash tubs in the exclusion zone to remove the gross amount of contamination.
3. Deposit equipment used (tools, sampling devices, and containers) at designated drop stations - on plastic drop sheets or in plastic lined containers.
4. Rinse outer boots if worn and gloves with clean water in designated rinse tubs. Remove outer boots if worn and gloves and deposit in designated area to be determined in the field for use the next day or when necessary. If disposable outer boots are worn, remove and discard in designated container.
5. Remove hard hat & safety glasses, rinse with clean water as necessary and deposit in designated area for use the next day or when necessary.
6. Remove protective suit, if worn, and discard in designated container. Remove respirator at this time, if used; wash and rinse with clean water. Organic vapor and particulate cartridges, when used, will be replaced daily. Used cartridges will be discarded in the designated waste container. Remove inner gloves and discard in designated container.

10.2 Equipment and Sample Containers Decontamination

All decontamination will be completed by personnel in protective gear appropriate for the level of protection determined by the site HSO or designee. Manual sampling equipment including scoops, hand augers, shovels and core samplers which come into contact with the site's soils will be cleaned with a tap water/detergent wash and a bottled water rinse. The sampling equipment will be decontaminated after each sample is collected at the Contaminant Reduction Zone (Decontamination Station). The sampling equipment wash and rinse water will be captured in plastic pails or tubs and ultimately transferred to labeled DOT 17H approved 55-gallon open top steel drums and staged on-site at a secure location.

Drill rig equipment (i.e., casing, drill rods, bits, augers) which comes into contact with the site's soils will be decontaminated with a high pressure/hot water wash and/or other methods within the Contaminant Reduction Area. The cleaning will be performed at the completion of each boring location. Equipment decontamination wastes will be transferred to labeled DOT 17H approved 55-gallon open top steel drums and staged on-site at a secure location.

Larger equipment (i.e., drill rig) which comes into contact with the site's soils will be decontaminated with a high pressure/hot water wash and/or other methods within a decontamination pad. The decontamination procedure will focus on portions of the equipment that has come into contact with the site's soils such as the tires and tracks. The cleaning will be performed prior to the equipment leaving the site. Equipment decontamination wastes will be transferred to labeled DOT 17H approved 55-gallon open top steel drums and staged on-site at a secure location.

Exterior surfaces of sample containers will be wiped clean with disposable paper towels in the decontamination zone and transferred to a clean cooler for transportation or shipment to the analytical laboratory. Sample identities will be noted and checked off against the chain-of-custody record. The disposable paper towels will be placed in the designated disposal container and disposed of as solid waste.

11.0 EMERGENCY RESPONSE PROCEDURES

THE PROJECT EMERGENCY COORDINATOR IS:

Site Health and Safety Officer (HSO)	Nancy Garry
Project Manager	Kirk Moline

The following standard emergency procedures will be used by on-site personnel. The Project Manager and HSO shall be notified of any on-site emergencies and be responsible for assuring that the appropriate procedures are followed.

11.1 Personal Injury

Emergency first aid shall be administered on-site as deemed necessary and only by a trained individual, if available at the site. If a trained individual is not available on-site, decontaminate, if feasible, and transport individual to nearest medical facility (Ellis Hospital). The HSO will supply medical data sheets to appropriate medical personnel and be responsible for completing the incident report. If the HSO is injured or controlling the emergency situation, the medical data sheets are available in Attachment A of this Health and Safety Plan.

11.2 Personal Exposure

The recommended response to worker exposure from contaminants on-site includes the following:

SKIN CONTACT:	Use generous amounts of soap and water. Wash/rinse affected area thoroughly, then provide appropriate medical attention, as necessary.
EYE CONTACT:	Wash eyes thoroughly with tepid potable water supply provided on site. Eyes should be rinsed for at least 15 minutes subsequent to chemical contamination. Provide medical attention, as necessary.
INHALATION:	Move worker to fresh air and outside of the work zone and/or, if necessary, decontaminate and transport to hospital (Ellis

	Hospital). If respirator use is implemented at the time of inhalation, worker must not remove respirator until completely away from the work zone.
INGESTION:	Decontaminate, if feasible, and transport to hospital (Ellis Hospital).
PUNCTURE WOUND OR LACERATION:	Provide first aid at the site and if wound needs medical attention, decontaminate, if feasible, and transport to hospital (Ellis Hospital).

