Site Management Plan

Oregon Road Site
BCP Site No. C905045
Olean, New York

December 2021

0311-020-001

Prepared For:

Homer Street Properties, LLC
Olean, New York

Prepared By:

BENCHMARK

In Association With:

TURNKEY
ENVIRONMENTAL
RESTORATION, LLC

BROWNFIELD CLEANUP PROGRAM

SITE MANAGEMENT PLAN

OREGON ROAD SITE
SITE NUMBER: C905045
OLEAN, NEW YORK

December 2021 0311-020-001

Prepared for:

Homer Street Properties, LLC

Prepared By:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045

Certification Statement

I, Thomas H. Forbes, certify that I am currently a NYS registered professional engineer as defined in 6 NYCRR Part 375 and that this December 2021 Site Management Plan for the Oregon Road Site (C905045) was prepared in general accordance with the applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

P.E.

12-2-21 DATE

SEAL:

THOMAS H. FORBES
No. 70550-1

SITE MANAGEMENT PLAN
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List of Acronyms

AS	Air Sparging
ASP	Analytical Services Protocol
BCA	Brownfield Cleanup Agreement
BCP	Brownfield Cleanup Program
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CFR	Code of Federal Regulation
CLP	Contract Laboratory Program
COC	Certificate of Completion
CO2	Carbon Dioxide
CP	Commissioner Policy
DER	Division of Environmental Remediation
EC	Engineering Control
ECL	Environmental Conservation Law
ELAP	Environmental Laboratory Approval Program
ERP	Environmental Restoration Program
EWP	Excavation Work Plan
FOP	Field Operating Procedure
GHG	Green House Gas
GWE&T	Groundwater Extraction and Treatment
HASP	Health and Safety Plan
IC	Institutional Control
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYCRR	New York Codes, Rules, and Regulations
O&M	Operations and Maintenance
OM&M	Operation, Maintenance and Monitoring
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PID	Photoionization Detector
PRP	Potentially Responsible Party
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
QAPP	Quality Assurance Project Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study

SITE MANAGEMENT PLAN
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List of Acronyms

ROD	Record of Decision
RP	Remedial Party
RSO	Remedial System Optimization
SAC	State Assistance Contract
SCG	Standards, Criteria, and Guidelines
SCO	Soil Cleanup Objective
SMP	Soil Management Plan
SOP	Standard Operating Procedures
SOW	Statement of Work
SPDES	State Pollutant Discharge Elimination System
SSD	Sub-slab Depressurization
SVE	Soil Vapor Extraction
SVI	Soil Vapor Intrusion
SVMS	Soil Vapor Mitigation System
TAL	Target Analyte List
TCL	Target Compound List
TCLP	Toxicity Characteristic Leachate Procedure
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank

EXECUTIVE SUMMARY

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

Site Identification: Oregon Road Site – C905045

Institutional Controls:	1. The property may be used commercial and industrial use as described in 6 NYCRR Part 375-1.8(g), although land is subject to local zoning laws;
	2. All ECs must be inspected at a frequency and in a manner defined in the SMP.
	3. The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Cattaraugus County Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
	4. Compliance with the Department approved Site Management Plan and Periodic Review Reporting is required.
	5. The remedial party or site owner is required to complete and submit a periodic certification of institutional and engineering controls to the Department in accordance with 6NYCRR Part 375-1.8(h)(3).
Engineering Controls:	1. A site cover has been placed over the site in all areas exceeding applicable SCOs. The cover is either a hardscape (asphalt) and/or a minimum of 12-inches of depth of material meeting the requirements as set forth in 6NYCRR Part 375-6.7(d) for commercial use.
	2. An in-situ groundwater treatment wall has been installed to prevent migration of PFAS compounds in groundwater requiring upgradient and downgradient monitoring as outlined in the NYSDEC Decision Document (June 2020).

Inspections:	Frequency
1. Cover Inspection	Annually

Site Identification: Oregon Road Site – C905045

Monitoring:	
1. Groundwater Monitoring	Semi-Annually for 2 years Annually thereafter
Maintenance:	
1. Cover System Maintenance	As needed
Reporting:	
1. Groundwater Data	Annually
2. Cover System Site Inspection	Annually
3. Periodic Review Report	Annually

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

1.0 INTRODUCTION

This Site Management Plan (SMP) is a required element of the remedial program for the Oregon Road Site located in Olean, New York (hereinafter referred to as the "Site"). The Site is currently in the New York State (NYS) Brownfield Cleanup Program (BCP) administered by New York State Department of Environmental Conservation (NYSDEC or Department), Site No. C905045. The Site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index# C905045-10-16, which was executed on December 1, 2016. A BCA Amendment was submitted to the Department to detail the addition of a 3.65-acre Homer Street Extension parcel and the removal of an approximate 3.73-acre portion of the Oregon Road parcel on the western portion of the Site.

1.1 General

Homer Street Properties, LLC entered into a Brownfield Cleanup Agreement (BCA) with the NYSDEC to investigate and remediate the Site. Figures showing the site location and boundaries of this site are provided in Figure 1 and Figure 2. The boundaries of the Site are more fully described in the metes and bounds site description that is part of the Environmental Easement and the survey provided in Appendix A.

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

This SMP was prepared by Benchmark Environmental Civil/Engineering & Geology, PLLC in association with Turnkey Environmental Restoration, LLC (Benchmark-TurnKey), to manage remaining contamination at the Site until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the Site-specific implementation procedures that are required by the Environmental Easement. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the Certificate of Completion (COC);
- Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the BCA, (Index #C905045-10-16; Site #C905045) for the Site, and thereby subject to applicable penalties.

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

This SMP was prepared by Benchmark Civil/Environmental Engineering & Geology, PLLC, in association with Turnkey Environmental Restoration, LLC, on behalf of Homer Street Properties, LLC, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs that are required by the Environmental Easement for the Site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. The NYSDEC can also make changes to the SMP or request revisions from the remedial party. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the Site conditions. In accordance with the Environmental Easement for the Site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

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

1. 60-day advance notice of any proposed changes in Site use that are required under the terms of the BCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
2. 7-day advance notice of any field activity associated with the remedial program.
3. 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan. If ground-intrusive activity qualifies as a change of use as defined in 6NYCRR Part 375, the above mentioned 60-day advance notice is required.
4. Notice within 48-hours of any damage or defect to the foundation, structures, or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
5. Notice within 48 hours of any non-routine maintenance activities.
6. Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the Site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
7. Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

The owner of the Site parcels at the time of issuance of this SMP is:

Homer Street Properties, LLC
1 Blue Bird Square
Olean, New York 14760

Responsibilities of the Owner and Remedial Party are provided in Appendix C.

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

8. At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective

purchaser/Remedial Party has been provided with a copy of the BCA, and all approved work plans and reports, including this SMP.

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

Table 1 (below) includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	Contact Information	Required Notification**
NYSDEC Project Manager Mr. Benjamin McPherson, P.E.	716-851-7220 benjamin.mcpherson@dec.ny.gov	All Notifications
NYSDEC Regional HW Engineer Ms. Andrea Caprio, P.E.	716-851-7220 andrea.caprio@dec.ny.gov	All Notifications
NYSDEC Site Control Ms. Kelly Lewandowski, P.E.	518-402-9543 kelly.lewandowski@dec.ny.gov	Notifications 1 and 8
NYSDOH Public Health Specialist Ms. Renata Ockerby	518-402-7867 beei@health.ny.gov	Notifications 4, 6, and 7

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

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

2.0 SUMMARY OF PREVIOUS INVESTIGATION & REMEDIAL ACTIONS

2.1 Site Location and Description

The site is located in the City/Town of Olean, Cattaraugus County, New York and is identified as the following parcels on the Cattaraugus County Tax Map:

- Oregon Road (a portion of): SBL No. 94.001-2-13.2
- Homer Street Extension: SBL No. 94.001-2-13.8

The approximate 24.57-acre site is bounded by vacant wooded land to the north/northwest, a commercial/industrial property to the southwest, Homer Street and several commercial/industrial properties to the south/southeast, and Oregon Road and three residential properties to the east/northeast (see Figure 2). The boundaries of the Site are more fully described in Appendix A – Environmental Easement.

2.2 Physical Setting

2.2.1 Land Use

The Site is currently vacant land consisting of a 12-inch cover system, an asphalt access road, Two-Mile Creek, and vegetated areas. Two-Mile Creek runs along the eastern and southern borders of the Site and an additional drainage swale runs along the western border of the Site. The Site is zoned for commercial/industrial use.

The properties adjoining the Site, and surrounding the Site, are primarily industrial/commercial with residential properties along Oregon Road. The properties immediately south and west of the Site include commercial/industrial properties and the properties immediately north and east of the Site include vacant land and residential properties.

2.2.2 Geology

The U.S. Department of Agriculture Soil Conservation Service soil survey map of Cattaraugus County shows the Site contains five differing soil types, Castile Gravel Silt Loam, Orpark Silt Loam, Shuyler Silt Loam, Towerville Silt Loam, and Volusia Channery Silt Loam.

The five soil types indicate moderately to well drained and gradually sloping soils that are present in hilltop and hill slides environments.

The geology at the Site was investigated during the RI and is generally described as topsoil material and silty sand in the upper approximate 4 fbgs overlying lean clays with various amounts of sand and/or gravel to depths of at least 15 fbgs. Layers of well graded/poorly sorted sand and gravel were also noted during the investigation, primarily at shallower intervals (i.e., 4 to 8 fbgs) on the northern portion of the Site and deeper intervals (i.e., 11 to 15 fbgs) throughout the Site. Site specific boring logs are provided in Appendix D.

Remedial activities discussed in Section 2.4 have altered the overburden geology of the Site, particularly in the area of the GCM excavation, located in the eastern portion of the Site. This area was excavated to depths ranging from 7 to 10 fbgs. Smaller excavations were completed in the southern portion of the Site to depths ranging from 3 to 11 fbgs. Excavations were backfilled with Department-approved on-Site overburden, as described above, then covered with a minimum of 12-inches of Department-approved imported stone/gravel and topsoil.

The unconsolidated soils cover most of the bedrock near Olean. The soil deposits are thin in the uplands and thick in the valleys, reaching thicknesses of 300 feet. Bedrock present below the unconsolidated soils consists of gray and black shale, and interbedded gray siltstone and sandstone of the Conneaut and Conewango Groups from the late Devonian age. The bedrock dips gently to the south and outcrops in the upland areas around Olean.

Bedrock was encountered in the northwestern portion of the Site, proximate to an embankment, during previous investigations ranging from 0 fbgs to 12 fbgs.

2.2.3 Hydrogeology

Based on the findings of the RI, groundwater was encountered at depths between 2.44 and 16.55 fbgs, in the uppermost water bearing zone. During remedial construction groundwater depths were monitored throughout the duration of the project and groundwater depths ranged between 0.40 and 14.99 fbgs. In general, localized groundwater flow direction is estimated to flow southeast towards Two-Mile Creek. Figures 3A through 3E depict the estimated groundwater network based on the water level measurements collected throughout the duration of the remedial construction work. Based on the water level measurements during the RI the estimated horizontal hydraulic gradient was calculated average of 0.045 ft/ft.

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

2.3 Investigation History

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

2.3.1 May 2008 – Phase I Environmental Site Assessment

GZA GeoEnvironmental of New York (GZA) completed a Phase I ESA in May 2008. Findings of the Phase I Report are summarized below:

- The Site is located on Oregon Road in Olean, New York, identified as SBL Number 94.001-2-13.2 consisting of approximately 24.57 acres of vacant land with a partial asphalt access road.
- Based on a review of the U.S. Geologic Survey Map of Olean, New York, dated 1980, the Site varies from approximately 1,700 feet to 1,430 feet above mean sea level.
- The Site and surrounding areas were originally developed in the 1890s to early 1900s for the oil industry and used as a petroleum storage tank farm. Four large tanks, portions of two tanks, and six berm areas were located within the Site limits. The Site appears to be part of the ExxonMobil Legacy Site (EMLS) Works #3 area, identified as Socony Vacuum and Felmont Oil. In the 1960s, the tanks were removed from on-site and nearby off-site locations. Since that time, the Site has been vacant, undeveloped land.
- The Site and surrounding areas were used for oil storage in large aboveground tanks, as was apparent in the 1938, 1955, and 1960 aerial photographs.
- Historic documentation from the North Olean area indicated that significant leakage occurred from the storage tanks in 1922, enough that nearby residences were able to retrieve barrels of oil from depths of l8 feet below ground surface (fbgs).

- The Site is within the City of Olean BOA and identified within the BOA as being with the EMLS Works #3 area. According to the BOA, these areas likely contain some level of petroleum contamination in the subsurface.
- Several areas of surface debris, including concrete, brick, rebar, etc., were present in the southeastern portions of the Site.

The Phase I ESA identified the following Recognized Environmental Conditions in connection with the property:

- The Site was historically occupied by an oil tank farm, including four large tanks, portions of two tanks, and six berm areas within the Site limits used for oil storage by Socony Vacuum and/or Felmont Oil. The Site was identified as part of the EMLS Works #3 area. The tank and berm areas were removed by the 1970s. Potential historic releases may have impacted the soil and/or groundwater at the Site.

2.3.2 February 2015 – Phase II Environmental Investigation Report

Findings of the Limited Phase II Environmental Investigation completed by TurnKey Environmental Restoration, LLC in December 2014 are detailed below:

- Olfactory evidence of impact (petroleum-like odors) were observed in 4 of the 7 test pits (TP-1, TP-2, TP-4, and TP-5) at depths ranging from 3 to 10 fbgs.
- Petroleum product (light non-aqueous phase liquid, LNAPL) was observed on the groundwater entering test pits TP-2 (at 2 fbgs) and TP-3 (at 3 fbgs). NYSDEC Spill No. 1409761 was assigned to the Site due to the visual/olfactory evidence of petroleum contamination and petroleum LNAPL identified.
- Volatile organic compounds (VOCs) 2-butanone, total xylene, and 1,2,4-trimethylbenzene were detected at concentrations above their respective Part 375 Unrestricted Use SCOs (USCOs) in the 5 to 7 fbgs sample collected from test pit TP-1. Elevated VOC tentatively identified compounds (TICs) were also identified in soil samples collected from test pit TP-1 at 5 to 7 fbgs (23 ppm) and TP-5 at 2 to 4 fbgs (52 ppm).
- Based on the evidence of petroleum odors, elevated photoionization detector (PID) measurements, the presence of LNAPL, as well as analytical results of this investigation, significant petroleum impacts are evident, with grossly contaminated soils present in some areas. The environmental impacts can reasonably be attributed to historical use of the Site as a bulk storage facility. Site remediation appears warranted as NYSDEC Spill No. 1409761 will need to be addressed.

2.3.3 March 2016 – Supplemental Phase II Environmental Investigation Report

Findings of the Supplemental Phase II Environmental Investigation completed by TurnKey Environmental Restoration, LLC in November 2015 are detailed below:

- Field evidence of suspected petroleum impacts (LNAPL and petroleum-like odors) reasonably attributable to the historical use of the Site as a petroleum bulk storage facility were identified during the test trench and soil boring investigations. Elevated PID readings up to 425 ppm were noted on-site. TurnKey made similar observations during the historic test pit investigation.
- Based on elevated PID readings, observed LNAPL and petroleum odors at sample locations proximate to the property boundary with the adjacent residences to the east, it is possible that petroleum impacts are present on the adjacent residences.
- Abandoned piping, believed to be associated with historic petroleum bulk storage operations (including the Buckeye Oil Company pipeline) was encountered in certain portions of test trenches TT-1 through TT-6, TT-8, and TT-9.
- Three 1-inch monitoring wells were installed. LNAPL and petroleum-like odors were observed in Well MW-2 from 3 to 6 fbgs. Analytical results revealed the presence of elevated concentrations of semi-volatile organic compounds (SVOCs) in groundwater at Well MW-3.
- Regarding the soil vapor assessment, the elevated isopropanol concentration is sample SV-03 is likely attributed to laboratory contamination. Numerous VOCs were detected in sample SV-02.
- The soil vapor assessment was not completed as planned due to Site conditions. Based on comments received from NYSDEC and NYSDOH, the soil vapor assessment was not considered complete and NYSDEC and NYSDOH recommended additional soil vapor assessment on the residential properties due to elevated PID readings, observed LNAPL and petroleum odors at sample locations proximate the property boundary with the adjacent residences to the east. ExxonMobil conducted off-site soil vapor intrusion concerns as discussed in Section 1.2.3.1 below.

2.3.3.1 October 2016 – Off-Site Soil Vapor Sampling Summary Report

Roux Associates, Inc. collected and had analyzed off-site soil vapor samples at three adjacent residential properties along Oregon Road. Results of the analysis indicated that VOCs were present in the soil vapor off-site with compounds similar to those found in on-site soil vapor. Roux calculated the potential health risk from the soil vapor concentrations and concluded that the cancer risk and hazard index posed by the potential receptors of the VOCs were below the EPA thresholds.

2.3.4 June 2017 – Off-Site Drinking Water Sampling

The NYSEC sampled drinking water from the three adjacent residences in June 2017. The NYSDEC indicated that there were no contaminants detected at concentrations above drinking water quality standards at that time.

2.3.5 BCP Remedial Investigation

A RI was completed at the Site in accordance with the approved RI-AA Work Plan (December 2016) and subsequent supplemental work plans. The purpose of the RI was to more fully define the nature and extent of contamination on the BCP Site, and to collect data of sufficient quantity and quality to perform the remedial alternatives evaluation. On-Site field activities included surface/near surface soil/fill sampling, the advancement of soil borings, test pits, groundwater sampling, sediment and surface water sampling within Two-Mile Creek, soil vapor investigation and sampling, underground pipe assessment, emerging contaminant investigation and sampling, and investigation/delineation of grossly contaminated soil (GCS) (see RI Figures 3 through 6).

Based on the results of the previous investigations and the RI, it was determined that remediation of the Site was necessary. A RI/AAR was prepared to provide a summary of the investigations and complete an assessment of remedial alternatives capable of achieving the Remedial Action Objectives (RAOs) for the Site as identified in the approved Decisions Document (DD). Results of the RI are provided below.

Summary of RI Findings by Media

Soil/Fill

GCS, LNAPL, petroleum sheen and staining were noted in test pits, test trenches, soil borings and monitoring wells in numerous sample locations across the Site (see RI Figures 6A and 6B). The area where mobile contaminants are present, which is targeted for remediation, is in the central portion of the Site, although residual weathered petroleum impacts are present to a greater extent. Underground piping was encountered in several test pits across the Site (see RI Figures 3 and 6). The total length of piping encountered was estimated at 3,000 linear feet. The piping encountered was mostly devoid of free liquids, although some pipe scale was noted.

Arsenic was the only metal detected in surface, near-surface and subsurface soil/fill at concentrations above its Part 375 CSCO of 16 mg/kg at multiple sample locations across the Site (see RI Figure 5A). PFAS were detected primarily in surface and near-surface soil/fill near impacted Wells MW-12 and MW-13 (see RI Figure 5B). SPLP PFAS results indicate a potential for additional groundwater impacts from residual PFAS compounds primarily in surface soil.

Soil Vapor

Four on-site soil vapor samples were collected along the eastern property boundaries. Compounds detected in the soil vapor samples generally included petroleum VOCs (BTEX and 1,2,4-trimethylbenzene). The highest soil vapor concentration was isopropanol detected at a concentration of 5,920 ug/m^3 in sample SV-03; however, this result appears anomalous compared to the other sample results. Petroleum-related VOCs are not included in the NYSDOH's Soil Vapor Intrusion guidance document. PCE (SV-02) and methylene chloride (SV-05) concentrations were below the lowest threshold of the NYSDOH indoor air guideline (Matrix B) and therefore do not require mitigation.

Roux Associates conducted off-site soil vapor sampling on the three residential properties along Oregon Road in 2016. The results of their study concluded that inhalation of vapors potentially present in indoor air as a result of potential vapor intrusion is below the allowable excess lifetime cancer risk (ELCR) of 1 x 10-6. Further, cumulative non-cancer risks associated with each sample location are below USEPA's hazard index of 1, indicating that potential impacts to indoor air via vapor intrusion do not yield significant non-cancer risk.

Groundwater

Individual VOCs, herbicides and PCBs were not detected in groundwater; however, VOC TICs were detected up to 334 ug/L (Well MW-7). Five SVOCs were detected above GWQS/GVs in Well MW-3 during the Phase II Investigation. During the RI, individual SVOC analytes were reported as non-detect; however, SVOC TICs ranging from 7.9 ug/L (Well MW-8) to 3,946 ug/L (Well MW-13) were identified at five RI monitoring well locations.

One pesticide (dieldrin) was detected above its GWQS/GV in Well MW-13; however, this compound is not mobile in natural groundwater systems. Total metals (i.e., arsenic, barium, lead) were detected above GWQS/GVs; however, dissolved phase metals, other than natural iron and manganese, were not detected in excess of GWQS/GVs. Iron and manganese are not a threat to public health or the environment. PFAs were detected at concentrations exceeding NYSDEC action levels in Wells MW-10, MW-12, and MW-13.

Surface Water

There were no significant VOC, SVOC, pesticides, herbicides or PCBs detections in surface water samples. VOC-TICs were present in 3 of the 4 samples with the highest concentration detected in upstream sample SW-1 (89 ug/L). Iron was detected in 2 of the 4 samples at concentrations exceeding the SWQS; however, iron is a naturally occurring mineral and does not pose an environmental threat to the Site or local receptors. Based on our knowledge of other nearby sites, naturally occurring iron is present in soil, groundwater and surface water.

Sediment

The inorganic compounds detected above Class A SGVs are arsenic in the midstream (SED-2) and downstream (SED-3) samples as well as nickel in the furthest downstream (SED-4) sample; however, all concentrations detected were below Class C SGVs. Sediment toxicity testing of samples SED-2 and SED-3 indicate the sediment is non-toxic to aquatic life. Individual SVOCs and pesticides were detected in sediment sample SED-4 but at concentrations below SGVs. Herbicides and PCBs were not detected at any sample locations.

2.4 Remedial Action Activities

Based on the findings of the RI-AAR, as described above, remedial activities were completed in accordance with the Department-approved Remedial Action Work Plan (June 2020 and revised September 2020). Details of the completed remedial activities are presented below, shown on Figure 4, and more fully documented in the FER.

2.4.1 Contaminated Materials Excavation Activities

2.4.1.1 GCS Excavation Activities

Grossly Contaminated Soil (GCS) excavation activities were completed between November 9th, 2020 and March 12th, 2021 which included the excavation of approximately 33,768 tons of non-hazardous soil/fill, transported by multiple 6 NYCRR Part 364registered hauling companies, and disposed of at Waste Management's (WM) Chaffee Landfill located in Chaffee, New York. During excavation and disposal activities WM indicated that material was "operationally challenging" and required the material be amended. As such, Portland cement was added and mixed with impacted soil/fill to stabilize the material and be deemed acceptable by the WM Chaffee Landfill. A total of 340 tons of cement was mixed into the impacted soil/fill for stabilization purposes.

Twenty-three (23) post-excavation end-point sidewall samples and thirty-two (32) post-excavation end-point bottom samples were collected from areal and vertical excavation extents. All post-excavation end-point sample results were below the Site Specific Action Levels (SSALs). Analytical results are presented in Table 3 and sample locations are shown on Figure 5.

During excavation activities and after the excavation area was determined to achieve Remedial Action Objectives (RAOs) with no exceedances of SSALs (field screening and confirmatory post-excavation sampling), the excavation was backfilled with Department-approved on-Site overburden to redevelopment subgrade then filled and graded with a minimum 12-inch cover system consisting of Department-approved fill materials and/or topsoil in accordance with DER-10.

2.4.1.2 SVOC-Impacted Non-hazardous Soil/Fill

Semi-Volatile Organic Compound-(SVOC) impacted soil/fill excavation activities were completed between November 6th, 2020 and November 9th, 2020 which included the excavation of approximately 816 tons of non-hazardous soil/fill, transported by multiple 6 NYCRR Part 364 registered hauling companies, and disposed of at Waste Management's (WM) Chaffee Landfill located in Chaffee, New York.

Eight (8) post-excavation end-point sidewall samples and three (3) post-excavation end-point bottom samples were collected from areal and vertical excavation extents. All post-excavation end-point sample results were below the SSALs. Analytical results are presented in Table 4 and sample locations are shown on Figure 5.

During excavation activities and after the excavation area was determined to achieve Remedial Action Objectives (RAOs) with no exceedances of SSALs (field screening and confirmatory post-excavation sampling), the excavation was backfilled with Department-approved on-Site overburden to redevelopment subgrade then filled and graded with a minimum 12-inch cover system consisting of Department-approved fill materials and/or topsoil in accordance with DER-10.

2.4.2 PFAS-Impacted Soil/Fill Stabilization

During the RI four distinct treatment zones (TZ), identified as TP-52, and TP-54 TZ-1 through TP-54 TZ-3, were delineated requiring in-situ stabilization utilizing Powder Activated Carbon (PAC). As a result of a supplemental investigation completed during the remedial construction work, TP-54 TZ-3 was split in half (TP-54 TZ-3A and TP-54 TZ-3B). As such, five distinct areas were treated and stabilized as follows:

- TP-52: 0-2 in.; 9,200 ft^2; 56 cy; 1,700-pounds PAC
- TP-54 TZ-1: 0-2 ft; 4,400 ft^2; 326 cy; 10,200-pounds PAC
- TP-54 TZ-2: 0-3 ft; 3,150 ft^2; 349 cy; 10,200-pounds PAC
- TP-54 TZ-3A: 0-11 ft; 1,691 ft^2; 689 cy; 13,600-pounds PAC
- TP-54 TZ-3B: 0-5 ft; 1,691 ft^2; 313 cy; 5,100-pounds PAC

Five (5) post-treatment end-point composite samples were collected, one composite per treatment zone. All post-excavation end-point sample results were below the SSALs. Analytical results are presented in Table 5 and sample locations are shown on Figure 5.

2.4.3 Additional Materials Removal

2.4.3.1 Subsurface Piping Removal

Known and anticipated subsurface piping was removed and cleaned during remedial activities and in accordance with the Department-approved RAWP. Approximately 4,188 LF of scrap metal was transported by Benson Construction & Development, LLC for recycling at Ben Weitsman of Allegheny located in Allegheny, New York (see Figure 4). As shown on Figures 4 and 5 two areas within the southeastern portion of the Site were impacted by residual petroleum product remaining in the pipes. Soil/fill in contact with the petroleum product was segregated, excavated, and included in the GCS material tonnage previously summarized in Section 2.4.1.1. Post-excavation end-point samples were collected in accordance with the GCS verification sampling procedures discussed in Section 2.4.1.1 and analytical results are included in Table 3.

2.4.4 PlumeStop Liquid Activated Carbon Application

Injection and application of PlumeStop® liquid activated carbon was completed between August 12 and August 18, 2021. Prior to injection activities, a downgradient monitoring well was installed south of Two-Mile Creek for future monitoring to determine the success of the remedial injection activities. The monitoring well, identified as MW-16, was installed on July 19, 2021. Monitoring well completion details are included in Appendix D. All wells on-Site were then gauged prior to injection activities to monitor groundwater levels as described below in Section 2.4.5 and summarized on Table 2 and Figure 3E. During injection activities, a total of 50 injection points were completed by Regenesis Remediation Services (RRS) along an approximate 100 liner feet (LF) section with a target injection zone between 12 and 18 fbgs, depending on grade elevations as shown on Figure 4. All injection activities were completed in accordance with the Department-approved RAWP. Nearby wells, MW-12 (upgradient) and MW-16 (downgradient), along with a temporary piezometer, were continuously monitored during injection activities to determine areal application of the liquid activated carbon. Approximately 5,600 pounds of liquid activated carbon was applied during the remedial injection activities. All permits, approvals, RRS reports, and daily summaries will be provided in the FER.

2.4.5 Groundwater Monitoring

As a requirement of the Department-approved RAWP, two wells proximate to residences east of the Site (MW-2R and MW-9) were sampled pre-, during-, and post-remedial excavation activities. A total of six (6) groundwater samples (excluding QA/QC samples) were collected (see Figures 3A through 3E). During remedial excavation activities several SVOCs were identified above their respective GWQS/GV at MW-9. However, all compounds were identified as either non-detect or well below their respective GWQS/GV after the remedial excavation was complete (see Table 8)

In addition to groundwater sampling, all on-Site wells were gauged monthly to monitor groundwater levels during remedial activities (see Table 2 and Figures 3A through 3E). Samples were collected in accordance with DER-10 and the Department-approved RAWP.

2.5 Remedial Action Objectives

The Remedial Action Objectives (RAOs) for the Site as listed in the Decision Document dated June 2020 are as follows:

Groundwater:

RAOs for Public Health Protection

- Prevent ingestion of groundwater with contaminant levels exceeding drinking water standards.

RAOs for Environmental Protection

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

Soil:

RAOs for Public Health Protection

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

RAOs for Environmental Protection

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

Soil Vapor:

RAOs for Public Health Protection

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

2.5.1 Site Specific Action Levels (SSALs)

Site-specific action levels (SSALs) were developed for the Site. These SSALs are applicable to soil/fill that greatly exceeds Restricted-Commercial SCOs, has the potential to impact groundwater, or otherwise represents an unacceptable risk to public health or the environment in the context of reasonably anticipated future use and a Track 4 cleanup. These SSALs were developed based on the removal of source areas, including areas that had a greater potential for contaminant migration, and the feasibility of achieving the SSALs based on the nine factors outlined in 6NYCRR Part 375-1.8(f). The SSALs only apply to a Track 4 cleanup with a cover system installed over all areas with remaining soil/fill concentrations above CSCOs, a Site Management Plan (SMP), and Environmental Easement. The following SSALs were developed and were used to designate soil/fill AOCs requiring remediation:

- Total SVOCs > 500 mg/kg
- GCS soil/fill areas
- Total PFAS > 500 ng/L SPLP
- PFOA + PFOS > 70 ng/L SPLP

2.6 Remaining Contamination

The Oregon Road Site was remediated to address GCS and SVOC-impacted soil/fill, PFAS-impacted soil/fill and groundwater, and remove subsurface piping to achieve a Track 4 Commercial Use Cleanup, which is consistent with the intended use of the Site.

Residual contamination remaining at the Site is summarized below. Figure 6 identifies soil/fill sample locations that exceed USCOs after completion of the remedial measures. It should be noted that although some sample locations remain in exceedance of USCOs, SSALs were achieved in accordance with the Department-approved RAWP.

2.6.1 Soil/Fill

Residual contamination remaining in on-Site soil/fill above USCOs, includes certain SVOCs and arsenic located beneath the NYSDEC approved cover system. Areas that are excavated and disturbed during redevelopment activities will have a minimum of 12-inches of approved cover material above a demarcation layer in accordance with 6NYCRR Part 375. Table 6 summarizes the remaining on-Site soil/fill sample locations with constituents above USCOs. Potential exposure to the remaining constituents above regulatory guidelines is mitigated due to the depth of the remaining contamination after the completion of the remedial excavation, depth to impacted soil, and the placement of a cover system.

2.6.2 Groundwater

RI and Supplemental sampling results identified certain metals above their respective GWQS/GV, however, the dissolved fraction did not show exceedances except for iron and manganese, which are naturally occurring and are commonly present in drinking water. One pesticide, dieldrin, was detected in one well, MW-13, exceeding its GWQS/GV. PFAS were present at concentration exceeding NYSDEC action levels at MW-10, MW-12, and MW-13. 1,4-dioxane was detected exceeding its GWQS/GV at MW-4, MW-12, and MW-15 (see Table 7 for RI analytical data).

Wells MW-2R and MW-9 were sampled and monitored pre-, during-, and post remedial excavation activities in accordance with the Department-approved RAWP due to the proximity of excavation activities to nearby residential properties. During remedial excavation activities several SVOCs were identified above their respective GWQS/GV at MW-9. However, all compounds were identified as either non-detect or well below their respective GWQS/GV after the remedial excavation was complete (see Table 8)

Due to the depth of contamination, completed remedial action, and the placement of a cover system, potential exposure to the remaining contamination is highly unlikely.

2.6.3 Soil Vapor

Soil Vapor (SV) sampling results identified certain petroleum-related VOCs, tetrachloroethane (PCE) and methylene chloride at SV-02 and SV-05 (see RI Table 9). NYSDEC and NYSDOH do not currently have standards, criteria or guidance values for concentrations of petroleum compounds in soil vapor. PCE and methylene chloride was detected below the lowest threshold of the NYSDOH indoor air guideline (Matrix B) that would require mitigation.

Although the remedy did not require mitigation, should the redevelopment of the Site include occupied buildings, a provision for soil vapor intrusion evaluation will be required.

3.0 INSTITUTIONAL & ENGINEERING CONTROL PLAN

3.1 General

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

This plan provides:

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

3.2 Institutional Controls

A series of ICs is required by the Decision Document to: (1) implement, maintain and monitor the Engineering Controls with periodic certification submittal to the Department; (2) prevent future exposure to remaining contamination by controlling disturbances of the subsurface contamination; (3) limit the use and development of the site to Commercial and Industrial uses only; and (4) require compliance with the Department-approved SMP. Adherence to these ICs on the site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The boundaries of the Site are shown on Figure 2. These ICs are as follows:

- Allows the use and development of the controlled property for restricted commercial and/or industrial uses as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- Requires compliance with the Department-approved SMP;
- Restricts the use of groundwater underlying the Site as a source of potable water, without necessary water quality treatment as determined by the NYSDOH or the Cattaraugus County DOH;
- Groundwater monitoring must be performed as defined in the SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Require the remedial party or Site owner to complete and submit to the Department a periodic certification of institutional and engineering controls in accordance with Part 375-1.8(h)(3);
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement.

3.3 Engineering Controls

3.3.1 Cover System

Exposure to remaining contamination at the Oregon Road Site is prevented by a cover system placed over the site. This cover system is comprised of a minimum of 12-inches of DER-10 compliant soil/gravel/stone material over a demarcation layer and hardscape elements of the redevelopment, including asphalt. Figure 7 presents the cover system layout and details.

Should any portions of the cover system be removed in any area of the Site, these areas will be replaced with the previously described 12-inches of DER-10 compliant soil/gravel/stone material over a demarcation layer or other hardscape elements.

An Excavation Work Plan (EWP) provided in Appendix E outlines the procedures required to be implemented in the event the cover system is breached, penetrated, or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in Appendix F.

3.3.1.1 Undisturbed Soil

A portion of existing undisturbed soil/fill located in the southeastern portion of the Site (south of Two-Mile Creek) was tested to ensure it met the CSCOs. Based on analytical results presented on Table 9, this area did not require placement of additional cover soil, with approval from NYSDEC.

An additional area north of the residential properties along Oregon Road was also left undisturbed to maintain a mature tree line between residents and future on-Site redevelopment. The heavy brush and mature trees were left in-place in this area in consultation with the Department. Figure 7 presents the locations of undisturbed areas.

3.3.1.2 Two-Mile Creek

A portion of the Two-Mile Creek tributary was excavated to remove GCS and restored in accordance with a United States Army Corps of Engineers (USACE) and New York State (NYS) Joint Application Permit. The streambed was covered by a minimum of 12-inches of clean, imported stone/gravel over filter fabric. Riparian shrubs were planted along this portion of Two-Mile Creek tributary for bank stabilization purposes over an erosion control blanket and a minimum of 12 inches of clean, imported soil meeting Protection of Ecological Resources SCOs (PERSCOs) and USCOs. PERSCOs are the applicable SCO in the area of the stream as the presence of a habitat supporting fish and wildlife was identified. Figure 7 shows the location of Two-Mile Creek tributary restoration and details.

3.3.2 In-Situ Groundwater Treatment Wall

Off-site migration of PFAS compounds in groundwater is mitigated by a permeable in-situ groundwater treatment wall. This treatment wall consists of fifty (50) injection points of PlumeStop® Liquid Activated Carbon along an approximate 100-linear foot (LF) section proximate to the southern property boundary as shown on Figure 4. A new monitoring well, identified as MW-16, was installed downgradient of the treatment area. The upgradient monitoring well (MW-12) and downgradient monitoring well (MW-16) will be monitored as described in Section 4.3 below. Monitoring well construction detail logs are provided in Appendix D.

The NYSDEC will be notified prior to any repair or decommissioning of monitoring wells as discussed in Section 4.3.1.

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered complete when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10. Unless waived by the NYSDEC, confirmation samples of applicable environmental media are required before terminating any remedial actions at the site. Confirmation samples require Category B deliverables and a Data Usability Summary Report (DUSR).

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

The remedial party will also conduct any needed site restoration activities, such as asphalt patching, restoration of vegetated cover, and/or trees, which will comply with NYSDEC regulations and guidance. Also, the remedial party will ensure that no ongoing erosion is occurring on the site.

3.3.3.1 Cover System

The cover system is a permanent control, and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP.

3.3.3.2 In-Situ Groundwater Treatment Wall

Groundwater monitoring activities to assess the effectiveness of the *in-situ* groundwater treatment well will continue, as determined by the NYSDEC project manager with consultation with the NYSDOH project manager, until residual groundwater concentrations are found to be consistently below ambient water quality standards or have become asymptotic at an acceptable level over an extended period. If monitoring data indicates that monitoring may no longer be required, a proposal to discontinue the remedy will be submitted by the remedial party. Monitoring will continue until permission to discontinue is granted in writing by the NYSDEC project manager. Once permission is granted, the remaining groundwater wells will be decommissioned. If groundwater contaminant levels become asymptotic at a level that is not acceptable to the NYSDEC, additional treatment and/or control measures will be evaluated.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of the Site management for the Site are included in the Quality Assurance Project Plan provided in Appendix G. Field operating procedures applicable to the Site are provided in Appendix H.

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

- Monitoring the performance and effectiveness of the site cover;
- A schedule of monitoring and frequency of submittals to the Department.
- Sampling and analysis of groundwater;
- Sampling and analysis of soil vapor intrusion, should the redevelopment of the Site include occupied buildings. The soil vapor intrusion investigation would be completed per a NYSDEC-approved work plan and QAPP submitted separately from this SMP;
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs); and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment;

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

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

Reporting requirements are provided in Section 7.0 of this SMP.

4.2 Site-Wide Inspection

Site-wide inspections will be performed at a minimum of once per year (annually), or at a lesser frequency as approved by the Department. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

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

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

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

Reporting requirements are outlined in Section 7.0 of this plan.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.3 Post-Remediation Monitoring and Sampling

Samples shall be collected from the groundwater monitoring wells on a routine basis. Sampling locations, required analytical parameters, and schedule are provided in Table 10 – Groundwater Sampling Requirements and Schedule below. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Table 10 – Groundwater Sampling Requirements and Schedule

Sampling Location	**Schedule**			
	VOCs (EPA Method 8260) plus Tentatively Identified Compounds (TICs)	SVOCs (EPA Method 8270) plus TICs	PFAS (modified EPA Method 537)	
MW-2R	X	X		Semi-Annually 2022 and 2023 Annually thereafter
MW-5	X	X		
MW-7	X	X		
MW-8	X	X		
MW-9	X	X		
MW-12	X	X	X	
MW-13	X	X		
MW-15	X	X		
MW-16	X	X	X	

Detailed sample collection and analytical procedures and protocols are provided in Appendix G – Quality Assurance Project Plan.

4.3.1 Groundwater Sampling

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

The network of monitoring wells has been installed to monitor on-site groundwater conditions at the site. The network of on-site wells has been designed based on the following criteria:

Nine (9) groundwater monitoring wells identified in Table 10 above will be utilized to assess groundwater flow direction and groundwater quality. Wells have been developed and sampled in accordance with Benchmark-TurnKey and NYSDEC protocols.

Table 11 summarizes the wells identification number, as well as the purpose, location, depths, diameter and screened intervals of the wells. As part of the groundwater monitoring, thirteen (13) on-site wells are sampled to evaluate the effectiveness of the remedial system.

Table 11 – Monitoring Well Construction Details

Monitoring Well ID	Well Location	Coordinates (longitude/ latitude)	Well Diameter (inches)	Elevation (see note below)			
				Casing (TOR)	Surface	Screen Top	Screen Bottom
MW-2R	On-Site	78.4396° W, 42.1033° N	2	1441.52	1439.60	1433.84	1423.84
MW-5	On-Site	78.4387° W, 42.1028° N	2	1432.01	1430.37	1423.58	1413.58
MW-7	On-Site	78.4408° W, 42.1042° N	2	1462.56	1459.95	1452.93	1442.93
MW-8	On-Site	78.4411° W, 42.1031° N	2	1445.49	1444.84	1438.43	1428.43
MW-9	On-Site	78.4402° W, 42.1035° N	2	1444.09	1442.13	1436.98	1426.98

MW-12	On-Site	78.4401° W, 42.1018° N	2	1431.77	1428.87	1422.00	1412.00
MW-13	On-Site	78.4414° W, 42.1024° N	2	1445.77	1443.58	1435.79	1425.79
MW-15	On-Site	78.4407° W, 42.1014° N	2	1433.21	1432.32	1424.96	1414.96
MW-16	On-Site	78.4400° W, 42.1017° N	2	1427.65	1428.37	1417.30	1407.30

Note: Elevations are referenced to NGVD 88.

Groundwater monitoring wells were completed with the advancement of a hollow stem auger to install 2-inch inside diameter PVC Sch 40 pipe to a target minimum of five (5) feet below the first encountered groundwater. Each well has a 10-foot flush-joint Sch 40 PVC, 0.010-inch machine slotted well screen and a silica sand filter pack (size #0) is installed from the base of each well to a minimum of two (2) feet above the top of the screen. A bentonite chip seal is installed to mitigate downhole contamination and the wells are finished with keyed-alike locks, a lockable J-plug, and a steel stick-up casing. Figures 3A through 3E illustrate the monitoring well network, groundwater depths, and groundwater flow. Monitoring well construction logs are included in Appendix D of this document.

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

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

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

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

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

4.3.2 Groundwater Monitoring and Sampling Protocol

All sampling activities will be recorded in a field book and/or associated sampling log as provided in Appendix I - Site Management Forms. Other observations (e.g., groundwater monitoring well integrity, etc.) will be noted on the sampling log. The sampling log will serve as the inspection form for the monitoring network. Additional detail regarding monitoring and sampling protocols are provided in the site-specific QAPP as Appendix G of this document.

5.0 OPERATION & MAINTENANCE PLAN

5.1 General

The site remedy does not rely on any mechanical systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

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

The subject site is considered to have low vulnerability related to climatic conditions. There are no State or Federal wetlands or floodplains located on the Site. The site will not employ any remedial systems reliant upon electrical power; the site is serviced by municipal sewer system (storm and sanitary). As such, acute cover system erosion resultant in potential exposure to remaining contamination, a minimum of 12-inches below surface, is highly unlikely.

6.2 Green Remediation Evaluation

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

No mechanical engineering systems are included in the SMP. The only engineering control established for the Site are the cover system and in-situ groundwater treatment wall. Maintenance of the cover system and groundwater treatment wall is not anticipated to generate additional waste, use energy, produce emissions, require substantial water to promote vegetative cover growth, and/or affect any ecosystem (Site is located in a highly developed commercial/industrial area in the City/Town of Olean).

6.3 Remedial System Optimization

A Remedial Site Optimization (RSO) study will be conducted any time that the NYSDEC project manager or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy. The RSO study will focus on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0 REPORTING REQUIREMENTS

7.1 Site Management Reports

All site management inspection, maintenance, and monitoring events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data, generated for the Site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 12 and summarized in the Periodic Review Report.

Table 12: Schedule of Interim Monitoring/Inspection Reports

Task/Report	Collection Frequency	Reporting Frequency*
Groundwater Monitoring Data	Semi-annually (2022-2023) Annually (2024 onward)	Annually
Periodic Review Report	Annual Site Inspection	Annually, or as otherwise determined by the Department

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

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

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc.);
- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);

- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

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

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

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

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

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS™ database in accordance with the requirements found at this link

http://www.dec.ny.gov/chemical/62440.html.

7.2 Periodic Review Report

A Periodic Review Report (PRR) will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A – Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment, and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;
  - The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;

  - Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
  - Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
  - Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
  - The overall performance and effectiveness of the remedy.

7.2.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a qualified environmental professional will prepare, and include in the Periodic Review Report, the following certification as per the requirements of NYSDEC DER-10:

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

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

- *The information presented in this report is accurate and complete.*
- *No new information has come to my attention, including groundwater monitoring data from wells located at the site boundary, if any, to indicate that the assumptions made in the qualitative exposure assessment of off-site contamination are no longer valid.*

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

In addition, every five years the following certification will be added:

- *The assumptions made in the qualitative exposure assessment remain valid.*

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

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

7.3 Corrective Measures Work Plan

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

7.4 Remedial Site Optimization Report

If an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the NYSDEC project manager for approval. A general outline for the RSO report is provided in Appendix J. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC project manager and the NYSDOH project manager.

8.0 REFERENCES

1. 6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.
2. NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation."
3. NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).
4. United States Department of Agriculture (USDA), Soil Conservation Service. *Soil Survey of Cattaraugus County, New York*. 2007.
5. GZA GeoEnvironmental of Buffalo, New York. *Phase I Environmental Site Assessment, Oregon Road, Olean, New York*. May 2008.
6. TurnKey Environmental Restoration, LLC. *Phase II Environmental Investigation Report, Oregon Road Site, Olean, New York, BCP Site No. C905045*. February 2015.
7. TurnKey Environmental Restoration, LLC. *Supplemental Phase II Environmental Investigation Report, Oregon Road Site, Olean, New York, BCP Site No. C905045*. March 2016.
8. Benchmark Environmental Engineering and Science, PLLC in association with TurnKey Environmental Restoration, LLC., Oregon Road Site, *Remedial Investigation/Alternatives Analysis Work Plan, Olean, New York, BCP Site No. C905045*. December 2016.
9. TurnKey Environmental Restoration, LLC., Oregon Road Site, *Supplemental Remedial Investigation Work Plan, Olean, New York, BCP Site No. C905045*. June 5, 2018.
10. TurnKey Environmental Restoration, LLC., Oregon Road Site, *Additional PFAS Groundwater Sampling Work Plan, Olean, New York, BCP Site No. C905045*. April 9, 2019.
11. TurnKey Environmental Restoration, LLC., Oregon Road Site, *PFAS Soil Sampling Work Plan, Olean, New York, BCP Site No. C905045*. June 5, 2019.
12. Benchmark Environmental Engineering and Science, PLLC in association with TurnKey Environmental Restoration, LLC., Oregon Road Site, *Remedial Investigation/Alternatives Analysis Report, Olean, New York, BCP Site No. C905045*. January 2019, revised February 2020.
13. Benchmark Environmental Engineering and Science, PLLC in association with TurnKey Environmental Restoration, LLC., Oregon Road Site, *Remedial Action Work Plan, Olean, New York, BCP Site No. C905045*. Revised September 2020.

TABLES

TABLE 2
SUMMARY OF GROUNDWATER ELEVATIONS
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO C905045
OLEAN, NEW YORK

Location[1]	TOR Elevation[2] (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)	DTW (fbTOR)	Groundwater Elevation (ft)
		2/8/17		8/2/18		4/12/19		10/22/20		11/18/20		1/26/21		2/11/21		3/4/21		4/14/21		8/3/21	
MW-2R	1441.52	NM	NM	6.45	1435.07	6.76	1434.76	5.76	1435.76	NM	NM	6.94	1434.58	6.95	1434.57	5.95	1435.57	6.06	1435.46	6.11	1435.41
MW-4	1469.48	6.59	1462.89	6.70	1462.78	6.04	1463.44	9.18	1460.30	7.61	1461.87	7.26	1462.22	7.49	1461.99	6.52	1462.96	6.77	1462.71	5.32	1464.16
MW-5	1432.01	11.15	1420.86	14.10	1417.91	12.66	1419.35	16.87	1415.14	15.91	1416.10	13.81	1418.20	14.89	1417.12	14.12	1417.89	13.50	1418.51	12.65	1419.36
MW-6	1456.65	9.35	1447.30	11.10	1445.55	8.96	1447.69	12.89	1443.76	8.41	1448.24	10.22	1446.43	11.05	1445.60	7.31	1449.34	3.44	1453.21	5.58	1451.07
MW-7	1462.56	10.00	1452.56	13.40	1449.16	9.75	1452.81	11.39	1451.17	NM	NM	11.51	1451.05	12.86	1449.70	11.36	1451.20	13.53	1449.03	10.72	1451.84
MW-8	1445.49	5.21	1440.28	5.61	1439.88	5.31	1440.18	9.96	1435.53	4.90	1440.59	5.41	1440.08	5.57	1439.92	5.22	1440.27	2.39	1443.10	1.22	1444.27
MW-9	1444.09	6.02	1438.07	6.20	1437.89	5.80	1438.29	6.89	1437.20	5.78	1438.31	5.82	1438.27	5.91	1438.18	5.38	1438.71	5.61	1438.48	5.75	1438.34
MW-10	1439.02	7.97	1431.05	8.20	1430.82	8.10	1430.92	13.29	1425.73	12.31	1426.71	11.97	1427.05	12.37	1426.65	12.31	1426.71	11.85	1427.17	12.34	1426.68
MW-11	1436.17	5.66	1430.51	6.45	1429.72	6.03	1430.14	10.68	1425.49	10.41	1425.76	NM	NM	NM	NM	9.72	1426.45	9.51	1426.66	9.96	1426.21
MW-12	1431.77	13.69	1418.08	16.55	1415.22	14.55	1417.22	NM	NM	18.50	1413.27	16.63	1415.14	17.50	1414.27	16.95	1414.82	16.15	1415.62	15.25	1416.52
MW-13	1445.77	NM	NM	11.15	1434.62	4.15	1441.62	9.75	1436.02	9.05	1436.72	7.62	1438.15	8.20	1437.57	8.01	1437.76	6.27	1439.50	4.00	1441.77
MW-15	1433.21	NM	NM	16.15	1417.06	14.20	1419.01	17.80	1415.41	17.99	1415.22	16.01	1417.20	17.22	1415.99	16.58	1416.63	15.84	1417.37	15.16	1418.05
MW-16	1427.65	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	11.15	1416.50

Notes:

1. Wells MW-2R, MW-13, & MW-15 were installed in July 2018. Well MW-16 was installed July 2021. All other existing wells installed in January and February 2017.
2. Elevations are referenced to NGVD 88.