If the affected worker is exposed to contaminants on-site and the injury or accident prevents decontamination of the individual, the emergency responders must be notified of this condition and the exposure must be kept to a minimum.

11.3 Potential or Actual Fire or Explosion

Immediately evacuate area in the event of potential or actual fire or explosion. Notify the local Fire and Police Departments, and other appropriate emergency response groups as listed in Section 1.2. Perform off-site decontamination and contain wastes for proper disposal. If a fire or explosion occurs, all on-site personnel must meet in the designated area of the site (established by the HSO or designee) for an accurate head count.

11.4 Equipment Failure

Should there be any equipment failure, breakdown, etc. the Project Manager and HSO shall be contacted immediately. The Project Manager or the HSO will make every effort to replace or repair the equipment in a timely manner.

11.5 Spill Response

The site HSO or designee shall initiate a corrective action program with the subcontractors in the event of an accidental release of a hazardous material, suspected hazardous material or petroleum. The HSO or designee will act as the Emergency Coordinator with the subcontractors for the purposes of: spill prevention; identifying releases; implementing clean up measures; and notification of appropriate personnel.

The corrective action program will be implemented by the HSO and subcontractor to effectively control and minimize any impact accidental releases may have to the environment.

Effective control measures will include:

- Preliminary assessment of the release.
- Control of the release source.
- Containment of the released material.
- Effective clean-up of the released material.

Potential sources of accidental releases include: hydraulic oil spills or petroleum leaks from heavy equipment; cooling oils (potentially PCB containing) for electrical equipment handling and cleaning; and spills from drums, vats, vessels, and tanks. The HSO/Emergency Coordinator in conjunction with the subcontractor shall respond to an accidental release in the following manner:

- Identify the character, source, amount and area affected by the release.
- Have subcontractor take all reasonable steps to control the release.
- Notify facility personnel.
- Notify the NYSDEC Spill Hotline at 1-800-457-7362 if required.
- Contain the release with sorbent material which should include speedi-dry, spill socks and sorbent pads.
- Prevent the release from entering sensitive receptors (i.e., catch basins and surface water) using the specified sorbent material or sandbags.
- Coordinate cleanup of the released material.
- Oversee proper handling and storage of contaminated material for disposal.

At no time should personal health or safety be compromised or jeopardized in an attempt to control a release. All health and safety measures as outlined in this HASP should be adhered to.

12.0 ADDITIONAL WORK PRACTICES

Workers will be expected to adhere to the established safety practices. Work on the project will be conducted according to established protocol and guidelines for the safety and health of all involved. The following will be adhered to:

- Employ the buddy system when possible, and for those work tasks which require it. Establish and maintain communications.
- Minimize contact with potentially contaminated soil and groundwater.
- Employ disposable items when possible to minimize risks during decontamination and possible cross-contamination during sample handling.
- Smoking, eating, or drinking after entering the work zone and before decontamination will not be allowed.
- Avoid heat and other work stress related to wearing personal protective equipment. Take breaks as necessary and drink plenty of fluids to prevent dehydration.
- Withdrawal from a suspected or actual hazardous situation to reassess procedures is the preferred course of action.
- The removal of facial hair (except mustaches, if it does not affect the seal/fit of the respirator) prior to working on-site will be required to allow for a proper respiratory face piece fit.
- The Project Manager, the HSO, and sampling personnel shall maintain records recording daily activities, meetings, facts, incidents, data, etc. relating to the project. These records will remain at the project site during the full duration of the project so that replacement personnel may add information while maintaining continuity. These daily records will become part of the permanent project file.

13.0 AUTHORIZATIONS

Personnel authorized to enter the exclusion zone at the Hamilton Hill II – Target Area 1 Site at 830 & 834 Albany Street in the City of Schenectady, Schenectady County, New York while operations are being conducted must be certified by the HSO. Authorization will involve completion of appropriate training courses and review and sign off of this HASP.

C.T. Male personnel identified below will be authorized to perform work on the Site after they have read and signed this HASP, as per Section 15.0.