Acronyms:

fbTOR = Feet below top of riser
DTW = Depth to water
NM = Not measured

TABLE 3
SUMMARY OF GCS EXCAVATION AREA END-POINT SAMPLE ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter[1]	Unrestricted Use SCOs[2]	Sample Location																
		Additional GCS Excavation Area-1		GCS Excavation Area										Additional GCS Excavation Area-2				GCS Excav. Area
		SW-1 3-6 FT	SW-2 3-6 FT	SW-3 4-7 FT	SW-4 4-7 FT	SW-5 4-7 FT	SW-6 4-7 FT	SW-7 4-7 FT	SW-8 4-7 FT	SW-9 4-7 FT	SW-10 4-7 FT	SW-11 4-7 FT	SW-12 4-7 FT	SW-13 1-3 FT	SW-14 1-3 FT	SW-15 1-3 FT	SW-16 1-3 FT	SW-17 4-7 FT
Sample Date		10/23/2020		11/3/2020					11/25/2020					12/21/2020				1/6/2021
Volatile Organic Compounds (VOCs) - mg/kg[3]																		
Acetone	**0.05**	0.028	0.044	0.0069 J	*ND*	*ND*	*ND*	0.0077 J	0.018	**0.46 J**	**0.23**	*ND*	*ND*	**0.063**	0.0078 J	*ND*	*ND*	*ND*
2-Butanone (MEK)	**0.12**	0.0038 J	0.010 J	*ND*	*ND*	*ND*	0.0077 J	*ND*	*ND*	*ND*	0.01 J	*ND*	*ND*	0.013	*ND*	*ND*	*ND*	*ND*
Cyclohexane	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	8.6	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Isopropylbenzene (Cumene)	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.022 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Methyl acetate	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.25 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Methyl cyclohexane	**--**	*ND*	*ND*	0.0031 J	*ND*	*ND*	*ND*	*ND*	0.0084	33 D	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
1,2,3-Trichlorobenzene	**--**	*ND*	*ND*	0.0023	*ND*	0.00074 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Trichloroethene	**0.47**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.00099	0.1	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Total Xylene	**0.26**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.11 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Ethylbenzene	**1**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.033 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Toluene	**0.7**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Total VOCs	**--**	0.032	0.054	0.012	*ND*	0.001	0.008	0.008	0.027	42.575	0.240	*ND*	*ND*	0.076	0.008	*ND*	*ND*	*ND*
Tentatively Identified Compounds (TICs)	**--**	*ND*	*ND*	0.32 J	*ND*	0.091 J	*ND*	*ND*	0.0856 J	56 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.404 J
Semi-Volatile Organic Compounds (SVOCs) - mg/kg[3]																		
Acenaphthene	**20**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Acenaphthylene	**100**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Anthracene	**100**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.043 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Benzaldehyde	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.07 J	*ND*
Benzo(a)anthracene	**1**	*ND*	0.062 J	*ND*	*ND*	0.026 J	*ND*	*ND*	*ND*	0.032 J	0.076 J	0.14	*ND*	0.051 J	0.025 J	0.057 J	0.038 J	*ND*
Benzo(a)pyrene	**1**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.074 J	0.14 J	*ND*	*ND*	*ND*	0.051 J	*ND*	*ND*
Benzo(b)fluoranthene	**1**	*ND*	0.064 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.034 J	0.099 J	0.19	*ND*	0.057 J	*ND*	0.07 J	0.037 J	*ND*
Benzo(g,h,i)perylene	**100**	*ND*	0.036 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.046 J	0.098 J	*ND*	0.039 J	*ND*	0.038 J	0.04 J	*ND*
Benzo(k)fluoranthene	**0.8**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.034 J	0.054 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Carbazole	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.041 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Chrysene	**1**	*ND*	0.054 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.066 J	0.078 J	0.14	*ND*	0.054 J	0.025 J	0.055 J	0.058 J	*ND*
Dibenzo(a,h)anthracene	**0.33**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.022 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Dibenzofuran	**7**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.061 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Fluoranthene	**100**	*ND*	0.12 J	*ND*	*ND*	0.036 J	*ND*	*ND*	0.025 J	0.076 J	0.19	0.33	*ND*	0.11 J	0.048 J	0.12 J	0.051 J	*ND*
Fluorene	**30**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.075 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Indeno(1,2,3-cd)pyrene	**0.5**	*ND*	0.035 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.05 J	0.1 J	*ND*	0.035 J	*ND*	0.037 J	0.029 J	*ND*
Phenanthrene	**100**	*ND*	0.061 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.21	0.14	0.2	*ND*	0.055 J	0.033 J	0.066 J	0.058 J	*ND*
Pyrene	**100**	*ND*	0.11 J	*ND*	*ND*	0.031 J	*ND*	*ND*	0.02 J	0.077 J	0.14	0.26	*ND*	0.089 J	0.04 J	0.1 J	0.059 J	*ND*
Naphthalene	**12**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.49	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.028 J	*ND*
2-Methylnaphthalene	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.98	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.056 J	*ND*
1,4-Dioxane	**0.1**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Total SVOCs (SSAL)[4]	**500**	*ND*	0.542	*ND*	*ND*	0.093	*ND*	*ND*	0.045	2.101	0.927	1.758	*ND*	0.49	0.171	0.594	0.524	*ND*
TICs	**--**	*ND*	1.29	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	41.1 J	0.263 J	*ND*	*ND*	0.417 J	0.284 J	0.581 J	4.18 J	*ND*
Metals - mg/kg																		
Arsenic	**13**	**15.1**	10.9	6.63	**19.5**	12.3	5.25	4.5	9.49	7.21	8.12	5.99	9.67	8.59	**14.3**	10.8	10.4	11.9

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).

Definitions:

mg/kg = milligrams per kilogram

ND = Parameter not detected above laboratory detection limit

"--" = No value available for the parameter; or parameter not analyzed for.

J = Estimated value; result is less than the sample quantitation limit but greater than zero

D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

Bold = Exceeds USCOs or SSAL

TABLE 3
SUMMARY OF GCS EXCAVATION AREA END-POINT SAMPLE ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Locations																					
		GCS Excavation Area						Additional GCS Excav, Area-1	GCS Excavation Area			Additional GCS Excav. Area-2	GCS Excavation Area										
		SW-18 2-5 FT	SW-19 2-5 FT	SW-20 2-5 FT	SW-21 4-7 FT	SW-22 4-7 FT	SW-23 4-6 FT	BTM-1 6 FT	BTM-2 7 FT	BTM-3 7 FT	BTM-4 7 FT	BTM-5 3 FT	BTM-6 7 FT	BTM-7 7 FT	BTM-8 7 FT	BTM-9 7 FT	BTM-10 5 FT	BTM-11 7 FT	BTM-12 7 FT	BTM-13 7 FT	BTM-14 7.5 FT	BTM-15 7 FT	BTM-16 7 FT
Sample Date		1/13/2021			2/24/2021		2/25/2021	10/23/2020	11/11/2020		11/17/2020	12/21/2020	1/6/2021				1/13/2021	1/25/2021					
Volatile Organic Compounds (VOCs) - mg/kg [3]																							
Acetone	**0.05**	**0.12**	0.048	ND	0.011	0.025	0.016	0.028	ND	0.015	ND	**0.052**	ND	ND	0.014 J	ND	0.026	0.0065 J	ND	ND	0.0073 J	0.034	ND
2-Butanone (MEK)	**0.12**	ND	ND	ND	0.0025 J	ND	0.0068 J	0.0061 J	ND	ND	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0078 J	ND
Cyclohexane	**--**	0.019	0.0041 J	0.99	ND	ND	ND	ND	0.0018 J	ND	ND	ND	ND	ND	ND	ND	0.00093 J	ND	ND	ND	ND	ND	ND
Isopropylbenzene (Cumene)	**--**	0.0054	ND	0.0075 J	ND	0.0003 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0002 J	ND	ND	ND	ND	ND	ND
Methyl acetate	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl cyclohexane	**--**	0.18	0.023	6.3	ND	0.037	0.0031 J	ND	0.0036 J	ND	ND	ND	ND	0.004 J	ND	ND	0.0076	ND	ND	ND	ND	0.00097 J	ND
1,2,3-Trichlorobenzene	**--**	ND	ND	ND	ND	0.001 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	**0.47**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylene	**0.26**	0.0018 J	ND	ND	ND	0.00138 J	ND	0 J	0.00089 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**0.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00051 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	**--**	0.326	0.075	7.298	0.014	0.065	0.026	0.034	0.006	0.015	ND	0.064	ND	0.004	0.014	ND	0.035	0.007	ND	ND	0.007	0.043	ND
Tentatively Identified Compounds (TICs)	**--**	1.27 J	0.279 J	20.9 J	0.551 J	0.677 J	0.132 J	0.00255 J	0.148 J	0.00249 J	ND	ND	ND	0.13 J	ND	ND	0.176 J	0.157 J	ND	0.0305 J	0.284 J	0.439 J	0.00314 J
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																							
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	ND	ND	ND	ND	ND	0.17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	**100**	ND	ND	ND	ND	ND	ND	0.35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.090 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	ND	ND	ND	ND	ND	ND	**2**	ND	ND	ND	0.051 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	**1**	ND	ND	ND	ND	ND	ND	**1.9**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	**1**	ND	ND	ND	ND	ND	ND	**2.3**	ND	ND	ND	0.062 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	**100**	ND	ND	ND	ND	ND	ND	1.3	ND	ND	ND	0.034 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.8**	ND	ND	ND	ND	ND	ND	**0.93**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	**--**	ND	ND	ND	ND	ND	ND	0.13 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	ND	ND	ND	ND	ND	ND	**1.8**	ND	ND	ND	0.052 J	ND	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	ND	ND	ND	ND	ND	0.24	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	**7**	ND	ND	ND	ND	ND	ND	0.022 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	**100**	ND	ND	ND	ND	ND	0.024 J	3.8	0.05 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	**30**	ND	ND	ND	ND	0.051 J	ND	0.052 J	ND	ND	ND	0.11	ND	ND	ND	ND	0.046 J	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	ND	ND	ND	ND	ND	ND	**1.2**	ND	ND	ND	0.032 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	**100**	ND	ND	ND	ND	0.063 J	ND	1.5	0.046 J	ND	ND	0.076 J	ND	ND	ND	ND	0.096 J	ND	ND	ND	ND	ND	ND
Pyrene	**100**	ND	ND	ND	ND	ND	0.020 J	3.4	0.05 J	ND	ND	0.09 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	**12**	ND	ND	ND	ND	ND	ND	0.025 J	ND	ND	ND	ND	ND	ND	ND	ND	0.12 J	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.4	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	ND	ND	ND	ND	0.114	0.044	21.119	0.146	ND	ND	0.597	ND	ND	ND	ND	0.682	ND	ND	ND	ND	ND	ND
TICs	**--**	0.178 J	ND	0.458 J	ND	19.6 J	ND	6.21 J	0.426 J	0.561 J	ND	0.416 J	ND	0.754 J	0.168 J	ND	14.1 J	0.146 J	ND	ND	ND	ND	ND
Metals - mg/kg																							
Arsenic	**13**	5.26	2.42	4.32	12.8	**14.5**	**14.8**	6.24	**16.5**	**18.2**	**13.2**	7.6	**19.5**	**16.5**	7.61	9.72	4.11	**21.8**	10.5	**13.6**	**16**	13	**14.9**

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).

Definitions:

mg/kg = milligrams per kilogram

ND = Parameter not detected above laboratory detection limit

"--" = No value available for the parameter; or parameter not analyzed for.

J = Estimated value; result is less than the sample quantitation limit but greater than zero

D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

Bold = Exceeds USCOs or SSAL

TABLE 3
SUMMARY OF GCS EXCAVATION AREA END-POINT SAMPLE ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Locations															
		GCS Excavation Area															
		BTM-17 7.5 FT	BTM-18 7.5 FT	BTM-19 7.5 FT	BTM-20 8 FT	BTM-21 7.5 FT	BTM-22 7.5 FT	BTM-23 7.5 FT	BTM-24 8 FT	BTM-25 8 FT	BTM-26 8 FT	BTM-27 8 FT	BTM-28 7 FT	BTM-29 8 FT	BTM-30 8 FT	BTM-31 7 FT	BTM-32 8 FT
Sample Date		1/27/2021			2/2/2021				2/12/2021		2/23/2021		2/24/2021	3/4/2021		3/11/2021	
Volatile Organic Compounds (VOCs) - mg/kg [3]																	
Acetone	**0.05**	0.0059 J	0.0074 J	ND	0.0074 J	ND	ND	ND	ND	0.02	0.027	0.014	0.038	0.026	0.032	0.019	0.041
2-Butanone (MEK)	**0.12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0031 J	ND	0.006 J	ND	0.0028 J
Cyclohexane	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.031	ND	ND	ND	ND	ND	ND
Isopropylbenzene (Cumene)	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00023 J	ND	ND	ND	ND	ND	ND
Methyl acetate	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0027 J	ND	ND	ND	ND
Methyl cyclohexane	**--**	ND	ND	ND	0.0018 J	ND	ND	ND	ND	0.0038 J	0.16	0.0011 J	ND	ND	0.0021 J	ND	ND
1,2,3-Trichlorobenzene	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	**0.47**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylene	**0.26**	ND	ND	ND	ND	ND	ND	ND	ND	0.0012 J	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**0.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total VOCs	**--**	0.006	0.007	ND	0.009	ND	ND	ND	ND	0.025	0.218	0.015	0.044	0.026	0.040	0.019	0.044
Tentatively Identified Compounds (TICs)	**--**	ND	ND	0.0533 J	0.532 J	ND	ND	ND	ND	ND	0.52 J	ND	0.0107 J	ND	0.0378 J	ND	ND
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																	
Acenaphthene	**20**	ND	ND	0.052 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	0.23	0.67	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	**100**	0.067 J	0.44	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	0.053 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	0.17	**1.5**	**4.2**	ND	ND	ND	0.062 J	ND	ND	ND	ND	0.024 J	ND	ND	ND	ND
Benzo(a)pyrene	**1**	0.15 J	**1.3**	**3.8**	ND	ND	ND	0.054 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	**1**	0.19	**1.7**	**4.9**	ND	ND	ND	0.069 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	**100**	0.1 J	0.92	2.6	ND	ND	ND	0.039 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.8**	0.071 J	0.57	**1.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	**--**	0.037 J	0.25	0.75	ND	ND	ND	0.02 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	0.16	**1.4**	**3.9**	ND	ND	0.057 J	0.062 J	ND	ND	ND	ND	0.021 J	ND	ND	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	0.21	**0.57**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	**7**	ND	0.056 J	0.16 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	**100**	0.48	3.7	12.0 D	ND	0.025 J	0.048 J	0.16	ND	ND	ND	ND	0.040 J	ND	ND	ND	ND
Fluorene	**30**	ND	0.051 J	0.18 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	0.1 J	**0.9**	**2.6**	ND	ND	ND	0.042 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	**100**	0.29	2	5.6	ND	ND	0.038 J	0.12	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	**100**	0.39	2.9	9.6 D	ND	0.022 J	0.038 J	0.13	ND	ND	ND	ND	0.034 J	ND	ND	ND	ND
Naphthalene	**12**	ND	0.053 J	0.13 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	ND	ND	0.03 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	2.205	18.18	54.995	ND	0.047	0.181	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TICs	**--**	0.406 J	3.25 J	9.64 J	ND	2.3 J	1.06 J	0.226 J	ND	ND	0.8 J	ND	ND	ND	ND	0.389 J	0.257 J
Metals - mg/kg																	
Arsenic	**13**	**15**	**15.3**	**14.3**	8.81	**16.2**	11.8	8.39	**14.4**	10.7	**13.5**	**17.3**	**16.6**	**31**	7.8	8.67	**20.1**

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).

Definitions:

mg/kg = milligrams per kilogram

ND = Parameter not detected above laboratory detection limit

"--" = No value available for the parameter; or parameter not analyzed for.

J = Estimated value; result is less than the sample quantitation limit but greater than zero

D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

Bold = Exceeds USCOs or SSAL

TABLE 4
SUMMARY OF SVOC EXCAVATION AREA END-POINT SAMPLE ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Locations										
		SVOC SW-1 5-11 FT	SVOC SW-2 5-11 FT	SVOC SW-3 5-11 FT	SVOC SW-4 5-11 FT	SVOC SW-5 5-11 FT	SVOC SW-6 5-11 FT	SVOC SW-7 5-11 FT	SVOC SW-8 5-11 FT	SVOC BTM-1 11 FT	SVOC BTM-2 11 FT	SVOC BTM-3 11 FT
Sample Date		11/5/2020										
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]												
Anthracene	**100**	*ND*	0.089 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Benzo(a)anthracene	**1**	*ND*	0.23	0.026 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Benzo(a)pyrene	**1**	*ND*	0.20	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Benzo(b)fluoranthene	**1**	*ND*	0.24	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Benzo(g,h,i)perylene	**100**	*ND*	0.12 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Benzo(k)fluoranthene	**0.8**	*ND*	0.095 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Carbazole	**--**	*ND*	0.036 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Chrysene	**1**	*ND*	0.20	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Dibenzo(a,h)anthracene	**0.33**	*ND*	0.033 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Dibenzofuran	**7**	*ND*	0.027 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Fluoranthene	**100**	0.023 J	0.51	0.042 J	*ND*	*ND*	*ND*	*ND*	0.024 J	*ND*	0.032 J	*ND*
Fluorene	**30**	*ND*	0.029 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Indeno(1,2,3-cd)pyrene	**0.5**	*ND*	0.13 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Phenanthrene	**100**	*ND*	0.42	0.028 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Pyrene	**100**	0.022 J	0.38	0.033 J	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.027 J	*ND*
1,4-Dioxane	**0.1**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Total SVOCs (SSAL) [4]	**500**	0.045	2.739	0.129	*ND*	*ND*	*ND*	*ND*	0.024	*ND*	0.059	*ND*
Total Tentatively Identified Compounds (TICs)	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	0.573 J	*ND*	0.377 J	*ND*	18.5 J	0.327 J

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).

Definitions:

mg/kg = milligrams per kilogram

ND = Parameter not detected above laboratory detection limit

"--" = No value available for the parameter; or parameter not analyzed for.

J = Estimated value; result is less than the sample quantitation limit but greater than zero

Bold = Exceeds USCOs or SSAL

TABLE 5
SUMMARY OF PFAS TREATMENT AREA
END-POINT SAMPLE ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Parameter [1]	**Site Specific Action Level (SSAL) [2]**	**Sample Locations**				
		TP-52 0-2 IN	**TP-54 TZ-1 0-2 FT**	**TP-54 TZ-2 0-3 FT**	**TP-54 TZ-3A 0-11 FT**	**TP-54 TZ-3B 0-5 FT**
Sample Date		**11/5/2020**			**12/4/2020**	
SPLP Perfluorinated Alkyl Acids (PFAS) - ng/L						
Perfluorohexanoic Acid (PFHxA)	--	4.28 JF	2.30 J	3.68 J	*ND*	*ND*
Perfluorooctanoic Acid (PFOA)	--	*ND*	*ND*	*ND*	*ND*	3.3 JF
Perfluorooctanesulfonic Acid (PFOS)	--	5.4 J	*ND*	*ND*	5.70 J	4.24 JF
Perfluorodecanoic Acid (PFDA)	--	*ND*	*ND*	*ND*	*ND*	3.88 J
Perfluoroundecanoic Acid (PFUnA)	--	*ND*	*ND*	*ND*	*ND*	1.36 J
PFOA + PFOS	**70**	5.4	*ND*	*ND*	5.7	7.54
Total PFAS	**500**	9.68	2.3	3.68	5.7	12.78

Notes:
1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Site Specific Action Level (SSAL)

Definitions:

PFAS = Perfluorinated Alkyl Acids
SPLP = Synthetic Precipitation Leachate Procedure
ng/L = nanograms per liter
ND = Parameter not detected above laboratory detection limit
"--" = No value available for the parameter; or parameter not analyzed for.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
F = The ratio of quantifier ion response falls outside of the laboratory criteria. Results are considered to be an estimated maximum concentration.
Bold = Exceeds SSAL

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Location																			
		TP-1 5-7 FT	TP-5 2-4 FT	TP-10 0.5-1 FT	TP-10 3-5 FT	TP-16 4-6 FT	TP-42 8-10 FT	TP-44 2-3 FT	TP-45 4-6 FT	TP-46 4-6 FT	TP-47 2-4 FT	SB-1 10-12 FT	SB-4 4-6 FT	MW-5 0.75-2 FT	MW-5 6-8 FT	MW-7 8.5-9.5 FT	MW-8 4-6 FT	MW-9 0.25-1 FT	MW-12 10-11.5 FT	MW-13 8-10 FT	MW-15 4-6 FT
Sample Date		12/23/2014		1/5/2017			6/26/2018					1/27/2017	1/20/2017	2/1/2017	1/31/2017	1/30/2017	1/31/2017		1/19/2017	6/26/2018	6/22/2018
Volatile Organic Compounds (VOCs) - mg/kg[3]																					
1,2,3-Trichlorbenzene	**--**	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**3.6**	**4.5**	2	NA	ND	0.291 J+	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	**8.4**	2.2	0.99	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	**0.12**	**1.2**	ND	NA	ND	ND	0.0071 J	ND	ND	0.0032 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acetone	**0.05**	**0.29**	**0.33 J**	NA	**0.104 J+**	**0.086 J+**	0.036	ND	ND	0.025 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	**0.06**	ND	ND	NA	ND	0.0023 J+	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	**0.37**	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	**--**	0.88 J	0.07 J	NA	ND	2.97 J+	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	**1**	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene (Cumene)	**--**	0.18	0.092 J	NA	ND	ND	ND	ND	0.28 J	0.035	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	**--**	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl cyclohexane	**--**	5.1	2.6	NA	ND	5.46 J+	ND	ND	1.3	0.075	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	23
n-Butylbenzene	**12**	0.057 J	0.14	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0059	ND	ND	ND	ND
n-Propylbenzene	**3.9**	0.33	0.13 J	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Cymene (p-isopropyltoluene)	**--**	0.36	0.36	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	**11**	0.16	0.3	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**0.7**	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	**0.47**	ND	ND	NA	ND	ND	0.0015 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylene	**0.26**	**0.63**	ND	NA	ND	ND	ND	ND	ND	0.0026 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tentatively Identified Compounds (TICs)	**--**	23	52	NA	9032	258	0.0073	0.12	108	0.0627	ND	ND	ND	ND	10.1	ND	16.5	ND	ND	ND	172
Semi-Volatile Organic Compounds (SVOCs) - mg/kg[3]																					
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.8**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	**7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl pthhalate	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 J	ND
Fluoranthene	**100**	ND	ND	0.115	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	**30**	ND	0.099 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-methylphenol	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	**100**	ND	0.26	ND	ND	0.17	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	**100**	ND	0.0927	0.0927	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	**12**	ND	0.22	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	0.23 J	1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	0.23 J	1.77 J	0.2077	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 J	ND
TICs	**--**	1.5	5.3	5.3	22	30	**1095**	2.01	114	2.5 J	1.6 J	ND	ND	ND	0.26	ND	0.94	ND	ND	2.5	172
Metals - mg/kg																					
Aluminum	**--**	NA	NA	2740	12000	12800	13600	16900	15000	15400	14800	13100	11400	5540	12300	13900	17300 J	2130	11500	17200	13600
Antimony	**--**	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	**13**	8.5	8.8	**25.9**	13	12.2	10.2	**15.9**	**15**	**14.4**	**13.6**	**15.9**	**13.1**	**38.9**	**15.1**	9.2	**15.9**	**28.2**	**17.1**	**17.7**	**18.7**
Barium	**350**	160	130	162	108	140	154	157	162	141	168	159	114	116	117	177	205 J	20.3	64.3	211	141
Beryllium	**7.2**	NA	NA	ND	ND	ND	0.9	1	0.74	0.9	0.81	ND	ND	ND	ND	ND	ND	ND	ND	1.1	0.87
Cadmium	**2.5**	ND	ND	ND	ND	ND	0.34	ND	0.12 J	0.055 J	0.04 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17 J
Calcium	**--**	NA	NA	247	500	989	722 B	3230 B	607 B	2000 B	4830 B	1610	4360	38200	1080	834	763	1070	1560	3020 B	1100 B
Chromium [4]	**30**	15	10	16	16.3	16.3	16.3	20.4	17.1	18.5	17.4	16.5	15.9	6.12	15.2	15.7	23.2	8.23	16.3	23.4	15.7
Cobalt	**--**	NA	NA	2.67	12.8	14.1	8.6	18.1	14.8	18.6	15.8	14.9	12.1	5.29	10.7	11.5	15.9	3.61	13.7	17	11.3
Copper	**50**	NA	NA	21.1	10.6	10	15.5	19.7	15.2	21	19.2	16.8	15.7	**85**	20.7	15.5	14.6	9.33	16	15.2	17.1
Iron	**--**	NA	NA	33100	24900	24300	18600	35800	26500	30900	28000	32400	29800	15000	20800	28300	28600	14500	20800	34600	28300
Lead	**63**	6.4	4.8	35.5	21.1	22.9	24.5	20..3	22	22.3	20	19.2	14.8	**81.2**	23	18.6	33	11.1	16.1	17.7	27.5
Magnesium	**--**	NA	NA	289	3130	3230	2340	5450	3380	4260	4600	3560	4530	4170	3040	3660	4120	ND	4330	5660	2330
Manganese	**1600**	NA	NA	56.9	303	367	183 B	716 B	502 B	649 B	698 B	562	472	350	308	456	793	47.6	169	423 B	864 B
Mercury	**0.18**	0.03	ND	**0.297**	ND	ND	0.033	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.037
Nickel	**30**	NA	NA	11.5	28	29.6	16.3	**34.7**	26	**32.3**	28.8	**30.8**	27.2	12.6	26.2	**31.2**	**36.8**	10.4	27.9	**38.8**	15.5
Potassium	**--**	NA	NA	372	810	1120	1730	3380	2520	3150	2880	1390	1090	500	1080	1230	1640	ND	1210	2710	1760
Selenium	**3.9**	ND	ND	2.97	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.65	ND	ND	ND	1.58	ND	ND	ND	ND	ND
Sodium	**--**	NA	NA	ND	ND	ND	37 J	79.7 J	46.1 J	68.8 J	79.5 J	ND	ND	ND	ND	ND	ND	ND	ND	73 J	46.8 J
Thallium	**--**	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND	2.17	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**--**	NA	NA	ND	12.9	12.6	26.3	22.8	22.7	23.3	20.5	14.6	ND	19.6	18.6	13.7	26.2	14.9	15.1	18	26.7
Zinc	**109**	NA	NA	19.6	67.4	72.5	56.1	69.3	60.6	65.4	58.6	64.1	67.7	60.5	64.5	65.5	86.9	14.9	71.4	78.5	49.6
Organochlorine Pesticides - mg/kg[3]																					
delta-BHC	**0.04**	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Dieldrin	**0.005**	NA	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA
Endosulfan II	**2.4**	NA	NA	NA	NA	NA	NA	NA	ND	0.0005 J	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	NA

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).
5. Columns highlighted in red represent historic investigation locations which were excavated and removed during remedial activities.

Definitions:

mg/kg = milligrams per kilogram
ND = Parameter not detected above laboratory detection limit
NA = Parameter not analyzed for.
"--" = No value available for the parameter.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
Bold = Exceeds USCOs

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Location															
		NS-1 2 IN - 1 FT	NS-1 1-2 FT	NS-1 3-4 FT	SS-2	NS-2 2 IN - 1 FT	NS-2 1-2 FT	NS-2 3-4 FT	NS-3 1-2 FT	NS-3 2-3 FT	NS-3 3-4 FT	SS-5	NS-5 2 IN - 1 FT	NS-5 1-2 FT	NS-5 2-3 FT	NS-5 3-4 FT	SS-6
Sample Date		7/2/2018			1/11/2017	7/2/2018						1/11/2017	7/2/2018				1/11/2017
Volatile Organic Compounds (VOCs) - mg/kg [3]																	
1,2,3-Trichlorbenzene	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	**3.6**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	**8.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	**0.12**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	**0.05**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	**0.06**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	**0.37**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	**1**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene (Cumene)	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl cyclohexane	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	**12**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	**3.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (p-isopropyltoluene)	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	**11**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	**0.7**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	**0.47**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Xylene	**0.26**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tentatively Identified Compounds (TICs)	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																	
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.8**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	**7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl pthhalate	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	**30**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-methylphenol	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TICs	**--**	0.35	0.38	0.36	1.4	0.3	0.35	0.33	0.41	0.32	0.32	0.21	1.16	0.34	0.33	0.34	0.79
Metals - mg/kg																	
Aluminum	**--**	14100	13600	12300	11200 J-	13900	14400	13600	15400	15900	15500	10700	16200	15200	17300	15000	10400
Antimony	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	**13**	**14 B**	11 B	**14.9 B**	**14.1**	**14.5 B**	**73.3 B**	**16.5 B**	**13.4 J-**	**15.6 B**	**14 B**	**16.3**	**13.7 B**	**13.6 B**	**13.9 B**	12.2 B	9.88
Barium	**350**	150	113	120	71.2	219	147	211	153 F1	192	172	78	140	132	231	153	136
Beryllium	**7.2**	0.79	0.9	0.67	ND	0.83	0.82	0.84	0.9	0.95	0.9	ND	0.94	0.85	1	0.88	ND
Cadmium	**2.5**	0.048 J	0.1 J	0.1 J	ND	0.044 J	0.087 J	0.058 J	0.051 J	0.068 J	0.053 J	ND	0.06 J	0.062 J	0.043 J	0.067 J	ND
Calcium	**--**	2090 B	1860 B	1890 B	1830	4540 B	7140 B	3650 B	4080 J	3680 B	2940 B	2370	3860 B	7320 B	3620 B	4010 B	1900
Chromium [4]	**30**	17.5	17.7	15.7	13.6	17.2	16.5	16.5	19.1	19.3	19.3	13.3	19.6	18	20.4	17.8	13.3
Cobalt	**--**	15	14.2	13.2	13	14.1	14.8	15.1	15.5	19.6	14	13.4	15.8	15.2	16.2	14.7	11
Copper	**50**	17.8	20.8	18.5	11.7	18.7	21.3	18.7	18	18.5	17.6	10.2	18.9	18	20.5	16.8	12.9
Iron	**--**	29300	26800	27100	26800 J+	30000	31400	29700	30300	32200	30300	29300	30800	29300	33900	29600	23800
Lead	**63**	17.9	16.5	18.5	22.3	17.3	35.8	27.6	17.8	19	16.7	25.5	20.7	16.1	19.1	15.9	20.3
Magnesium	**--**	4020	4180	3500	4290	4840	4490	4320	4710	4780	4660	4390	5240	5390	4670	4680	3250
Manganese	**1600**	639 B	1530 B	548 B	655 J-	532 B	497 B	716 B	596 B	1160 B	768 B	957	632 B	437 B	536 B	546 B	562
Mercury	**0.18**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	**30**	30	**33**	27	29	30	29	29.3	**31.9**	**36.9**	**31**	29.6	**33.4**	**30.7**	**34.4**	**31.2**	22.2
Potassium	**--**	2420	2630	2060	1610	2450	2660	2550	3010 J	3060	3060	1580	3330	3120	3760	3180	1190
Selenium	**3.9**	ND	ND	ND	**4.23**	ND	ND	ND	ND	ND	ND	**4.65**	ND	ND	ND	ND	**5.19**
Silver	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	**--**	56.6 J	59.9 J	57.2 J	ND	66.9 J	68 J	76.2 J	73.7 J	76.2 J	70.2 J	ND	82 J	83.5 J	88.4 J	89.6 J	ND
Thallium	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**--**	19.1	19	18.7	14.5	18	20.2	17.8	20.4	20.9	20.5	ND	21.7	20.9	23.6	20.3	16.1
Zinc	**109**	63.6	59.5	59.6	93.5 J	63.6	63.5	61.9	65.7	68.5	65.2	73.2	69.3	65.7	72.9	66	60.3
Organochlorine Pesticides - mg/kg [3]																	
delta-BHC	**0.04**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND
Dieldrin	**0.0005**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND
Endosulfan II	**2.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).
5. Columns highlighted in red represent historic investigation locations which were excavated and removed during remedial activities.

Definitions:

mg/kg = milligrams per kilogram
ND = Parameter not detected above laboratory detection limit
NA = No value available for the parameter; or parameter not analyzed for.
"--" = No value available for the parameter.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.

Bold = Exceeds USCOs

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Location																		
		SS-7	SS-8	SS-10	SS-15	SS-18	NS-22 2 IN - 1 FT	SS-23	NS-23 2 IN - 1 FT	SS-24	NS-24 2 IN - 1 FT	NS-25 2 IN - 1 FT	SS-27	NS-27 2 IN - 1 FT	SS-28	NS-28 2 IN - 1 FT	SS-29	NS-29 2 IN - 1 FT	SS-30	SS-34
Sample Date		1/11/2017			1/13/2017	1/16/2017	6/29/2018												7/2/2018	
Volatile Organic Compounds (VOCs) - mg/kg [3]																				
1,2,3-Trichlorbenzene	**--**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
1,2,4-Trimethylbenzene	**3.6**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
1,3,5-Trimethylbenzene	**8.4**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
2-Butanone (MEK)	**0.12**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Acetone	**0.05**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Benzene	**0.06**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Chloroform	**0.37**	NA	NA	NA	NA	NA	ND	NA	0.00072 J	NA	ND	0.00037 J	NA	ND	NA	0.00041 J	NA	ND	NA	NA
Cyclohexane	**--**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Ethylbenzene	**1**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Isopropylbenzene (Cumene)	**--**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Methyl acetate	**--**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Methyl cyclohexane	**--**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
n-Butylbenzene	**12**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
n-Propylbenzene	**3.9**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
p-Cymene (p-isopropyltoluene)	**--**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
sec-Butylbenzene	**11**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Toluene	**0.7**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Trichloroethene	**0.47**	NA	NA	NA	NA	NA	0.0024 J	NA	0.0013 J	NA	ND	0.0014 J	NA	ND	NA	ND	NA	ND	NA	NA
Total Xylene	**0.26**	NA	NA	NA	NA	NA	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Tentatively Identified Compounds (TICs)	**--**	NA	NA	NA	NA	NA	ND	NA	0.0062	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	NA
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																				
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	ND	ND	ND	ND	ND	0.21 J	ND	ND	0.11 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	**100**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	ND	ND	ND	ND	ND	0.09 J	0.66 J	0.47 J	0.13 J	0.48	ND	ND	ND	ND	ND	ND	0.17 J	ND	ND
Benzo(a)pyrene	**1**	ND	ND	ND	ND	ND	0.091 J	0.71 J	0.5 J	ND	0.44	ND	ND	ND	ND	ND	0.082 J	0.15 J	ND	ND
Benzo(b)fluoranthene	**1**	ND	ND	ND	ND	0.11 J	0.12 J	0.97 J	0.7 J	0.23 J	0.57	ND	ND	ND	ND	ND	0.095 J	0.21 J	ND	ND
Benzo(g,h,i)perylene	**100**	ND	ND	ND	ND	ND	0.076 J	0.53 J	0.33 J	ND	0.31	ND	ND	ND	ND	ND	0.084 J F2	0.13 J	ND	ND
Benzo(k)fluoranthene	**0.8**	ND	ND	ND	ND	ND	0.039 J	0.39 J	0.2 J	ND	0.22	ND	ND	ND	ND	ND	ND	0.098 J	ND	ND
Carbazole	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.03 J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	ND	ND	ND	ND	0.0758 J	0.091 J	0.69 J	0.47 J	ND	0.45	ND	ND	ND	ND	ND	ND	0.18 J	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.084 J	ND	ND	ND	ND	ND	ND	0.045 J	ND	ND
Dibenzofuran	**7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl pthhalate	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	**100**	ND	0.0848 J	ND	ND	0.155 J	0.17 J	1.6	1.1 J	0.22 J	0.84	ND	ND	ND	ND	ND	0.17 J	0.35	ND	ND
Fluorene	**30**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.031 J	0.027 J	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	ND	ND	ND	ND	ND	0.058 J	0.43 J	0.29 J	ND	0.26 J	ND	ND	ND	ND	ND	ND	0.11 J	ND	ND
4-methylphenol	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13 J
Phenanthrene	**100**	ND	ND	ND	ND	ND	0.1 J	1 J	0.61 J	ND	0.43	ND	ND	ND	ND	ND	ND	0.17 J	ND	ND
Pyrene	**100**	ND	ND	ND	ND	0.116 J	0.17 J	1.3	0.86 J	0.18 J	0.82	ND	ND	ND	ND	ND	0.14 J	0.37	ND	ND
Naphthalene	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	ND	0.0848 J	ND	ND	0.4568 J	1.005 J	8.49 J	5.53 J	0.76 J	5.205 J	0.027 J	ND	ND	ND	ND	ND	1.983 J	ND	0.13 J
TICs	**--**	1.8	5.1	2.7	0.17	5.6	3.45	2.3	5.2	9.05	4.45	1.27	5	1.65	8.04	1.92	20.6	10.59	1.96	10.78
Metals - mg/kg																				
Aluminum	**--**	15100	9870	10200 J-	11100	4510	17100	14700	17200	17900	16600	16700	14500	14700	16800	15900	22400	21600	19600	20400
Antimony	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.72 J	0.54 J	0.69 J	0.81 J	0.8 J	0.75 J	0.82 J	ND	ND
Arsenic	**13**	**17.4**	10.4	11.7	**13.7 J-**	7.25	**17.9**	10.9	**14.6**	**14.6**	**14.5**	**16.4**	9.5	**18**	**16.2**	**16.9**	**20**	**14**	**23.3 B**	10 B
Barium	**350**	170	131	122	131	77.8	98.3	161	192	180	140	120 B	81.4 B	150 B	110 B	158 B	180 B	176 B	74	102
Beryllium	**7.2**	ND	ND	ND	ND	ND	0.97	0.68	0.87	0.85	0.78	0.92	0.86	0.87	0.91	0.92	1.1	0.97	1.3	1.2
Cadmium	**2.5**	ND	ND	ND	ND	ND	ND	0.23 J	0.14 J	0.13 J	0.076 J	ND	ND	ND	ND	ND	ND	ND	0.1 J	0.11 J
Calcium	**--**	1860	1920	1730	2360	1460	1760 B	2440 B	2270 B	1510 B	830 B	1810 B	1880 B	3410 B	2970 B	2140 B	1310 B	1120 B	1820 B	2300 B
Chromium [4]	**30**	18	12.9	13.2	19.1	5.69	19.8	17.2	20.7	20.1	18.5	19.1	17	17.8	20.1	18.6	25.3	24.1	23	23.3
Cobalt	**--**	7.32	10.2	12.4	11.8	ND	18.1	11.7	17.2	16.6	16	18.8	14.4	15.5	16.4	17.6	13.9	13.1	17.6	17.5
Copper	**50**	15	16.6	14.6	20.5	27.5	21.1	15.9	21	20	17.4	16.1	17.7	21.1	24.2	19.6	17.7	17.4	20.2	19.1
Iron	**--**	38900	22200	26800 J+	27600	5950	34800 B	21600 B	28700 B	31200 B	29700 B	32700	29500	21000	36500	33700	39400	34600	36600	37200
Lead	**63**	31	57.9	23.3 J	60.8	26.6	19.5	25.3	62.3	25.9	23.1	19.4	13	16.8	15.8	17.1	33.2	30	**67.5**	12.2
Magnesium	**--**	2880	2550	3290	4020	746	5270	3320	4260	3910	3370	4100	4770	5030	5510	5170	3410	3720	5870	5870
Manganese	**1600**	380	1000	654 J-	780	231	692 B	713 B	886 B	1070 B	833 B	734	545	583	709	795	263	554	293 B	755 B
Mercury	**0.18**	ND	ND	ND	ND	**0.191**	0.02 J	0.044	0.021 J	0.041	0.029	0.026	ND	ND	0.012 J	ND	0.039	0.05	0.022 J	ND
Nickel	**30**	18.5	19.5	22.3	27.2	6.23	**34.2**	20	28.3	25.8	23	**31.1**	**30.3**	**32.2**	**34.8**	**33.9**	20.9	23.6	**39.3**	**38.4**
Potassium	**--**	1470	796	809	891	511	3040	2790	2380	2480	2090	2670	3220	2910	3770	3270	2750	2810	4710	4300
Selenium	**3.9**	**8**	**4.46**	**4.65**	**4.68**	ND	ND	ND	ND	ND	ND	0.5 J	ND	ND	ND	ND	ND	ND	ND	ND
Silver	**2**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	**--**	ND	ND	ND	ND	ND	70.1 J	44.2 J	49.2 J	52.9 J	45 J	61.8 J	76.3 J	74 J	82.9 J	83.3 J	56.2 J	60.1 J	104 J	104 J
Thallium	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**--**	24.3	14.8	16.6	15.6	ND	22.5	22.9	26	26.6	25.5	24.5	19.3	19.5	22.9	21.7	43.4	39.4	27.8	29.3
Zinc	**109**	61.3	82.9	72.1 J	79.4	37	72.3	62.1	66.6	72.1	58.7	68.1	65.3	66.1	80.5	72.1	78.9	72.2	97.5	82.1
Organochlorine Pesticides - mg/kg [3]																				
delta-BHC	**0.04**	NA	NA	NA	NA	NA	NA	NA	NA	ND	0.00042 J	0.00051 J	NA	NA	NA	NA	ND	ND	NA	NA
Dieldrin	**0.0005**	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	NA	NA	NA	NA	ND	**0.016 J+**	NA	NA
Endosulfan II	**2.4**	NA	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND	NA	NA	NA	NA	ND	ND	NA	NA

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).
5. Columns highlighted in red represent historic investigation locations which were excavated and removed during remedial activities.

Definitions:

mg/kg = milligrams per kilogram
ND = Parameter not detected above laboratory detection limit
"--" = No value available for the parameter; or parameter not analyzed for.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
Bold = Exceeds USCOs

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Location														
		SS-35	NS-35 2 IN - 1 FT	SS-36	NS-36 2 IN - 1 FT	NS-36 1-2 FT	NS-36 2-3 FT	NS-36 3-4 FT	SS-37	NS-37 2 IN - 1 FT	NS-37 1-2 FT	NS-37 2-3 FT	NS-37 3-4 FT	NS-38 1-2 FT	NS-38 2-3 FT	NS-38 3-4 FT
Sample Date		7/2/2018														
Volatile Organic Compounds (VOCs) - mg/kg [3]																
1,2,3-Trichlorbenzene	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2,4-Trimethylbenzene	3.6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3,5-Trimethylbenzene	8.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
2-Butanone (MEK)	0.12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetone	0.05	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Benzene	0.06	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chloroform	0.37	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cyclohexane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Isopropylbenzene (Cumene)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl acetate	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Methyl cyclohexane	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Butylbenzene	12	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
n-Propylbenzene	3.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
p-Cymene (p-isopropyltoluene)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
sec-Butylbenzene	11	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toluene	0.7	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trichloroethene	0.47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Xylene	0.26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tentatively Identified Compounds (TICs)	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																
Acenaphthene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)pyrene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	0.8	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Di-n-octyl pthhalate	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluorene	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-methylphenol	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Pyrene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Naphthalene	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	500	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
TICs	--	4.02	2.11	5.56	2.36	1.78	2.2	2.03	4.12	3.13	2.04	1.37	2.54	2.35	1.360 J	1.88
Metals - mg/kg																
Aluminum	--	17300	16700	16200	15400	15300	16600	15500	16200	16400	16200	15300	19700	14500	15900	16200
Antimony	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	13	12 B	**19 B**	**13.9**	13	**13.1**	**16.6**	**14.1**	**13.6**	**14.4**	**20.2**	**16.5**	10	**14.6**	**13.1**	**13.2**
Barium	350	98.8	111	114 J	142	156	160	161	180	187	160	136	247	151 J	170	203
Beryllium	7.2	1	1.1	0.98	0.85	0.89	1	0.88	0.92	0.9	0.93	0.83	1.1	1	0.9	0.89
Cadmium	2.5	0.061 J	0.064 J	0.086 J	0.054 J	0.059 J	0.05 J	ND	0.045 J	0.046 J	0.041 J	0.038 J	ND	0.049 J	0.067 J	0.035 J
Calcium	--	1380 B	1770 B	3470 B	3920 B	2980 B	2270 B	3450 B	1900 B	1790 B	2040 B	2300 B	2080 B	2700 B	2350 B	4950 B
Chromium [4]	30	19.9	18.9	18.6	18	18.6	20.1	18.5	19.1	18.9	20.4	18.8	19.7	17.5	19	19.4
Cobalt	--	16.3	16.4	15.7	15.6	15.6	15.9	13.7	15.2	17	16.4	16	19.2	14.8	14.3	15.5
Copper	50	21.1	24.8	20.3	19.1	20.6	27	17.6	18.3	16.8	22.3	18.6	27.2	20.9	18.8	18.5
Iron	--	33400	38800	35000 F2	28700	31600	33800	28700	30000	30400	32500	30500	37600	38000 B	30000	30000
Lead	63	18.7	17.8	20.3 B	18.9 B	29.7 B	19 B	15.7 B	17.7 B	19.5 B	29.3 B	16.9 B	14.8 B	18.1 B	16.1 B	15.8 B
Magnesium	--	4790	4960	4580 F1	4700	4760	4560	4560	4590	4200	5000	4990	3820	4370 B	4530	5360
Manganese	1600	534 B	594 B	703 B F2	651 B	703 B	595 B	417 B	418 B	752 B	384 B	340 B	999 B	482 B	823 B	611 B
Mercury	0.18	ND	ND	0.013 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	30	**35.1**	**35.1**	**31.1**	**31.8**	**32.6**	**34.3**	29.7	**32**	**31.1**	**34.1**	**32.1**	**39.8**	**30.1**	**31.1**	**32.1**
Potassium	--	3840	3680	3600 J	2960	2540	3030	3190	3250	3330	3010	2810	4070	2430 J	3150	3340
Selenium	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	--	80.3 J	89 J	81.4 J B	73.2 J B	70.7 J B	73.4 J B	78.7 J B	65.4 J B	64.9 J B	70.4 J B	72.5 J B	83.3 J B	63.4 J B	76.6 J B	86.2 J B
Thallium	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	--	23.1	21.9	22.4 F1	20.4	19.7	21.6	20.4	20.5	20.7	20.3	19.4	23.8	18.5	20.8	21.4
Zinc	109	70.7	73.7	72.6	63.9	68.9	71.9	63.7	64.1	64.4	68.4	67.6	79	68.4	64.7	65
Organochlorine Pesticides - mg/kg [3]																
delta-BHC	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.0005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	2.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).
5. Columns highlighted in red represent historic investigation locations which were excavated and removed during remedial activities.

Definitions:

mg/kg = milligrams per kilogram
ND = Parameter not detected above laboratory detection limit
"--" = No value available for the parameter; or parameter not analyzed for.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
Bold = Exceeds USCOs

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Location							
		NS-39 2 IN - 1 FT	NS-39 2-3 FT	NS-39 3-4 FT	SS-40	NS-40 3-4 FT	NS-41 1-2 FT	SS-42	NS-42 2 IN - 1 FT
Sample Date		7/2/2018						6/29/2018	
Volatile Organic Compounds (VOCs) - mg/kg [3]									
1,2,3-Trichlorbenzene	**--**	NA	NA	NA	NA	NA	NA	NA	ND
1,2,4-Trimethylbenzene	**3.6**	NA	NA	NA	NA	NA	NA	NA	ND
1,3,5-Trimethylbenzene	**8.4**	NA	NA	NA	NA	NA	NA	NA	ND
2-Butanone (MEK)	**0.12**	NA	NA	NA	NA	NA	NA	NA	ND
Acetone	**0.05**	NA	NA	NA	NA	NA	NA	NA	ND
Benzene	**0.06**	NA	NA	NA	NA	NA	NA	NA	ND
Chloroform	**0.37**	NA	NA	NA	NA	NA	NA	NA	ND
Cyclohexane	**--**	NA	NA	NA	NA	NA	NA	NA	ND
Ethylbenzene	**1**	NA	NA	NA	NA	NA	NA	NA	ND
Isopropylbenzene (Cumene)	**--**	NA	NA	NA	NA	NA	NA	NA	ND
Methyl acetate	**--**	NA	NA	NA	NA	NA	NA	NA	ND
Methyl cyclohexane	**--**	NA	NA	NA	NA	NA	NA	NA	ND
n-Butylbenzene	**12**	NA	NA	NA	NA	NA	NA	NA	ND
n-Propylbenzene	**3.9**	NA	NA	NA	NA	NA	NA	NA	ND
p-Cymene (p-isopropyltoluene)	**--**	NA	NA	NA	NA	NA	NA	NA	ND
sec-Butylbenzene	**11**	NA	NA	NA	NA	NA	NA	NA	ND
Toluene	**0.7**	NA	NA	NA	NA	NA	NA	NA	ND
Trichloroethene	**0.47**	NA	NA	NA	NA	NA	NA	NA	ND
Total Xylene	**0.26**	NA	NA	NA	NA	NA	NA	NA	ND
Tentatively Identified Compounds (TICs)	**--**	NA	NA	NA	NA	NA	NA	NA	ND
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]									
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	ND	ND	0.25 J	ND	ND	ND	ND
Anthracene	**100**	ND	ND	ND	0.36 J	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	ND	ND	ND	**1.9**	ND	ND	ND	ND
Benzo(a)pyrene	**1**	ND	ND	ND	**2**	ND	ND	ND	ND
Benzo(b)fluoranthene	**1**	ND	ND	ND	**2.7**	ND	ND	ND	ND
Benzo(g,h,i)perylene	**100**	ND	ND	ND	1.3	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.8**	ND	ND	ND	**1 J**	ND	ND	ND	ND
Carbazole	**--**	ND	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	ND	ND	ND	**2**	ND	ND	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	**7**	ND	ND	ND	0.4 J	ND	ND	ND	ND
Di-n-octyl pthhalate	**--**	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	**100**	ND	ND	ND	3.6	ND	ND	ND	ND
Fluorene	**30**	ND	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	ND	ND	ND	**1.2**	ND	ND	ND	ND
4-methylphenol	**--**	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	**100**	ND	ND	ND	1.4	ND	ND	ND	ND
Pyrene	**100**	ND	ND	ND	3.1	ND	ND	ND	ND
Naphthalene	**12**	ND	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	ND	ND	ND	21.21 J	ND	ND	ND	ND
TICs	**--**	4.8	1.74	1.54	14.2	6.68	5.98	6.84	2.21
Metals - mg/kg									
Aluminum	**--**	15100	15500	14800	19700	14100	13900	12300	14600 J-
Antimony	**--**	ND	ND	ND	ND	ND	ND	0.72 J	0.83 J-
Arsenic	**13**	**13.2**	**17.8**	13	**14.4**	9.1	**17.4**	**16.7**	**18.8**
Barium	**350**	142	159	157	111	173	181	117 B	146 J-
Beryllium	**7.2**	0.85	0.89	0.86	0.82	0.66	0.72	0.71	0.82
Cadmium	**2.5**	0.055 J	0.051 J	0.061 J	0.1 J	0.22 J	0.058 J	ND	ND
Calcium	**--**	5940 B	5400 B	4340 B	646 B	1170 B	1350 B	1940 B	1370 B
Chromium [4]	**30**	18.4	19	18.3	22.9	17.3	16.9	15.6	18
Cobalt	**--**	15.6	16.4	15.6	13.4	17.3	13.5	10.9	15.5
Copper	**50**	18.5	19.3	18.7	20.4	16.5	17.4	15.8	18.5
Iron	**--**	29600 B	31100 B	30600 B	33100 B	26400 B	28300 B	28700	32900
Lead	**63**	16.7	19.6	16.9	21.8 B	14.8	37	13.6	17.6
Magnesium	**--**	5390 B	5250 B	5090 B	4300 B	3400 B	3550 B	3450	4000 J-
Manganese	**1600**	605 B	447 B	723 B	512 B	**1930 B**	524 B	339 B	787 J-
Mercury	**0.18**	ND	ND	ND	0.042	0.011 J	ND	ND	ND
Nickel	**30**	**31.3**	**32.3**	**31.7**	28.7	**31.7**	27.4	26.6	**31.9**
Potassium	**--**	2810	2880	2690	2480	1790	1750	2450	2810 J-
Selenium	**3.9**	ND	ND	ND	ND	ND	ND	ND	ND
Silver	**2**	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	**--**	77.8 J B	79.2 J B	77.4 J B	57.7 J B	41 J B	49.7 J B	49.3 J	67.1 J
Thallium	**--**	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	**--**	19.9	19.8	18.8	29.7	20.1	17.8	16.8	20.5
Zinc	**109**	65.8	68.1	68.1	80.2	63.3	59.7	58.7	65 J-
Organochlorine Pesticides - mg/kg [3]									
delta-BHC	**0.04**	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	**0.0005**	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	**2.4**	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).
5. Columns highlighted in red represent historic investigation locations which were excavated and removed during remedial activities.