1\. Kirk Moline C.T. Male

3\. Steve Bieber C.T. Male

4\. Jeff Marx C.T. Male

5\. Rosaura Andujar-McNeil C.T. Male

6\. Jon Dippert C.T. Male

7\. Dan Achtyl C.T. Male

8\. Reed Lewandowski C.T. Male

9\. Dan King C.T. Male

10\. Kendal Cietek C.T. Male

11\. Cliff Bondi C.T. Male

12\. Robert Koslosky C.T. Male

13\. Chris Ormsby C.T. Male

14\. Brittany Winslow C.T. Male

15\. Ryan Hubbard C.T. Male

16\. Nancy Garry C.T. Male

17\. Amanda Blackburn C.T. Male

14.0 MEDICAL DATA SHEET

This medical data sheet will be completed by all on-site personnel and will be kept on-site during the duration of the project. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

PROJECT: Remedial Investigation to be conducted at the Hamilton Hill II – Target Area 1 Site located at 830 & 834 Albany Street, City of Schenectady, Schenectady County, New York.

Name ___________________________ Home Telephone ________________________

Address ____

Emergency Contact ____

Drug or Other Allergies ____

Particular Sensitivities ____

Do You Wear Contact Lenses ____

Provide a Checklist of Previous Illness or Exposure to Hazardous Chemicals

____

What Medications Are You Presently Using _____________________________________

____

Do You Have Any Physical or Medical Restrictions ______________________________

____

Are You Qualified to Wear Respirator (Provide Fit Test Results)_________________

Name, Address, and Telephone Number of Personal Physician:

____

____

____

15.0 FIELD TEAM REVIEW

Each field team member shall sign this section after site specific training is completed and before being permitted to work on-site.

I have read and understood this Site Specific Health and Safety Plan, and I will comply with the provisions contained therein.

PROJECT: Remedial Investigation
Hamilton Hill II – Target Area 1 Site
830 & 834 Albany Street
City of Schenectady
Schenectady County, New York