Definitions:

mg/kg = milligrams per kilogram
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J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
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Bold = Exceeds USCOs

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs[2]	Sample Location															
		SW-1 3-6 FT	SW-4 4-7 FT	SW-9 4-7 FT	SW-10 4-7 FT	SW-13 1-3 FT	SW-14 1-3 FT	SW-18 2-5 FT	SW-22 4-7 FT	SW-23 4-6 FT	BTM-1 6 FT	BTM-2 7 FT	BTM-3 7 FT	BTM-4 7 FT	BTM-5 3 FT	BTM-6 7 FT	BTM-7 7 FT
Sample Date		10/23/2020	11/3/2020	11/25/2020		12/21/2020		1/13/2021	2/24/2021	2/25/2021	11/23/2020	11/11/2020		11/17/2020	12/21/2020	1/6/2021	
Volatile Organic Compounds (VOCs) - mg/kg [3]																	
1,2,3-Trichlorbenzene	--	ND	ND	ND	ND	ND	ND	ND	0.001 J	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	3.6	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	8.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	0.12	0.0038 J	ND	ND	0.1 J	0.013	ND	ND	ND	0.0068 J	0.0061 J	ND	ND	ND	0.011	ND	ND
Acetone	0.05	0.028	ND	**0.46 J**	**0.23**	**0.063**	0.0078 J	**0.12**	0.025	0.016	0.028	ND	0.015	ND	**0.052**	ND	ND
Benzene	0.06	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	0.37	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	--	ND	ND	8.6	ND	ND	ND	0.019	ND	ND	ND	0.0018 J	ND	ND	ND	ND	ND
Ethylbenzene	1	ND	ND	0.033 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene (Cumene)	--	ND	ND	0.022 J	ND	ND	ND	0.0054	0.0003 J	ND	ND	ND	ND	ND	ND	ND	ND
Methyl acetate	--	ND	ND	0.25 J	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methyl cyclohexane	--	ND	ND	33 D	ND	ND	ND	0.18	0.037	0.0031 J	ND	0.0036 J	ND	ND	ND	ND	0.004 J
n-Butylbenzene	12	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	3.9	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Cymene (p-isopropyltoluene)	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	11	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00051 J	ND	ND
Trichloroethene	0.47	ND	ND	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylene	0.26	ND	ND	0.11 J	ND	ND	ND	0.0018 J	0.00138 J	ND	ND	0.00089 J	ND	ND	ND	ND	ND
Tentatively Identified Compounds (TICs)	--	ND	ND	56 J	ND	ND	ND	1.27 J	0.677 J	0.132 J	0.00255 J	0.148 J	0.00249 J	ND	ND	ND	0.13 J
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]																	
Acenaphthene	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.17	ND	ND	ND	ND	ND	ND
Anthracene	100	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.35	ND	ND	ND	ND	ND	ND
Benzaldehyde	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.090 J	ND	ND
Benzo(a)anthracene	1	ND	ND	0.032 J	0.076 J	0.051 J	0.025 J	ND	ND	ND	**2**	ND	ND	ND	0.051 J	ND	ND
Benzo(a)pyrene	1	ND	ND	ND	0.074 J	ND	ND	ND	ND	ND	**1.9**	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	1	ND	ND	0.034 J	0.099 J	0.057 J	ND	ND	ND	ND	**2.3**	ND	ND	ND	0.062 J	ND	ND
Benzo(g,h,i)perylene	100	ND	ND	ND	0.046 J	0.039 J	ND	ND	ND	ND	1.3	ND	ND	ND	0.034 J	ND	ND
Benzo(k)fluoranthene	0.8	ND	ND	ND	0.034 J	ND	ND	ND	ND	ND	**0.93**	ND	ND	ND	ND	ND	ND
Carbazole	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13 J	ND	ND	ND	ND	ND	ND
Chrysene	1	ND	ND	0.066 J	0.078 J	0.054 J	0.025 J	ND	ND	ND	**1.8**	ND	ND	ND	0.052 J	ND	ND
Dibenzo(a,h)anthracene	0.33	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.24	ND	ND	ND	ND	ND	ND
Dibenzofuran	7	ND	ND	0.061 J	ND	ND	ND	ND	ND	ND	0.022 J	ND	ND	ND	ND	ND	ND
Di-n-octyl pthhalate	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	100	ND	ND	0.076 J	0.19	0.11 J	0.048 J	ND	ND	0.024 J	3.8	0.05 J	ND	ND	ND	ND	ND
Fluorene	30	ND	ND	0.075 J	ND	ND	ND	ND	0.051 J	ND	0.052 J	ND	ND	ND	0.11	ND	ND
Indeno(1,2,3-cd)pyrene	0.5	ND	ND	ND	0.05 J	0.035 J	ND	ND	ND	ND	**1.2**	ND	ND	ND	0.032 J	ND	ND
4-methylphenol	--	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	100	ND	ND	0.21	0.14	0.055 J	0.033 J	ND	0.063 J	ND	1.5	0.046 J	ND	ND	0.076 J	ND	ND
Pyrene	100	ND	ND	0.077 J	0.14	0.089 J	0.04 J	ND	ND	0.020 J	3.4	0.05 J	ND	ND	0.09 J	ND	ND
Naphthalene	12	ND	ND	0.49	ND	ND	ND	ND	ND	ND	0.025 J	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	--	ND	ND	0.98	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	500	ND	ND	2.101	0.927	0.49	0.171	ND	0.114	0.044	21.119	0.146	ND	ND	0.597	ND	ND
TICs	--	ND	ND	41.1 J	0.263 J	0.417 J	0.284 J	0.178 J	19.6 J	ND	6.21 J	0.426 J	0.561 J	ND	0.416 J	ND	0.754 J
Metals - mg/kg																	
Aluminum	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	13	**15.1**	**19.5**	7.21	8.12	8.59	**14.3**	5.26	**14.5**	**14.8**	6.24	**16.5**	**18.2**	**13.2**	7.6	**19.5**	**16.5**
Barium	350	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	7.2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	2.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium [4]	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	50	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	1600	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	0.18	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	30	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	3.9	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	109	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides - mg/kg [3]																	
delta-BHC	0.04	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	0.0005	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	2.4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

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J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
Bold = Exceeds USCOs

TABLE 6
SUMMARY OF REMAINING SOIL/FILL SAMPLE EXCEEDANCES ABOVE USCOs
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	Unrestricted Use SCOs [2]	Sample Location													
		BTM-11 7 FT	BTM-13 7 FT	BTM-14 7.5 FT	BTM-16 7 FT	BTM-17 7.5 FT	BTM-18 7.5 FT	BTM-19 7.5 FT	BTM-21 7.5 FT	BTM-24 8 FT	BTM-26 8 FT	BTM-27 8 FT	BTM-28 7 FT	BTM-29 8 FT	BTM-32 8 FT
Sample Date		1/25/2021				1/27/2021			2/2/2021	2/12/2021	2/23/2021		2/24/2021	3/4/2021	3/11/2021
Volatile Organic Compounds (VOCs) - mg/kg [3]															
1,2,3-Trichlorbenzene	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2,4-Trimethylbenzene	**3.6**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,3,5-Trimethylbenzene	**8.4**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone (MEK)	**0.12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0031 J	ND	0.0028 J
Acetone	**0.05**	0.0065 J	ND	0.0073 J	ND	0.0059 J	0.0074 J	ND	ND	ND	0.027	0.014	0.038	0.026	0.041
Benzene	**0.06**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	**0.37**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyclohexane	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.031	ND	ND	ND	ND
Ethylbenzene	**1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Isopropylbenzene (Cumene)	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.00023 J	ND	ND	ND	ND
Methyl acetate	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.0027 J	ND	ND
Methyl cyclohexane	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.16	0.0011 J	ND	ND	ND
n-Butylbenzene	**12**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
n-Propylbenzene	**3.9**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
p-Cymene (p-isopropyltoluene)	**--**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
sec-Butylbenzene	**11**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	**0.7**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	**0.47**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylene	**0.26**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tentatively Identified Compounds (TICs)	**--**	0.157 J	0.0305 J	0.284 J	0.00314 J	ND	ND	0.0533 J	ND	ND	0.52 J	ND	0.0107 J	ND	ND
Semi-Volatile Organic Compounds (SVOCs) - mg/kg [3]															
Acenaphthene	**20**	ND	ND	ND	ND	ND	ND	0.052 J	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	**100**	ND	ND	ND	ND	ND	0.23	0.67	ND	ND	ND	ND	ND	ND	ND
Anthracene	**100**	ND	ND	ND	ND	0.067 J	0.44	1.5	ND	ND	ND	ND	ND	ND	ND
Benzaldehyde	**--**	ND	ND	ND	ND	ND	ND	0.053 J	ND	ND	ND	ND	ND	ND	ND
Benzo(a)anthracene	**1**	ND	ND	ND	ND	0.17	**1.5**	**4.2**	ND	ND	ND	ND	0.024 J	ND	ND
Benzo(a)pyrene	**1**	ND	ND	ND	ND	0.15 J	**1.3**	**3.8**	ND	ND	ND	ND	ND	ND	ND
Benzo(b)fluoranthene	**1**	ND	ND	ND	ND	0.19	**1.7**	**4.9**	ND	ND	ND	ND	ND	ND	ND
Benzo(g,h,i)perylene	**100**	ND	ND	ND	ND	0.1 J	0.92	2.6	ND	ND	ND	ND	ND	ND	ND
Benzo(k)fluoranthene	**0.8**	ND	ND	ND	ND	0.071 J	0.57	**1.7**	ND	ND	ND	ND	ND	ND	ND
Carbazole	**--**	ND	ND	ND	ND	0.037 J	0.25	0.75	ND	ND	ND	ND	ND	ND	ND
Chrysene	**1**	ND	ND	ND	ND	0.16	**1.4**	**3.9**	ND	ND	ND	ND	0.021 J	ND	ND
Dibenzo(a,h)anthracene	**0.33**	ND	ND	ND	ND	ND	0.21	**0.57**	ND	ND	ND	ND	ND	ND	ND
Dibenzofuran	**7**	ND	ND	ND	ND	ND	0.056 J	0.16 J	ND	ND	ND	ND	ND	ND	ND
Fluoranthene	**100**	ND	ND	ND	ND	0.48	3.7	12.0 D	0.025 J	ND	ND	ND	0.040 J	ND	ND
Fluorene	**30**	ND	ND	ND	ND	ND	0.051 J	0.18 J	ND	ND	ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene	**0.5**	ND	ND	ND	ND	0.1 J	**0.9**	**2.6**	ND	ND	ND	ND	ND	ND	ND
Phenanthrene	**100**	ND	ND	ND	ND	0.29	2	5.6	ND	ND	ND	ND	ND	ND	ND
Pyrene	**100**	ND	ND	ND	ND	0.39	2.9	9.6 D	0.022 J	ND	ND	ND	0.034 J	ND	ND
Naphthalene	**12**	ND	ND	ND	ND	ND	0.053 J	0.13 J	ND	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	**--**	ND	ND	ND	ND	ND	ND	0.03 J	ND	ND	ND	ND	ND	ND	ND
1,4-Dioxane	**0.1**	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total SVOCs (SSAL) [4]	**500**	ND	ND	ND	ND	2.205	18.18	54.995	0.047	ND	ND	ND	ND	ND	ND
TICs	**--**	0.146 J	ND	ND	ND	0.406 J	3.25 J	9.64 J	2.3 J	ND	0.8 J	ND	ND	ND	0.257 J
Metals - mg/kg															
Aluminum	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Antimony	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Arsenic	**13**	**21.8**	**13.6**	**16**	**14.9**	**15**	**15.3**	**14.3**	**16.2**	**14.4**	**13.5**	**17.3**	**16.6**	**31**	**20.1**
Barium	**350**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Beryllium	**7.2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cadmium	**2.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Calcium	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium [4]	**30**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Cobalt	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Copper	**50**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Iron	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Lead	**63**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Magnesium	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Manganese	**1600**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Mercury	**0.18**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Nickel	**30**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Potassium	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Selenium	**3.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Silver	**2**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sodium	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Thallium	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Vanadium	**--**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Zinc	**109**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides - mg/kg [3]															
delta-BHC	**0.04**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dieldrin	**0.0005**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Endosulfan II	**2.4**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Unrestricted Use Soil Cleanup Objectives (USCOs).
3. Sample results were reported by the laboratory in micrograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).
5. Columns highlighted in red represent historic investigation locations which were excavated and removed during remedial activities.

Definitions:

mg/kg = milligrams per kilogram
ND = Parameter not detected above laboratory detection limit
"--" = No value available for the parameter; or parameter not analyzed for.
J = Estimated value; result is less than the sample quantitation limit but greater than zero
J- = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+ = Estimated value; the analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS /MSD RPD exceeds control limits.
B = Compound was found in the blank and sample.
D =Concentration of analyte was quantified from diluted analysis. Flag only applies to field samples that have detectable concentrations of the analyte.
Bold = Exceeds USCOs

TABLE 7
SUMMARY OF RI GROUNDWATER ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Parameter [1]	NYSDEC Class GA GWQS[2]	Oregon Road Site																											Homer Street Extension			
		MW-1		MW-2	MW-2R		MW-3		MW-4			MW-5		MW-6		MW-7		MW-8		MW-9		MW-10		MW-11		MW-12			MW-13		MW-15	
		11/24/15	4/12/19	11/24/15	7/25/18	4/12/19	11/24/15	4/11/19	2/8/17	7/25/18	4/12/19	2/8/17	4/12/19	2/7/17	4/11/19	2/9/17	4/12/19	2/9/17	4/11/19	2/9/17	4/12/19	2/7/17	4/11/19	2/7/17	4/11/19	2/7/17	7/25/18	3/4/19	7/25/18	3/4/19	7/25/18	4/11/19
TCL Volatile Organic Compounds (VOCs) - ug/L																																
Acetone	**50**	7.0	NA	13.0 D	ND	NA	2.4 J	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Carbon disulfide	**60**	ND	NA	ND	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	1.1	NA	ND	NA
Cyclohexane	--	ND	NA	1.0 JD	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	3.0	NA
Methylcyclohexane	--	ND	NA	68.0 D	0.49 J	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	4.3	NA
Methylene Chloride	**5**	ND	NA	ND	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	2.1	NA
VOC-TICs [3]	--	NA	NA	NA	*41*	NA	NA	NA	*0.90*	NA	NA	*2.7*	NA	*0.36*	NA	*334*	NA	*6.0*	NA	*50*	NA	*53*	NA	*0.38*	NA	*0.36*	NA	NA	*ND*	NA	*ND*	NA
TCL Semi-Volatile Organic Compounds (SVOCs) - ug/L																																
2-Methylnaphthalene	--	ND	NA	3.5 D	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Anthracene	**50**	ND	NA	1.2 D	ND	NA	0.05 J	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Benzo(a)anthracene	**0.002**	ND	NA	ND	ND	NA	0.43	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Benzo(a)pyrene	**ND**	ND	NA	ND	ND	NA	**0.26**	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Benzo(b)fluoranthene	**0.002**	ND	NA	ND	ND	NA	0.39	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Benzo(g,h,i)perylene	--	ND	NA	ND	ND	NA	0.16 J	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Caprolactam	--	ND	NA	ND	20	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	11 J	NA	59	NA
Chrysene	**0.002**	ND	NA	ND	ND	NA	0.45	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Dibenz(a,h)anthracene	--	ND	NA	ND	ND	NA	0.09 J	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Di-n-butyl phthalate	**50**	ND	NA	ND	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	1.8 J	NA	ND	NA
Fluoranthene	**50**	ND	NA	ND	ND	NA	0.24	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	0.35 J	NA
Ideno(1,2,3-cd)pyrene	**0.002**	ND	NA	ND	ND	NA	0.15 J	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Phenanthrene	**50**	ND	NA	3.7 D	ND	NA	0.12 J	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
Pyrene	**50**	ND	NA	ND	ND	NA	0.20	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	ND	NA	ND	NA
SVOC-TICs [3]	--	NA	NA	NA	*659*	NA	NA	NA	ND	ND	NA	ND	NA	ND	NA	*8.4*	NA	*7.9*	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	*3946*	NA	*729*	NA
TAL Metals (Total) - ug/L																																
Aluminum	--	NA	NA	NA	38600	NA	NA	NA	423	NA	NA	1250	NA	2940	NA	18200	NA	7900	NA	641 F1	NA	2820	NA	388	NA	11700	NA	NA	56200 J	NA	97900	NA
Arsenic	**25**	NA	NA	NA	56.0	NA	NA	NA	ND	NA	NA	**44.8**	NA	**50.2**	NA	10.5	NA	16.1	NA	ND	NA	ND	NA	**36.7**	NA	**42.2**	NA	NA	38.0	NA	**330**	NA
Barium	**1,000**	NA	NA	NA	1100	NA	NA	NA	147	NA	NA	368	NA	312	NA	228	NA	724	NA	237	NA	497	NA	322	NA	627	NA	NA	670 J	NA	**1900**	NA
Beryllium	**3**	NA	NA	NA	1.9 J	NA	NA	NA	ND	NA	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	3.0	NA	**4.5**	NA
Cadmium	**5**	NA	NA	NA	2.3	NA	NA	NA	ND	NA	NA	2.1	NA	2.4	NA	3.2	NA	ND	NA	ND	NA	ND	NA	2.2	NA	3.6	NA	NA	0.060 J	NA	2.3	NA
Calcium	--	NA	NA	NA	47100	NA	NA	NA	35200	NA	NA	31200	NA	42500	NA	12800	NA	70400	NA	29700	NA	11700	NA	29600	NA	102000	NA	NA	83700	NA	45300	NA
Chromium	**50**	NA	NA	NA	41.0	NA	NA	NA	ND	NA	NA	ND	NA	5.5	NA	18.1	NA	13.8	NA	ND	NA	ND	NA	ND	NA	12.7	NA	NA	67	NA	**130**	NA
Cobalt	--	NA	NA	NA	28.0	NA	NA	NA	ND	NA	NA	ND	NA	ND	NA	14	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	45.0 F1	NA	100	NA
Copper	**200**	NA	NA	NA	88.0	NA	NA	NA	ND	NA	NA	ND	NA	ND	NA	16	NA	13.8	NA	ND	NA	ND	NA	ND	NA	21.5	NA	NA	60	NA	**230**	NA
Iron	**300**	NA	NA	NA	64400	NA	NA	NA	**13700**	NA	NA	**28200**	NA	**32700**	NA	**8750**	NA	**34000**	NA	**6830 J-**	NA	**2770**	NA	**48400**	NA	**19100 J-**	NA	NA	88700 J	NA	**283000 F1**	NA
Lead	**25**	NA	NA	NA	64.0	NA	NA	NA	5.4	NA	NA	11.8	NA	16.7	NA	10.9	NA	15.4	NA	ND	NA	ND	NA	16	NA	**147**	NA	NA	65	NA	**210**	NA
Magnesium	**35,000**	NA	NA	NA	22000	NA	NA	NA	6320	NA	NA	12100	NA	9350	NA	5840	NA	18100	NA	7030	NA	3650	NA	7380	NA	1890	NA	NA	36700 J	NA	34200	NA
Manganese	**300**	NA	NA	NA	25900 B	NA	NA	NA	**2330**	NA	NA	**8410**	NA	**8410**	NA	**1980**	NA	**11800**	NA	**7280**	NA	**522**	NA	**8210**	NA	**8270**	NA	NA	3300 B	NA	**17900 B**	NA
Nickel	**100**	NA	NA	NA	48.0	NA	NA	NA	ND	NA	NA	ND	NA	ND	NA	27	NA	16.7	NA	ND	NA	ND	NA	ND	NA	11.9	NA	NA	87 F1	NA	**170**	NA
Potassium	--	NA	NA	NA	10400	NA	NA	NA	1250	NA	NA	1740	NA	3060	NA	6730	NA	5370	NA	1690	NA	1440	NA	1240	NA	4750	NA	NA	17400 J	NA	18800	NA
Sodium	**20,000**	NA	NA	NA	11400	NA	NA	NA	**24500**	NA	NA	1620	NA	2620	NA	11100	NA	5340	NA	**44700 J-**	NA	2420	NA	2400	NA	3480	NA	NA	11300	NA	2500	NA
Thallium	--	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	119	NA	ND	NA	ND	NA	13.8	NA	ND	NA	ND	NA	ND	NA	10.4	NA	NA	ND	NA	ND	NA
Vanadium	--	NA	NA	NA	59.0	NA	NA	NA	ND	NA	NA	ND	NA	ND	NA	24.3	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	80.0 F1	NA	140	NA
Zinc	**2,000**	NA	NA	NA	140.0 B	NA	NA	NA	ND	NA	NA	ND	NA	ND	NA	56	NA	61.1	NA	ND	NA	ND	NA	ND	NA	ND	NA	NA	210.0 B F1	NA	430 B	NA
TAL Metals (Dissolved) - ug/L																																
Barium	**1,000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	191 J-	NA	36.1 J-	NA	569 J-	NA	NA	NA	27.3 J-	NA	NA	NA	500 J-	NA	NA	NA	NA	NA	NA
Calcium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	39700 J-	NA	10900 J-	NA	69100 J-	NA	NA	NA	12000 J-	NA	NA	NA	110000 J-	NA	NA	NA	NA	NA	NA
Iron	**300**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	110 J-	NA	ND	NA	**6810 J-**	NA	NA	NA	ND	NA	NA	NA	**3520 J-**	NA	NA	NA	NA	NA	NA
Magnesium	**35,000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8650 J-	NA	2550 J-	NA	16200 J-	NA	NA	NA	3450 J-	NA	NA	NA	15300 J-	NA	NA	NA	NA	NA	NA
Manganese	**300**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**7990 J-**	NA	**1490 J-**	NA	**11400 J-**	NA	NA	NA	**434 J-**	NA	NA	NA	**8040 J-**	NA	NA	NA	NA	NA	NA
Potassium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2260 J-	NA	1180 J-	NA	3650 J-	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Sodium	**20,000**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2510 J-	NA	10700 J-	NA	5340 J-	NA	NA	NA	2440 J-	NA	NA	NA	3340 J-	NA	NA	NA	NA	NA	NA
Thallium	--	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	ND	NA	14 J-	NA	NA	NA	ND	NA	NA	NA	ND	NA	NA	NA	NA	NA	NA
Organochlorine Pesticides - ug/L																																
4,4'-DDE	**0.20**	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	0.028 J	NA	ND	NA
Dieldrin	**0.004**	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	**0.014 J**	NA	ND	NA
Endrin aldehyde	**5**	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	ND	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	ND	NA	NA	0.035	NA	ND	NA
Polychlorinated Biphenyls - ug/L																																
PCBs were not detected at concentrations above laboratory detection limits																																
Herbicides - ug/L																																
Herbicides were not detected at concentrations above laboratory detection limits																																
Semi-Volatile Organic Compounds 8270 (SIM) [4] - ug/L																																
1,4 - Dioxane	**0.35**	NA	NA	NA	ND	NA	NA	NA	NA	**2.5**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	**2.5**	ND	ND	ND	**2.5**	NA

TABLE 7
SUMMARY OF RI GROUNDWATER ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Parameter [1]	NYSDEC Class GA GWQS[2]	Oregon Road Site																												Homer Street Extension			
		MW-1		MW-2	MW-2R		MW-3		MW-4			MW-5		MW-6		MW-7		MW-8		MW-9		MW-10		MW-11		MW-12			MW-13		MW-15	
		11/24/15	4/12/19	11/24/15	7/25/18	4/12/19	11/24/15	4/11/19	2/8/17	7/25/18	4/12/19	2/8/17	4/12/19	2/7/17	4/11/19	2/9/17	4/12/19	2/9/17	4/11/19	2/9/17	4/12/19	2/7/17	4/11/19	2/7/17	4/11/19	2/7/17	7/25/18	3/4/19	7/25/18	3/4/19	7/25/18	4/11/19
Perfluorinated Alkyl Acids - ng/L																																
1H,1H,2H,2H-Perfluorodecanessulfonic Acid (8:2FTS)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	ND	ND	ND	ND	ND
1H,1H,2H,2H-Perfluorooctaneslfonic Acid (6:2FTS)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	ND	ND	0.42 J	ND	ND
N-ethyl Perfluorooctanesulfonamidoacetic Acid (NEtFOSAA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	4.74	ND	ND	ND	ND
N-methyl Perfluorooctanesulfonamidoacetic Acid (NMetFOSAA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	4.65	ND	ND	ND	ND
Perfluorobutanesulfonic Acid (PFBS)	--	NA	ND	NA	ND	ND	NA	ND	NA	1.3 J	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	92	NA	5.5 J	NA	61	111 J	670	732 J	3.0 J	2.5 J
Perfluorobutanoic acid (PFBA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	4.6 J	NA	9.4	NA	ND	NA	14	NA	ND	NA	37 J	26.9	200	182	120	25
Perfluorosulfonic Acid (PFDS)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	ND	ND	ND	ND	ND
Perfluorodecanoic Acid (PFDA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	ND	ND	ND	ND	ND
Perfluorododecanoic Acid (PFDoA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	0.629 J	ND	ND	ND	ND
Perfluoroheptanesulfonic Acid (PFHpS)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	18	31.4	4.4 J	ND	ND	ND
Perfluroroheptanoic acid (PFHpA)	--	NA	ND	NA	ND	ND	NA	ND	NA	3.8	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	22	NA	ND	NA	17	29.3	180	119	1.8 J	ND
Perfluorohexanesukfonic Acid (PFHxS)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	560	NA	40.0	NA	520 B	784	1100 B	847	2.4 JB	ND
Perflurorohexanoic acid (PFHxA)	--	NA	ND	NA	ND	ND	NA	ND	NA	3.5	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	130	NA	ND	NA	96	171	1900	1520	ND	ND
Perfluorononanoic acid (PFNA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	0.47 J	0.729 J	ND	ND	ND	ND
Perfluorooctane Sulfonamide (PFOSA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	ND	ND	ND	ND	ND
Perfluorooctanesulfonic Acid (PFOS)	**10**	NA	ND	NA	ND	ND	NA	ND	NA	1.4 J	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	**34**	NA	**12**	NA	**510**	**1020**	3.5 J	ND	1.6 J	ND
Perfluorooctanoic acid (PFOA)	**10**	NA	ND	NA	ND	ND	NA	ND	NA	5.5 B	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	**28**	NA	2.6 J	NA	**25 B**	**48.8**	**100 B**	**45.9**	2.0 JB	ND
Perfluroropentanoic acid (PFPeA)	--	NA	ND	NA	ND	ND	NA	ND	NA	6.2	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	25	NA	ND	NA	15	35.8	250	321	ND	ND
Perfluorotetradecanoic acid (PFTeA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	1.04 J	ND	ND	ND	ND
Pefluorotridecanoic Acid (PFTriDA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	0.671 J	ND	ND	ND	ND
Perfluoroundercanoic Acid (PFUnA)	--	NA	ND	NA	ND	ND	NA	ND	NA	ND	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	NA	ND	0.479 J	ND	ND	ND	ND
PFOA + PFOS[5]	**70**	NA	ND	NA	ND	ND	NA	ND	NA	6.9 J	ND	NA	ND	NA	ND	NA	ND	NA	0.0	NA	ND	NA	62	NA	15	NA	**535**	**1,069**	**104**	46	3.6	0.0
Total PFAS[5]	**500**	NA	ND	NA	ND	ND	NA	ND	NA	22	ND	NA	ND	NA	ND	NA	4.6 J	NA	9.4	NA	ND	NA	**905**	NA	60	NA	**1,299**	**2,271**	**4,408**	**3,767**	131	28

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC TOGS 1.1.1 Class GA Groundwater Quality Standards (GWQS); PFOA and PFOS results are compared to the NYSDEC proposed drinking water maximum contaminant level of 10 ng/L for each compound.
3. Tentatively Identified Compounds (TICs).
4. Extraction methodology of Selective Ion Monitoring (SIM) was used for 1,4-dioxane.
5. Per NYSDEC guidance, action levels in groundwater requiring additional monitoring.

Definitions:

ug/L = micrograms per liter; ng/L = nanograms per liter
NA = Parameter not tested.
ND = Parameter not detected above laboratory detection limit.
"--" = No GWQS or action level available.
J = Estimated value; result is less than the sample quantitation limit but greater than zero.
B = Analytical was detected in the associated blank as well as in the sample.
D = Analyzed at dilution
F1 = MS and/or MSD Recovery is outside acceptance limits.
F2 = MS/MSD RPD exceeds control limits.

🟩 **Result exceeds Class GA GWQS**

TABLE 8
SUMMARY OF REMEDIAL ACTION GROUNDWATER ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. 905045
OLEAN, NEW YORK

Parameter [1]	**NYSDEC Class GA GWQS [2]**	**Sample Locations**					
		MW-2R			**MW-9**		
Sample Date		**10/6/2020**	**2/9/2021**	**4/7/2021**	**10/6/2020**	**2/9/2021**	**4/7/2021**
Volatile Organic Compounds (VOCs) - ug/L							
Acetone	**50**	*ND*	*ND*	2 J	*ND*	*ND*	8.9
Methyl cyclohexane	**--**	2.4 J	2.2 J	2.4 J	*ND*	*ND*	*ND*
Semi-Volatile Organic Compounds (SVOCs) - ug/L							
Anthracene	**50**	0.02 J	0.02 J	*ND*	*ND*	*ND*	*ND*
Benzo(a)anthracene	**0.002**	*ND*	*ND*	*ND*	*ND*	**0.04 J**	*ND*
Benzo(a)pyrene	**0**	*ND*	*ND*	*ND*	*ND*	**0.02 J**	*ND*
Benzo(b)fluoranthene	**0.002**	*ND*	*ND*	*ND*	*ND*	**0.02 J**	*ND*
Benzo(g,h,i)perylene	**--**	*ND*	*ND*	*ND*	*ND*	0.02 J	*ND*
Benzo(k)fluoranthene	**0.002**	*ND*	*ND*	*ND*	*ND*	**0.02 J**	*ND*
Bis(2-ethylhexyl) phthalate	**5**	*ND*	*ND*	*ND*	*ND*	**6.2**	*ND*
Chrysene	**0.002**	*ND*	*ND*	*ND*	*ND*	**0.03 J**	*ND*
Dibenzo(a,h)anthracene	**--**	*ND*	*ND*	*ND*	*ND*	0.02 J	*ND*
Fluoranthene	**50**	0.03 J	*ND*	*ND*	*ND*	0.03 J	*ND*
Fluorene	**50**	0.12	0.16	0.05 J	*ND*	*ND*	*ND*
Indeno(1,2,3-cd)pyrene	**0.002**	*ND*	*ND*	*ND*	*ND*	**0.02 J**	*ND*
Pentachlorophenol	**1**	*ND*	*ND*	0.22 J	*ND*	*ND*	0.1 J
Phenanthrene	**50**	0.06 J	0.12	*ND*	*ND*	0.06 J	*ND*
Pyrene	**50**	0.02 J	*ND*	*ND*	*ND*	0.03 J	*ND*
Naphthalene	**10**	*ND*	0.07 J	*ND*	*ND*	0.05 J	*ND*
2-Methylnaphthalene	**--**	*ND*	0.02 J	*ND*	*ND*	*ND*	*ND*
1,4-Dioxane	**--**	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per NYSDEC Division of Water Qulaity Standards and Guidance Values (GWQS/GV) and Groundwater Effluent Limitations - Class GA (TOGS 1.1.1)

Definitions:

GWQS = Groundwater Quality Standards

ug/L = micrograms per liter

ND = Parameter not detected above laboratory detection limit

"--" = No value available for the parameter; or parameter not analyzed for.

J = Estimated value; result is less than the sample quantitation limit but greater than zero

Bold = Exceeds GWQS

TABLE 9
SUMMARY OF EXISTING COVER AREA SOIL/FILL ANALYTICAL DATA
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Parameter [1]	Commercial Use SCOs[2]	Sample Locations	
		Cover-1	Cover-2
Sample Date		1/27/2021	
Volatile Organic Compounds (VOCs) - mg/kg[3]			
Total VOCs [4]	--	*ND*	*ND*
Semi-Volatile Organic Compounds (SVOCs) - mg/kg[3]			
Benzo(a)anthracene	5.6	0.12 J	0.12 J
Benzo(a)pyrene	1	0.10 J	0.10 J
Benzo(b)fluoranthene	5.6	0.16	0.15 J
Benzo(g,h,i)perylene	500	0.65 J	0.074 J
Benzo(k)fluoranthene	56	*ND*	0.038 J
Chrysene	56	0.1 J	0.1 J
Fluoranthene	500	0.24	0.28
Indeno(1,2,3-cd)pyrene	5.6	0.87 J	0.081 J
Phenanthrene	500	0.14	0.12 J
Pyrene	500	0.18	0.18
1,4-Dioxane	130	*ND*	*ND*
Total SVOCs (SSAL) [5]	500	2.56	1.243
Tentatively Identified Compounds (TICs)	--	1.88 J	2.64 J
Metals - mg/kg			
Aluminum	--	9660	9700
Antimony	--	1.21 J	0.716 J
Arsenic	16	12	11.9
Barium	400	138	130
Beryllium	590	0.432 J	0.464 J
Cadmium	9.3	0.831 J	0.801 J
Calcium	--	2110	1850
Chromium	1500	12.2	12.6
Cobalt	--	9.7	9.83
Copper	270	14.7	14.5
Iron	--	21800	21400
Lead	1000	24.6	23.2
Magnesium	--	2480	2560
Manganese	10000	1230	1210
Mercury	2.8	0.06 J	0.064 J
Nickel	310	17.1	17.5
Potassium	--	778	741
Sodium	--	120 J	112 J
Thallium	--	1.36 J	1.22 J
Vanadium	--	16.3	15.6
Zinc	10000	64.5	64.3
Organochlorine Pesticides - mg/kg[3]			
Total Organochlorine Pesticides	--	*ND*	*ND*
Chlorinated Herbicides[3] - mg/kg			
Total Organochlorine Herbicides	--	*ND*	*ND*
Polychlorinated Biphenyls (PCBs)[3] - mg/kg			
Total PCBs	0.1	*ND*	*ND*
Perfluorinated Alkyl Acids (PFAS) - ng/g			
Perfluorobutanoic Acid (PFBA)	--	0.136 J	0.180 J
Perfluoropentanoic Acid (PFPeA)	--	0.066 J	0.072 J
Perfluorohexanoic Acid (PFHxA)	--	*ND*	0.064 J
Perfluoroheptanoic Acid (PFHpA)	--	0.060 J	0.065 J
Perfluorooctanoic Acid (PFOA)	500	0.134 J	0.108 J
Perfluorooctanesulfonic Acid (PFOS)	440	0.368	0.259 J
Perfluoroundecanoic Acid (PFUnA)	--	0.071 J	0.061 J
PFOA + PFOS	--	0.502 J	0.367 J
Total PFAS	--	0.835	0.809

Notes:

1. Only those parameters detected at a minimum of one sample location are presented in this table; all other compounds were reported as non-detect.
2. Values per 6NYCRR Part 375 Commercial Use Soil Cleanup Objectives (CSCOs).
3. Sample results were reported by the laboratory in micograms per kilogram (ug/kg) and converted to milligram per kilogram (mg/kg) for comparison to SCOs.
4. TICs were reported as non-detect for VOC analyses.
5. Total SVOC values per 6NYCRR Part 375 Site Specific Action Level (SSAL).

Definitions:

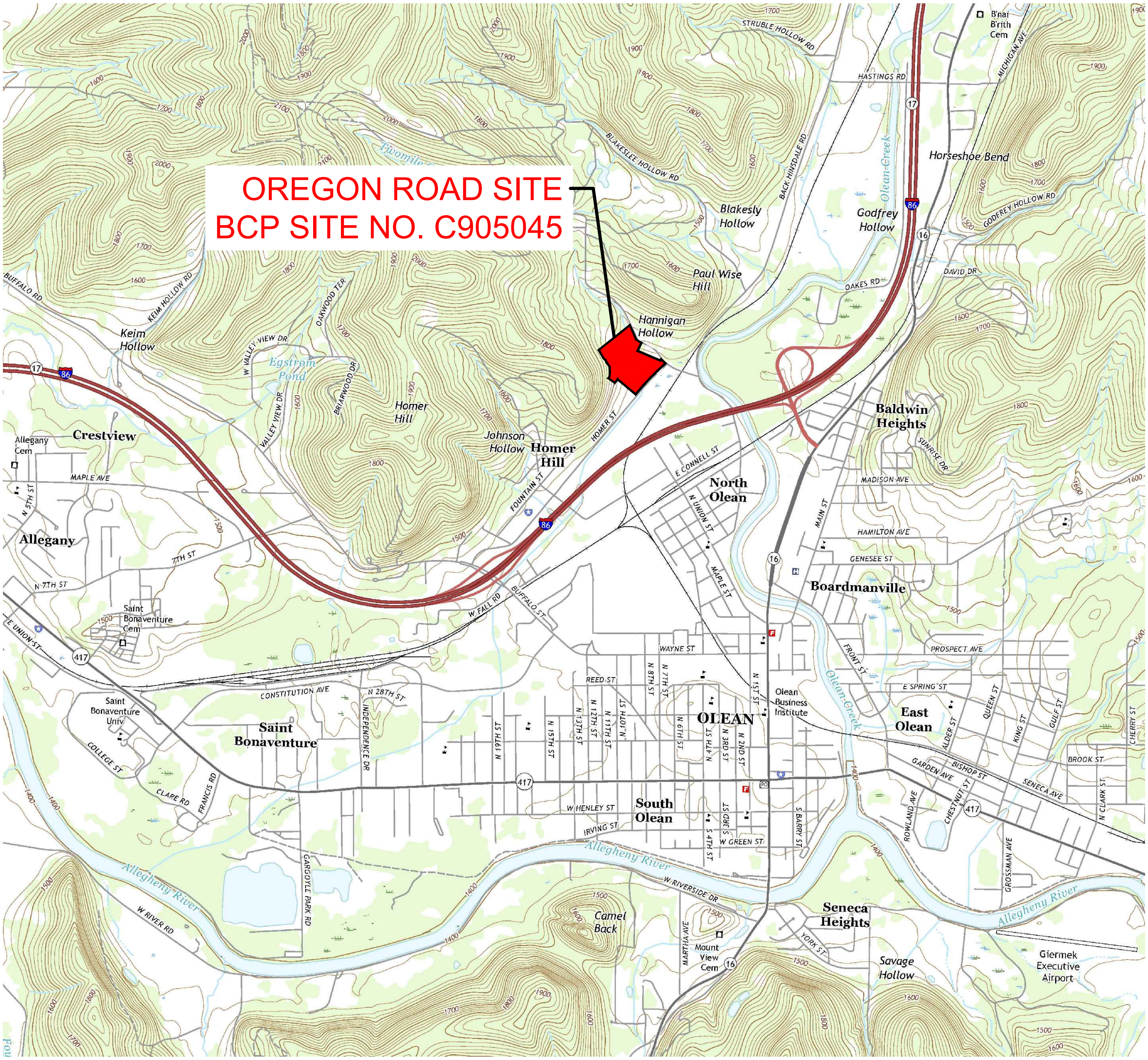
mg/kg = milligrams per kilogram
ng/g = nanograms per gram
ND = Parameter not detected above laboratory detection limit
"--" = No value available for the parameter; or parameter not analyzed for.
J = Estimated value; result is less than the sample quantitation limit but greater than zero

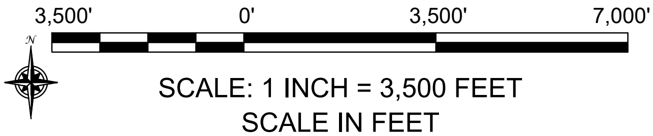
Bold = Exceeds CSCOs or SSAL

FIGURES

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 1; Site Location and Vicinity Map.dwg

FIGURE 1





SCALE: 1 INCH = 3,500 FEET
SCALE IN FEET
(approximate)

NOTE: BASE MAP USGS OLEAN, NY QUADRANGLE 2016

QUADRANGLE LOCATION

BENCHMARK IN ASSOCIATION WITH TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

PROJECT NO.: 0311-020-001

DATE: APRIL 2021

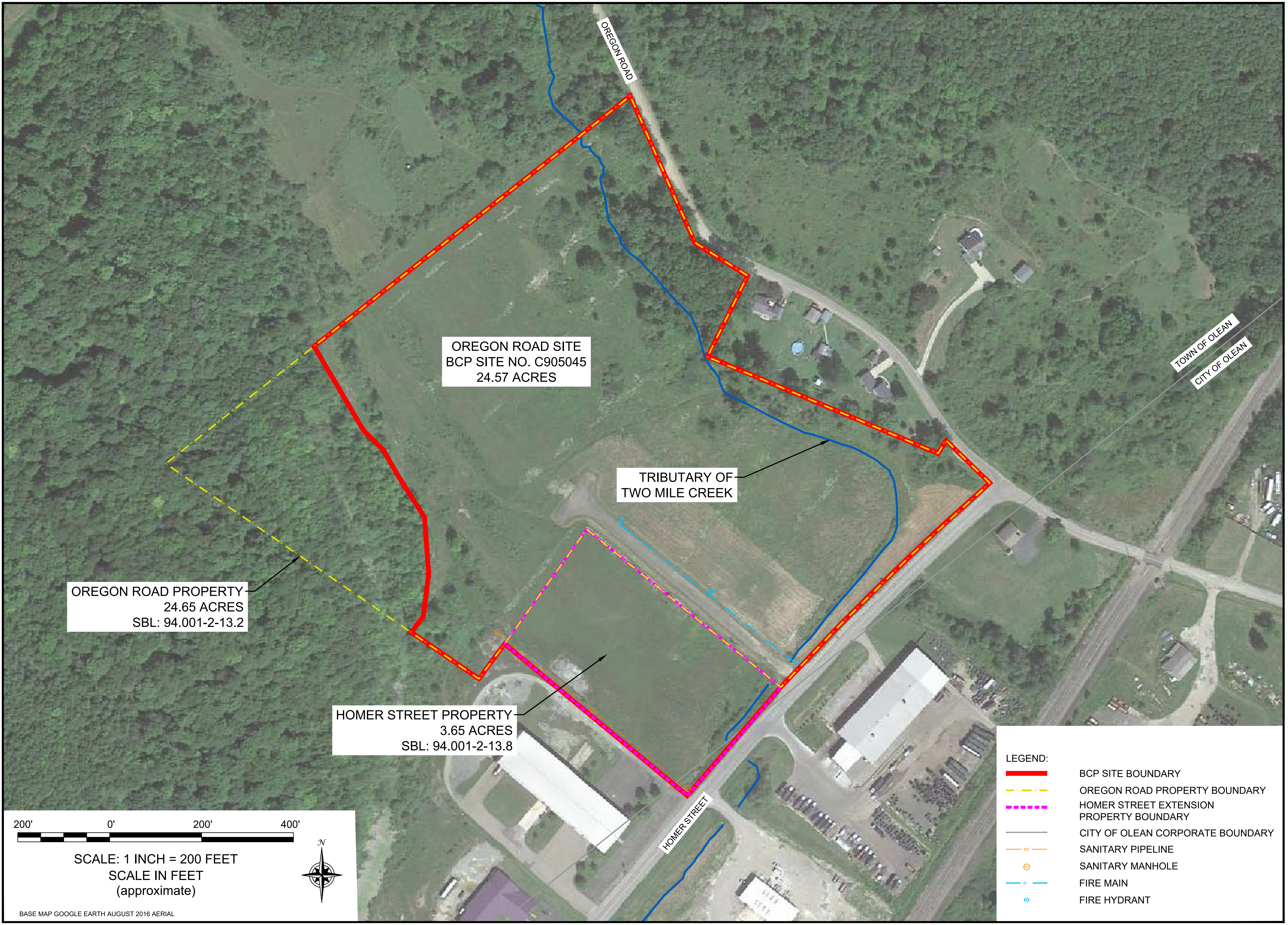
DRAFTED BY: CMS

SITE LOCATION & VICINITY MAP

SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 2; Site Plan (Aerial).dwg



DATE: APRIL 2021
DRAFTED BY: CMS

BENCHMARK
IN ASSOCIATION WITH
TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

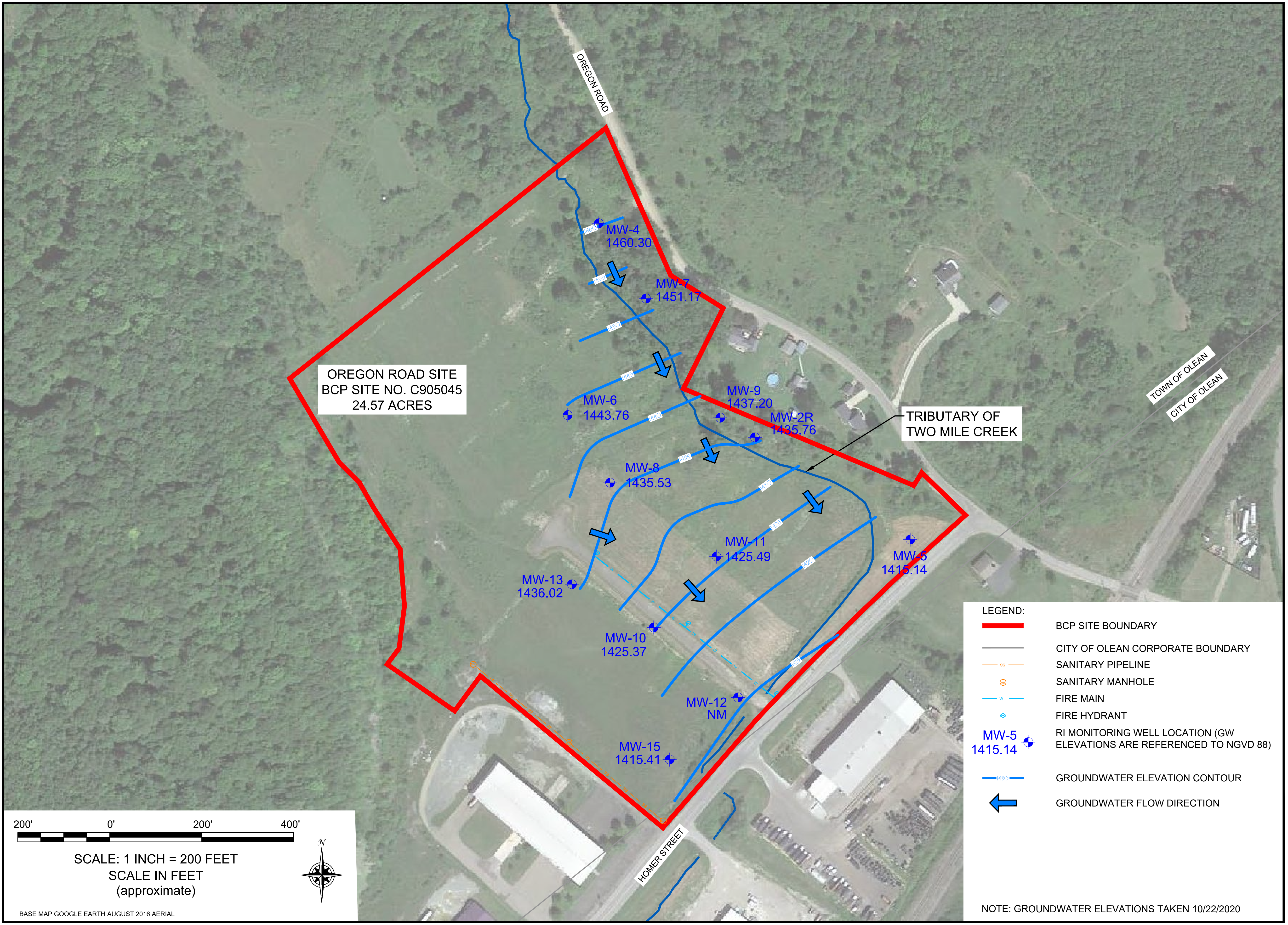
SITE PLAN (AERIAL)

SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

FIGURE 2

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 3A; Groundwater Isopotential Map_2020-10-22.dwg



NOTE: GROUNDWATER ELEVATIONS TAKEN 10/22/2020

DATE: JULY 2021
DRAFTED BY: CMS

BENCHMARK IN ASSOCIATION WITH TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

GROUNDWATER ISOPOTENTIAL MAP (OCTOBER 2020)