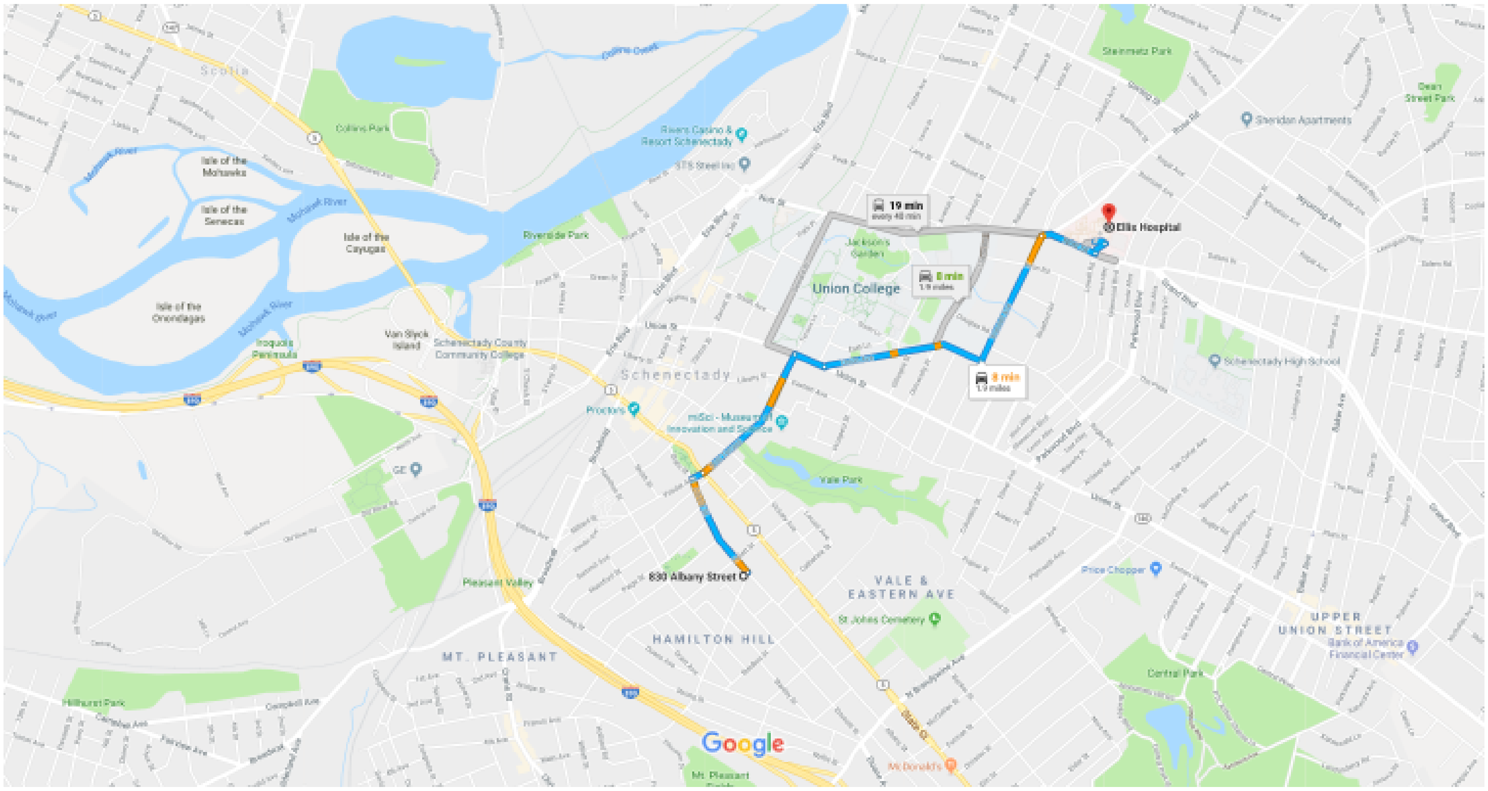
Name: Printed	Signature	Date

FIGURE 1

MAP SHOWING ROUTE TO ELLIS HOSPITAL

Google Maps 830 Albany Street, Schenectady, NY to Ellis Hospital

Drive 1.9 miles, 8 min



Map data ©2018 Google 1000 ft

830 Albany St

Schenectady, NY 12307

Follow Albany St and Nott Terrace to Union St

4 min (0.8 mi)

↑ 1. Head northwest on Albany St toward Hulett St

0.3 mi

↱ 2. Turn right onto Veeder Ave

177 ft

↑ 3. Continue onto Nott Terrace

0.4 mi

↱ 4. Turn right onto Union St

21 s (469 ft)

Continue on Union Ave to Nott St

2 min (0.8 mi)

↰ 5. Turn left onto Union Ave

0.5 mi

↰ 6. Turn left onto Wendell Ave

0.4 mi

↱ 7. Turn right onto Nott St

34 s (0.2 mi)

Drive to your destination

1 min (387 ft)

↰ 8. Turn left at Lowell Rd

223 ft

↰ 9. Turn left

ⓘ Destination will be on the right

164 ft

Ellis Hospital

1101 Nott St, Schenectady, NY 12308

ATTACHMENT A

MEDICAL DATA SHEETS

ATTACHMENT B

COMMUNITY AIR MONITORING PLAN

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. APeriodic@ monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

2. If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 mcg/m^3 above the upwind level, work must be stopped and a re-evaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 mcg/m^3 of the upwind level and in preventing visible dust migration.

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

APPENDIX D

TENTATIVE PROJECT SCHEDULE

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Hamilton Hill II - Target Area 1 Site

City of Schenectady, Schenectady County

BCP Site No. C444082

	January				February				March				April					May				June				July				
	2019				2019				2019				2019					2019				2019				2019				
PROJECT TASKS (830 and 834 Albany Street Parcels)	7	14	21	28	4	11	18	25	4	11	18	25	1	8	15	22	29	6	13	20	27	3	10	17	24	1	8	15	22	29
Draft RIWP 30-Day Public Comment Period	■	■	■	■	■																									
Address any Public Comments and Additional DEC Comments						■	■	■	■																					
DEC Approval of the Remedial Investigation Work Plan								■	■																					
Solicit and Mobilize SubContractors								■	■																					
RI Field Work										■	■	■																		
Laboratory Data Analysis											■	■	■																	
Data Validation												■	■	■																
Upload Data to EQuIS												■	■	■																
Prepare Draft RI Report (RIR) and Remedial Action Work Plan (RAWP)											■	■	■	■	■	■														
Client Review and Comment of Draft RIR and RAWP																■														
Address Client Comments to Draft RIR and RAWP																■														
DEC Review and Comment of Draft RIR and RAWP																■	■	■	■	■	■									
Address DEC Comments to the Draft RIR/RAWP																						■								
Finalize the RIR/RAWP and place in repository																						■								
DEC Significant Threat Site Determination																■	■	■	■	■	■									
Draft RIR/RAWP 45-Day Public Comment Period																				■	■	■	■	■	■	■				
Address DEC and Public Comments to the Draft RIR/RAWP and Finalize																											■			
DEC Issuance of Decision Document																												■		