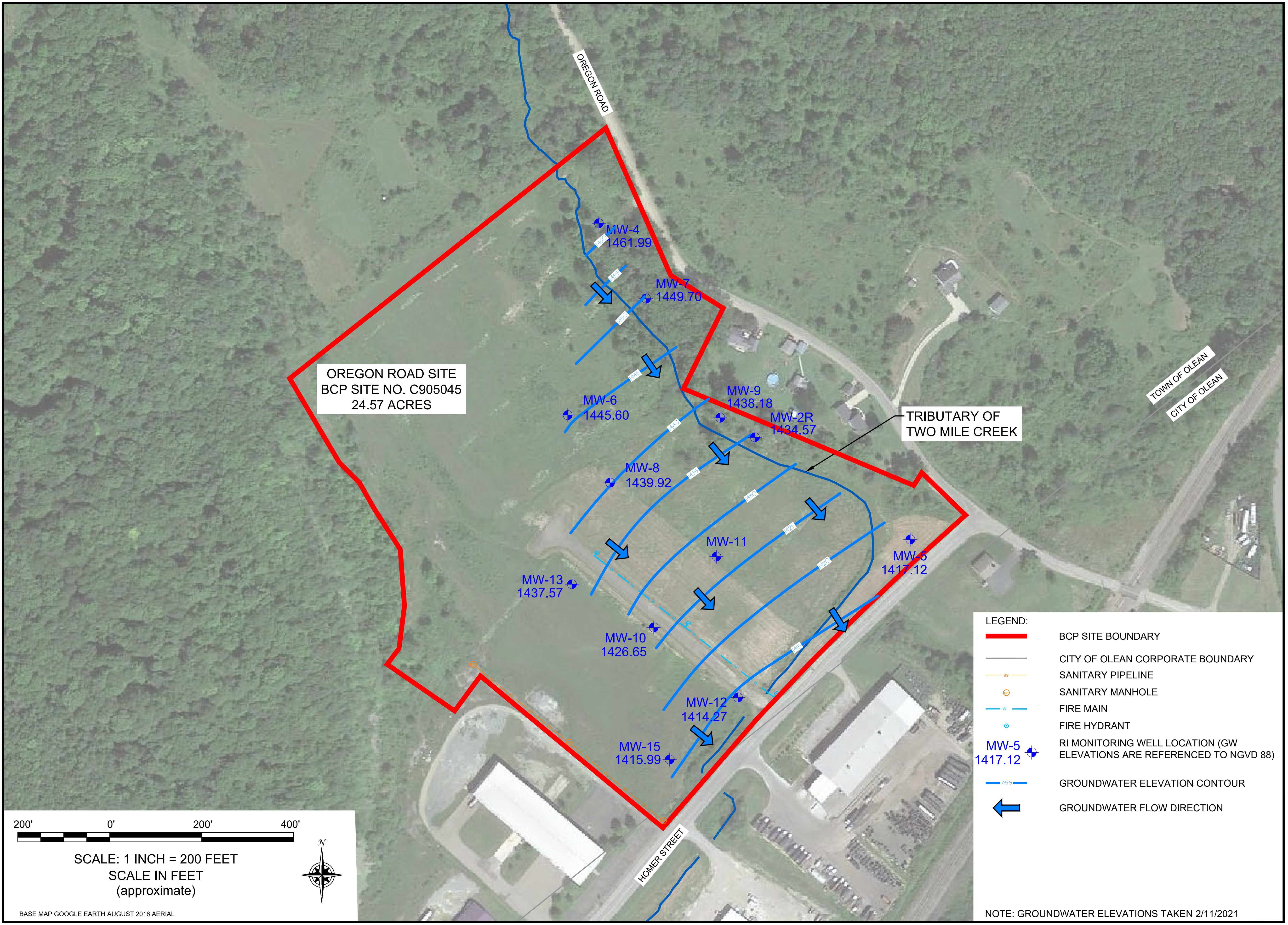
SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

FIGURE 3A

DISCLAIMER: ***PROPERTY OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC. & TURNKEY ENVIRONMENTAL RESTORATION, LLC*** *IMPORTANT: THIS DRAWING PRINT IS LOANED FOR MUTUAL ASSISTANCE AND AS SUCH IS SUBJECT TO RECALL AT ANY TIME. INFORMATION CONTAINED HEREON IS NOT TO BE DISCLOSED OR REPRODUCED IN ANY FORM FOR THE BENEFIT OF PARTIES OTHER THAN NECESSARY SUBCONTRACTORS & SUPPLIERS WITHOUT THE WRITTEN CONSENT OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC & TURNKEY ENVIRONMENTAL RESTORATION, LLC.*

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 3B; Groundwater Isopotential Map_2021-02-11.dwg



BASE MAP GOOGLE EARTH AUGUST 2016 AERIAL

NOTE: GROUNDWATER ELEVATIONS TAKEN 2/11/2021

DATE: APRIL 2021
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(716) 856-0599

JOB NO.: 0311-020-001

GROUNDWATER ISOPOTENTIAL MAP (FEBRUARY 2021)

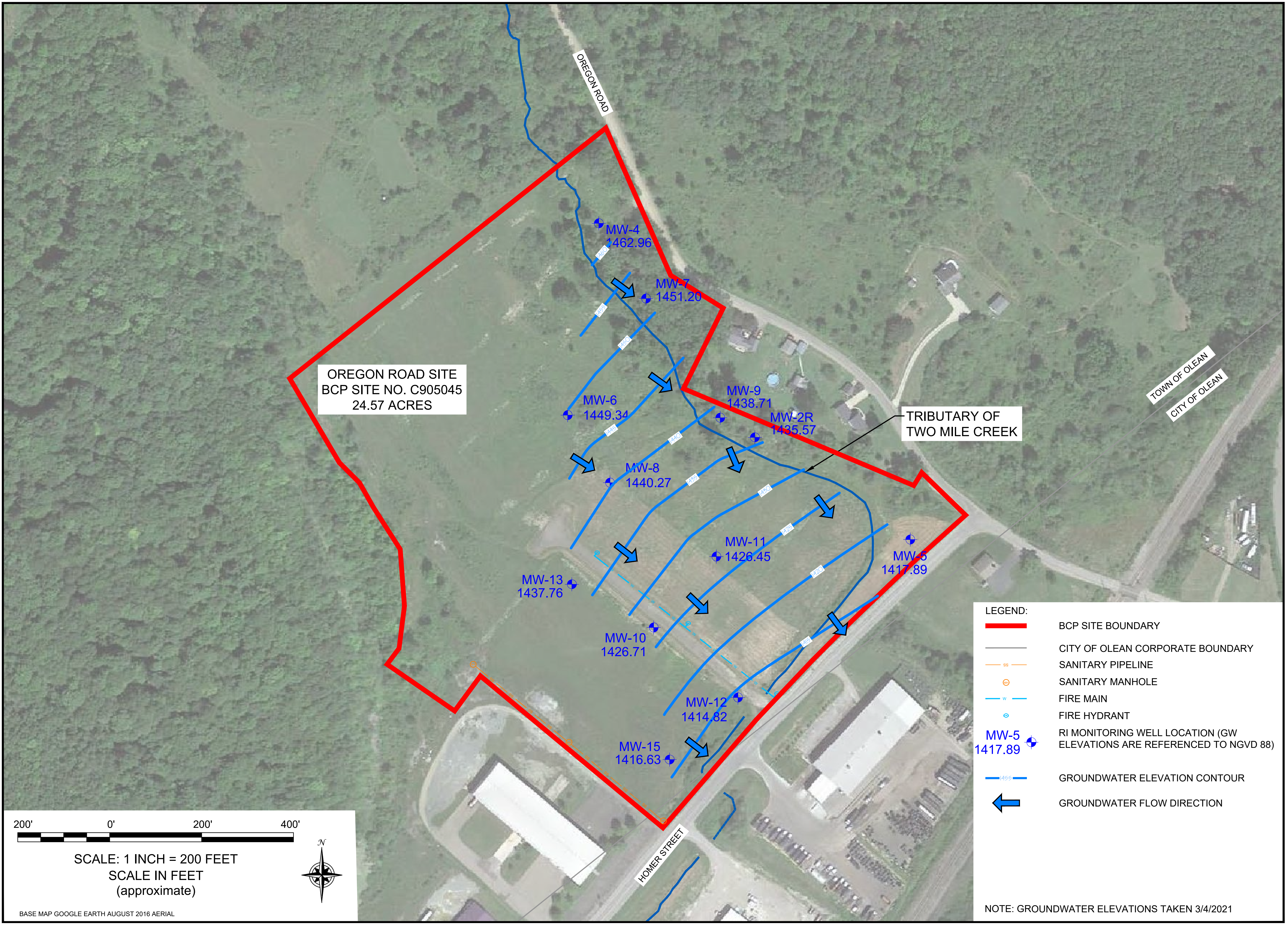
SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

PREPARED FOR

HOMER STREET PROPERTIES, LLC

FIGURE 3B



NOTE: GROUNDWATER ELEVATIONS TAKEN 3/4/2021

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 3C; Groundwater Isopotential Map_2021-03-04.dwg

DATE: JULY 2021
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2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

GROUNDWATER ISOPOTENTIAL MAP (MARCH 2021)

SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

FIGURE 3C

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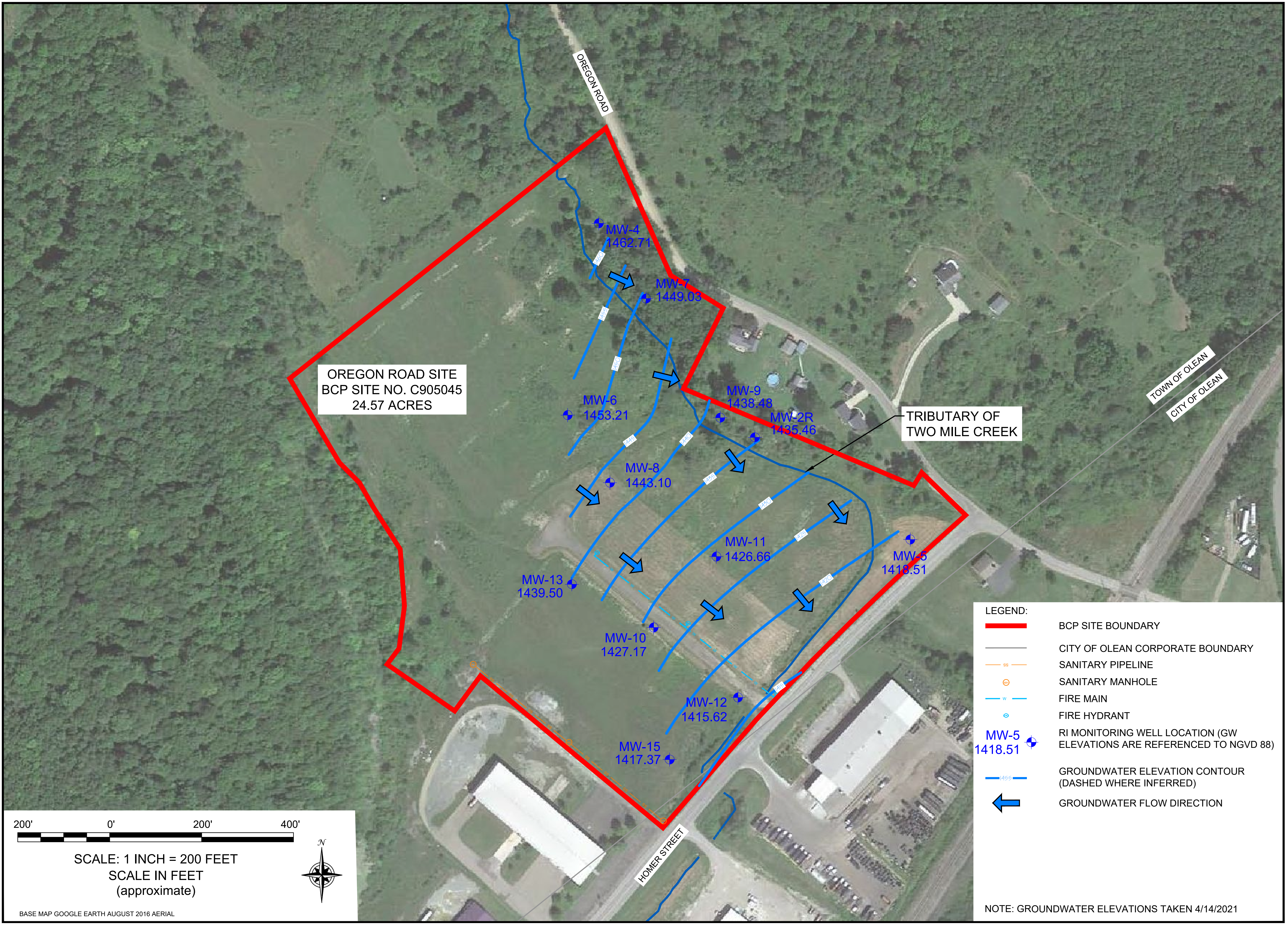
F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 3D; Groundwater Isopotential Map_2021-04-14.dwg



SCALE: 1 INCH = 200 FEET
SCALE IN FEET
(approximate)

BASE MAP GOOGLE EARTH AUGUST 2016 AERIAL

LEGEND:

🟥	BCP SITE BOUNDARY
—	CITY OF OLEAN CORPORATE BOUNDARY
— ss —	SANITARY PIPELINE
⊖	SANITARY MANHOLE
— w —	FIRE MAIN
⊙	FIRE HYDRANT
MW-5 1418.51 ⊕	RI MONITORING WELL LOCATION (GW ELEVATIONS ARE REFERENCED TO NGVD 88)
— 1455 —	GROUNDWATER ELEVATION CONTOUR (DASHED WHERE INFERRED)
⬅	GROUNDWATER FLOW DIRECTION

NOTE: GROUNDWATER ELEVATIONS TAKEN 4/14/2021

DATE: JULY 2021
DRAFTED BY: CMS

BENCHMARK IN ASSOCIATION WITH TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

GROUNDWATER ISOPOTENTIAL MAP (APRIL 2021)

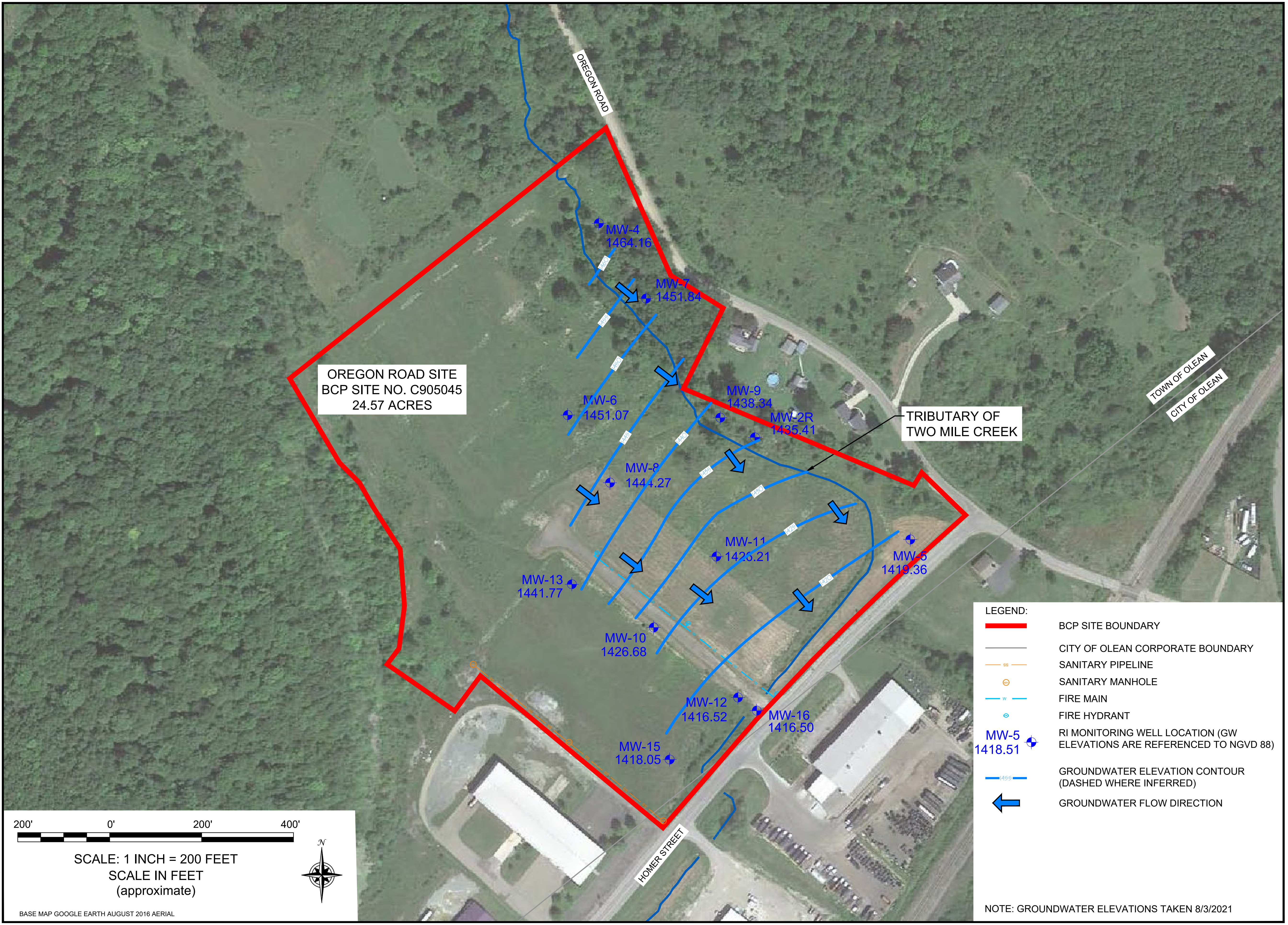
SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

FIGURE 3D

DISCLAIMER:* *PROPERTY OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC. & TURNKEY ENVIRONMENTAL RESTORATION, LLC *IMPORTANT: THIS DRAWING PRINT IS LOANED FOR MUTUAL ASSISTANCE AND AS SUCH IS SUBJECT TO RECALL AT ANY TIME. INFORMATION CONTAINED HEREON IS NOT TO BE DISCLOSED OR REPRODUCED IN ANY FORM FOR THE BENEFIT OF PARTIES OTHER THAN NECESSARY SUBCONTRACTORS & SUPPLIERS WITHOUT THE WRITTEN CONSENT OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC & TURNKEY ENVIRONMENTAL RESTORATION, LLC.*

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 3E; Groundwater Isopotential Map_2021-08-03.dwg



NOTE: GROUNDWATER ELEVATIONS TAKEN 8/3/2021

DATE: AUGUST 2021
DRAFTED BY: CMS

GROUNDWATER ISOPOTENTIAL MAP (AUGUST 2021)

SITE MANAGEMENT PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

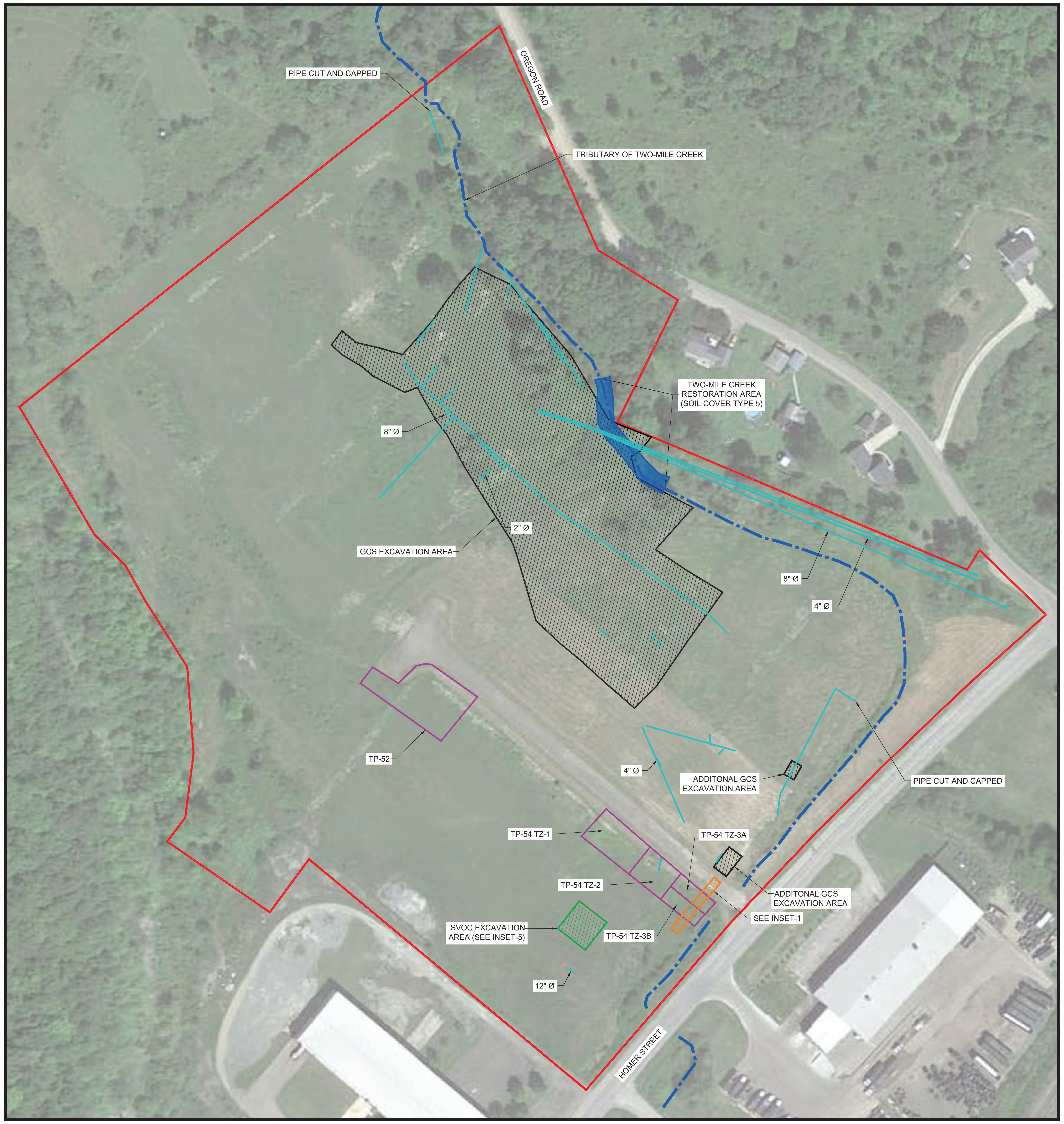
BENCHMARK
IN ASSOCIATION WITH
TURNKEY ENVIRONMENTAL RESTORATION, LLC
2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

FIGURE 3E

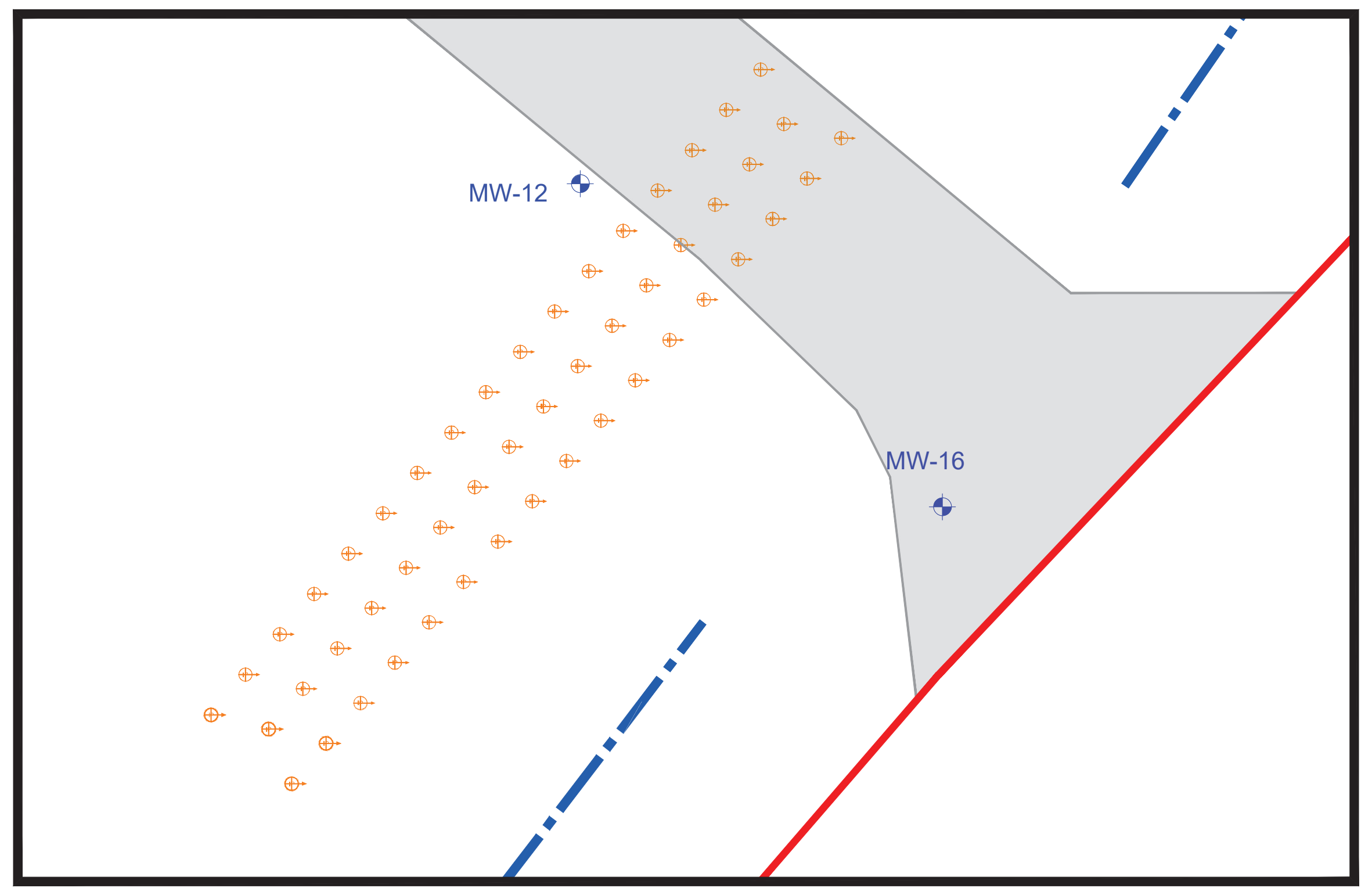
***DISCLAIMER: PROPERTY OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC. & TURNKEY ENVIRONMENTAL RESTORATION, LLC** IMPORTANT: THIS DRAWING PRINT IS LOANED FOR MUTUAL ASSISTANCE AND AS SUCH IS SUBJECT TO RECALL AT ANY TIME. INFORMATION CONTAINED HEREON IS NOT TO BE DISCLOSED OR REPRODUCED IN ANY FORM FOR THE BENEFIT OF PARTIES OTHER THAN NECESSARY SUBCONTRACTORS & SUPPLIERS WITHOUT THE WRITTEN CONSENT OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC & TURNKEY ENVIRONMENTAL RESTORATION, LLC.*

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 4; Remedial Action Areas.dwg



SITE PLAN (AERIAL)
SCALE: 1" = 80'

BASE MAP GOOGLE EARTH AUGUST 2016 AERIAL



INSET-1
PLUMESTOP INJECTION LOCATIONS
SCALE: 1" = 20'

SUMMARY OF SUBSURFACE PIPES REMOVED

DIAMETER (IN.)	TOTAL LENGTH (LF)
2	26.95
4	700.59
6	2705.27
8	745.28
12	9.68
TOTAL	4187.77

LEGEND:

🟥	BCP BOUNDARY
▨	GCS EXCAVATION AREAS
▨	SVOC EXCAVATION AREA
☐	PFAS SOIL STABILZATION AREAS
▨	PLUMESTOP INJECTION AREA
⊕	PLUMESTOP INJECTION POINT
🟦	CREEK RESTORATION AREA
—	SUBSURFACE PIPING (REMOVED)
MW-16 ⊕	MONITORING WELL
—·—	TRIBUTARY OF TWO-MILE CREEK

NOTE: ALL SUBSURFACE PIPING 6" Ø UNLESS OTHERWISE NOTED.

BENCHMARK
IN ASSOCIATION WITH
TURNKEY ENVIRONMENTAL RESTORATION, LLC
2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

REVISIONS

NO.	BY	DATE	REMARKS

STATE OF NEW YORK
THOMAS H. FORBES
No. 70950-1
LICENSED PROFESSIONAL ENGINEER

DRAWN BY:	CMS
DATE:	AUGUST 2021
CHECKED BY:	MAL
APPROVED BY:	

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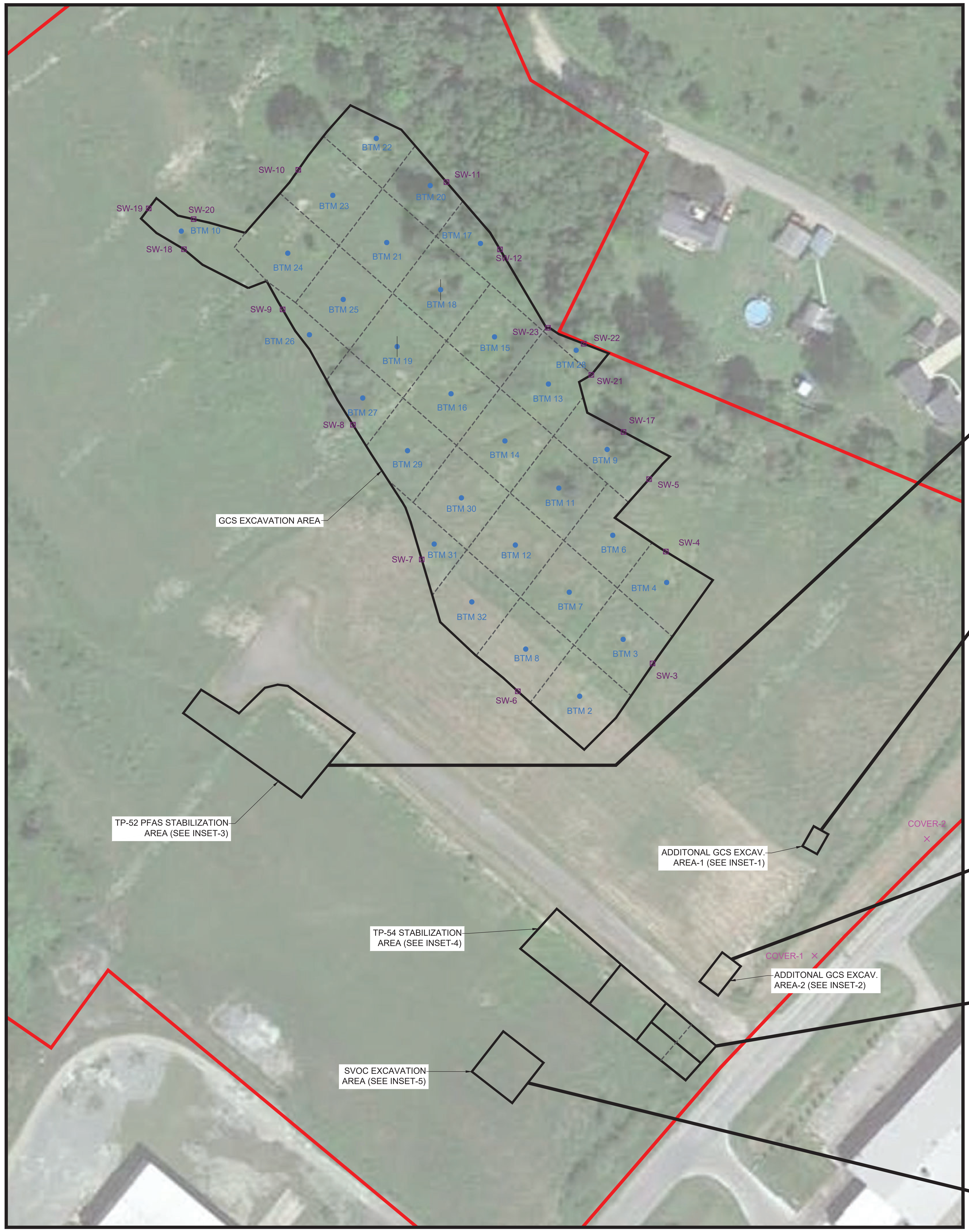
REMEDIAL ACTION AREAS

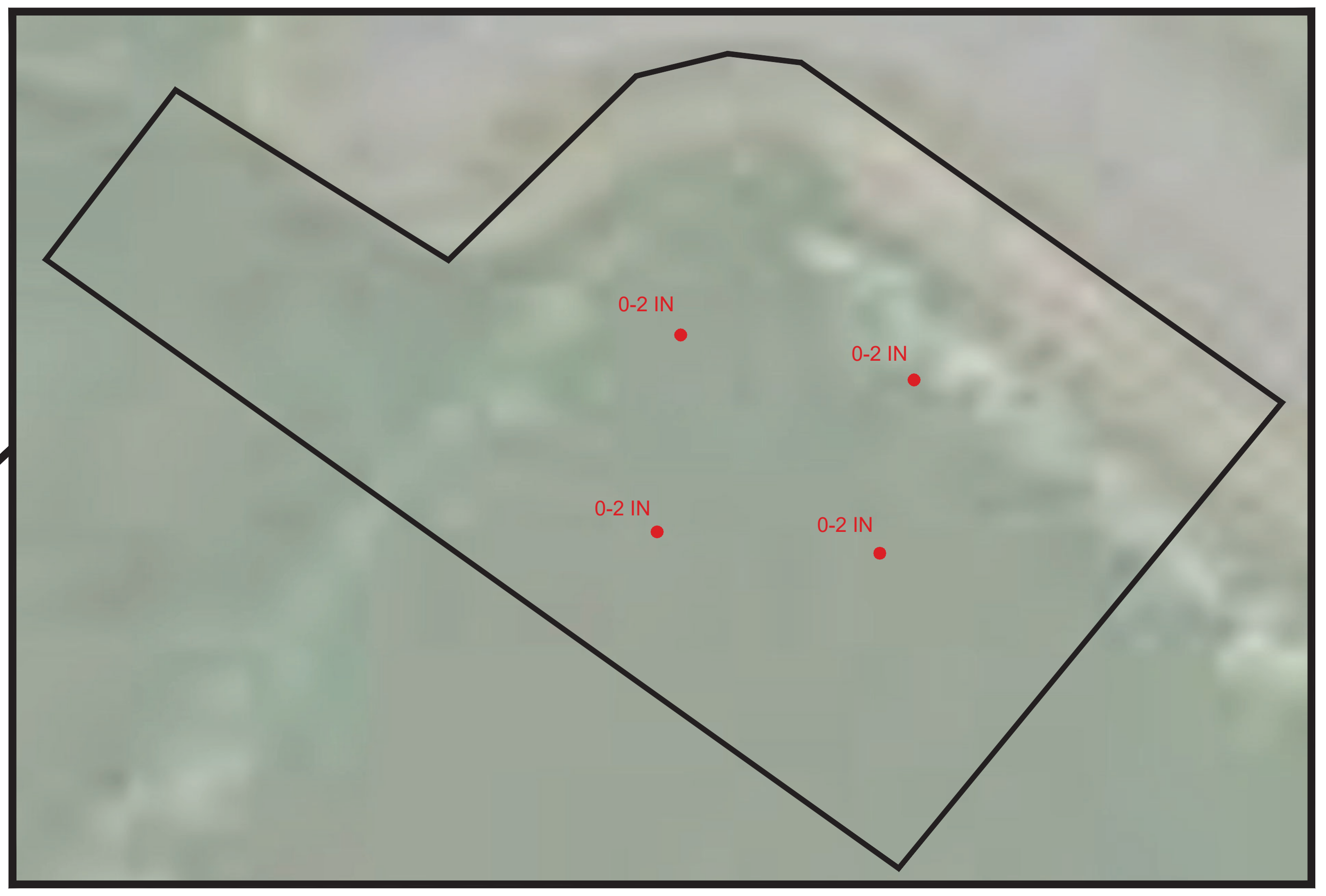
SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

FIGURE 4

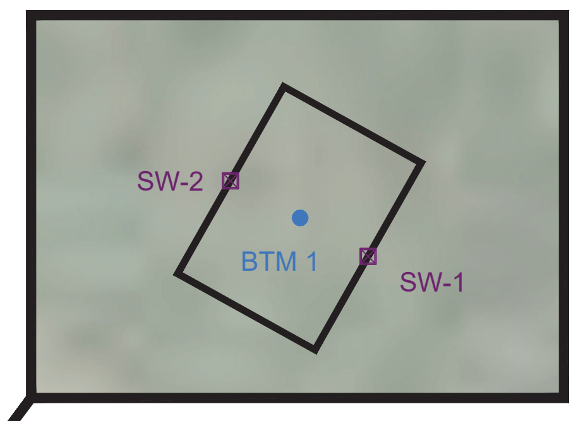
F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 5; Remedial Excavation and End-Point Sample Locations.dwg



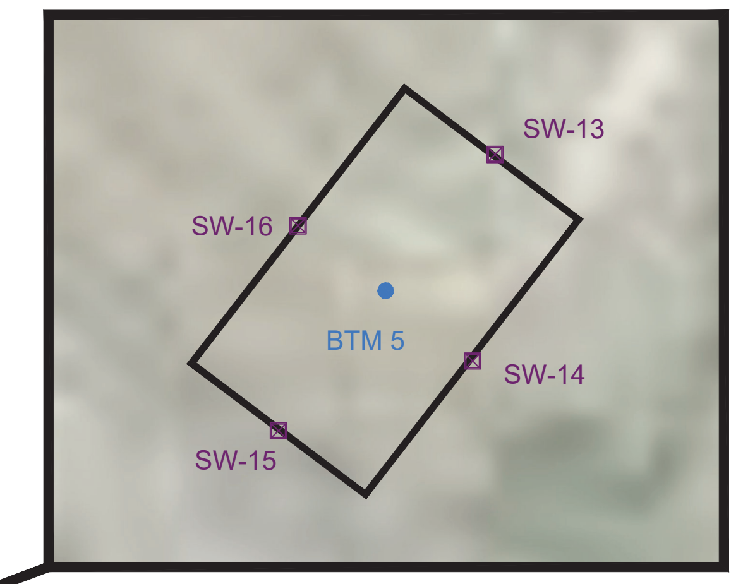
SITE PLAN (AERIAL)
SCALE: 1" = 60'



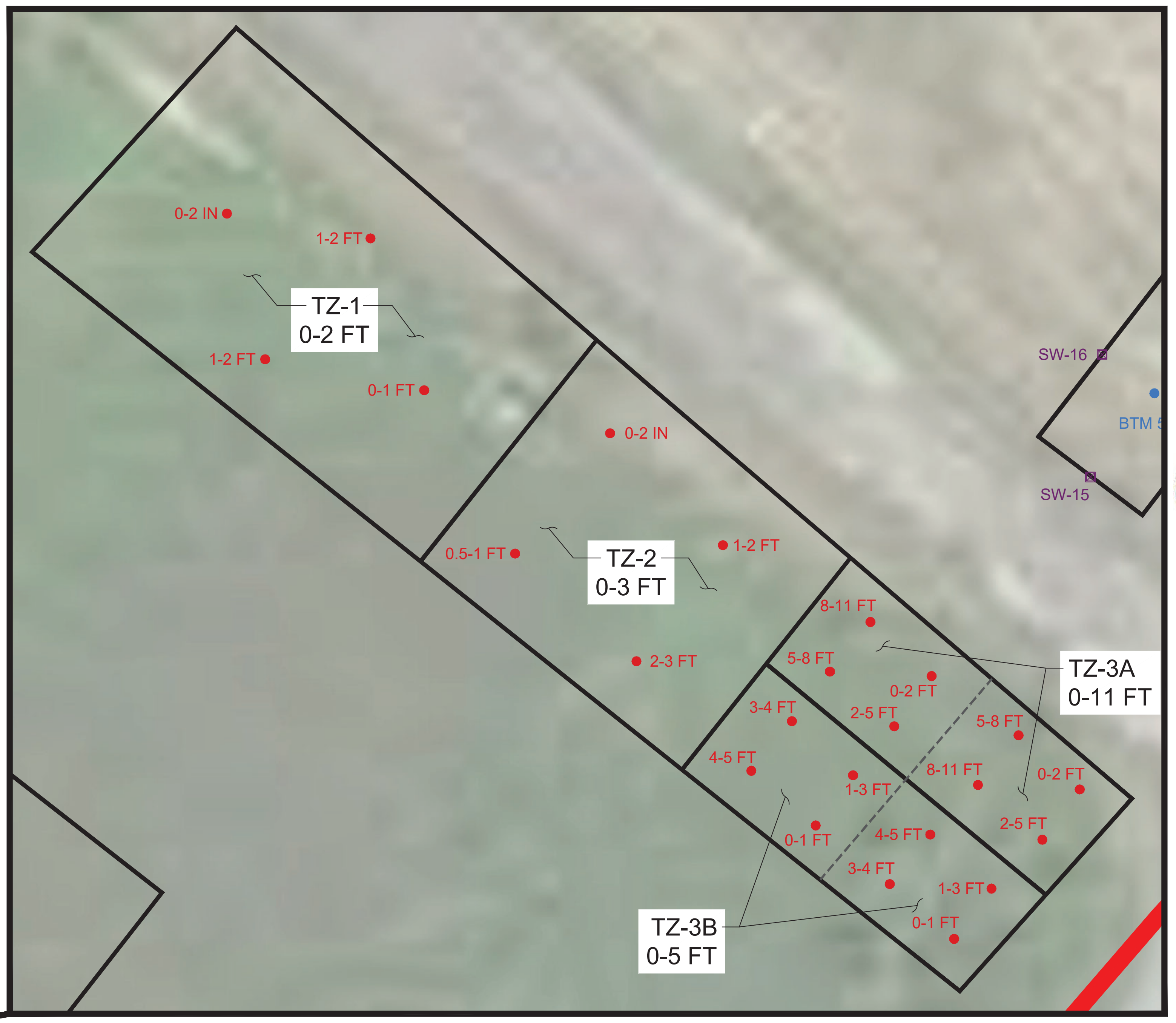
INSET-3
TP-52 PFAS STABILIZATION AREA
SCALE: 1" = 20'



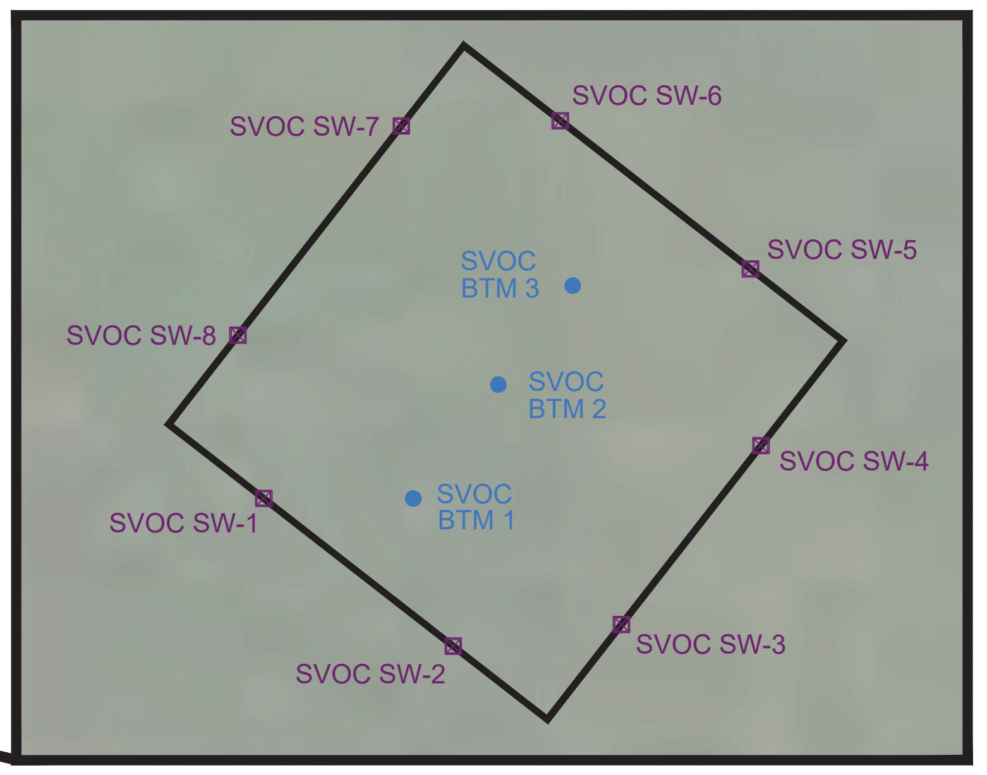
INSET-1
ADDITIONAL GCS EXCAVATION AREA-1
SCALE: 1" = 20'



INSET-2
ADDITIONAL GCS EXCAVATION AREA-2
SCALE: 1" = 20'



INSET-4
TP-54 PFAS STABILIZATION AREA
SCALE: 1" = 20'



INSET-5
SVOC EXCAVATION AREA
SCALE: 1" = 20'

LEGEND:

🟥	BCP BOUNDARY
SW-1 ☒	POST-EX END-POINT SIDEWALL SAMPLE LOCATION
BTM 5 ●	POST-EX END-POINT BOTTOM SAMPLE LOCATION
0-2 IN / 0-1 FT ●	PFAS STABILIZATION AREA CONFIRMATORY COMPOSITE SAMPLE
COVER-2 ×	EXISTING SITE COVER SAMPLE LOCATION

NOTES:
1. ALL END-POINT SAMPLES ACHIEVED TRACK 4 CLEANUP SITE SPECIFIC ACTION LEVELS.

BENCHMARK
IN ASSOCIATION WITH
TURNKEY ENVIRONMENTAL RESTORATION, LLC
2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

REVISIONS

NO.	BY	DATE	REMARKS

THOMAS H. FORBES
No. 70950-1

DRAWN BY:	CMS
DATE:	JULY 2021
CHECKED BY:	MAL
APPROVED BY:	

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REMEDIAL EXCAVATION AND END-POINT SAMPLE LOCATIONS

SITE MANAGEMENT PLAN

OREGON ROAD SITE

BCP SITE NO. C905045

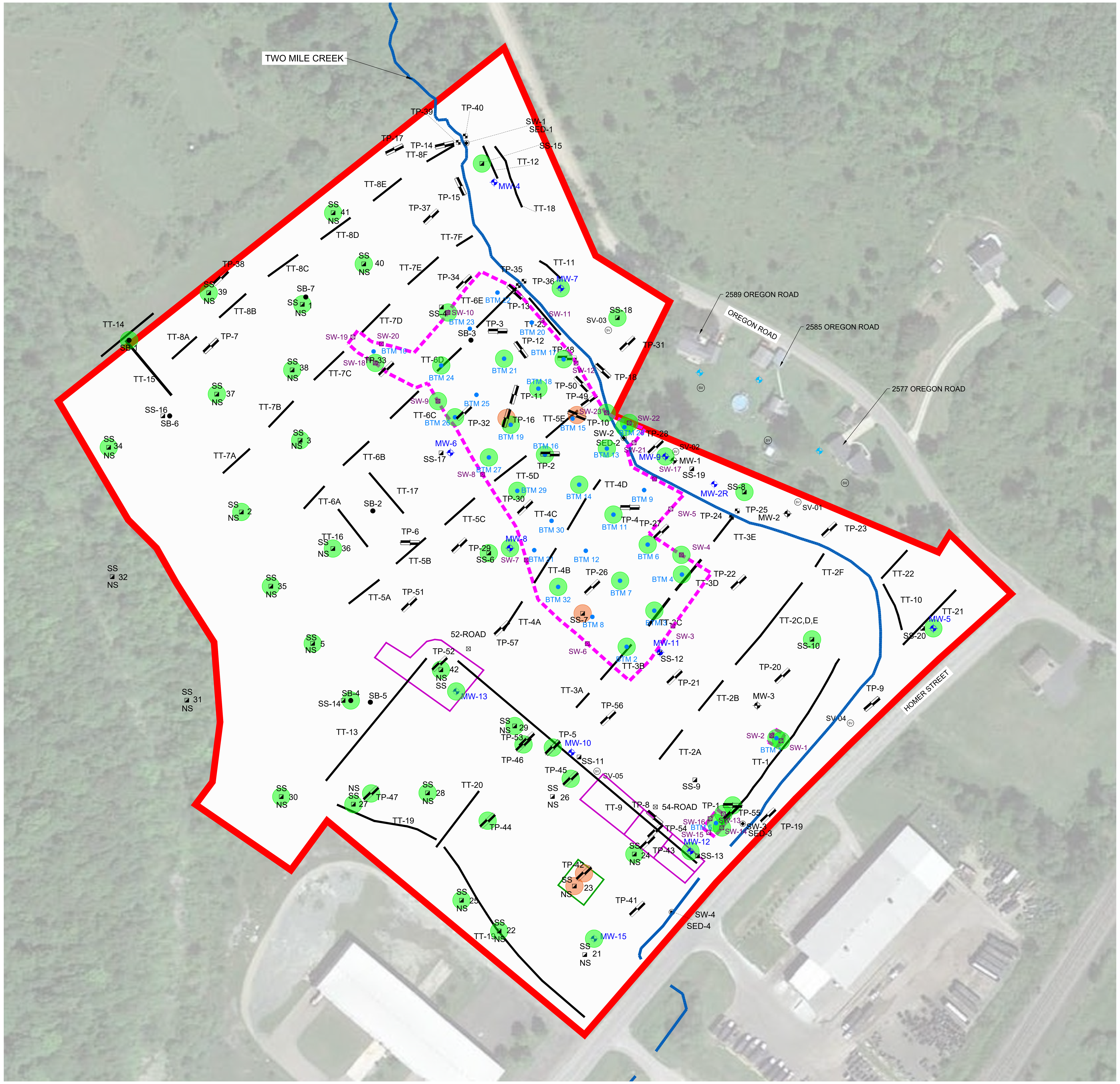
OLEAN, NEW YORK

PREPARED FOR

HOMER STREET PROPERTIES, LLC

FIGURE 5

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure 6; Remaining Soil Sample Exceedances Above USCOs.dwg



LEGEND:

🟥	BCP SITE BOUNDARY
—	HISTORIC TEST TRENCH LOCATIONS
—	IN-PLACE PIPING OBSERVED
TP-2	TEST PIT LOCATIONS
SV-02	SOIL VAPOR TEST LOCATIONS
MW-2	1" MONITORING WELL
MW-12	MONITORING WELL LOCATION
SW/SED	SURFACE WATER/SEDIMENT SAMPLE
26 SS NS	SURFACE/NEAR-SURFACE SOIL SAMPLE
SB-2 ◑	SOIL BORING LOCATION
SV	ROUX OFF-SITE SOIL VAPOR TEST LOCATIONS (INSTALLED OCTOBER 2016)
	PRIVATE WATER SUPPLY WELL IDENTIFIED BY PRIOR KNOWLEDGE
SW-1 ☒	POST-EX END-POINT SIDEWALL SAMPLE LOCATION
BTM 5 ●	POST-EX END-POINT BOTTOM SAMPLE LOCATION
🟢	SOIL/FILL EXCEEDANCE ABOVE USCOs
🟠	SOIL/FILL EXCEEDANCE ABOVE USCOs (EXCAVATED AND REMOVED DURING REMEDIAL ACTIVITIES)
—	PFAS STABILIZATION AREA
—	SVOC EXCAVATION AREA
▬ ▬ ▬	GCS EXCAVATION AREA

NOTES:
1. END-POINT SAMPLE LOCATIONS ARE NOT SHOWN WITHIN THE SVOC EXCAVATION AREA AND PFAS SOIL STABILIZATION AREAS FOR CLARITY. ALL END-POINT CONFIRMATORY SAMPLES WITHIN THESE AREAS ARE BELOW THEIR RESPECTIVE USCOs AND/OR SSALs

N

80' 0' 80' 160'

SCALE: 1 INCH = 80 FEET
SCALE IN FEET
(approximate)

BENCHMARK
IN ASSOCIATION WITH
TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

REVISIONS

NO.	BY	DATE	REMARKS

SEAL

DRAWN BY: CMS
DATE: SEPTEMBER 2021
CHECKED BY: MAL
APPROVED BY:

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REMAINING SOIL SAMPLE EXCEEDANCES ABOVE USCOs

SITE MANAGEMENT PLAN

OREGON ROAD SITE

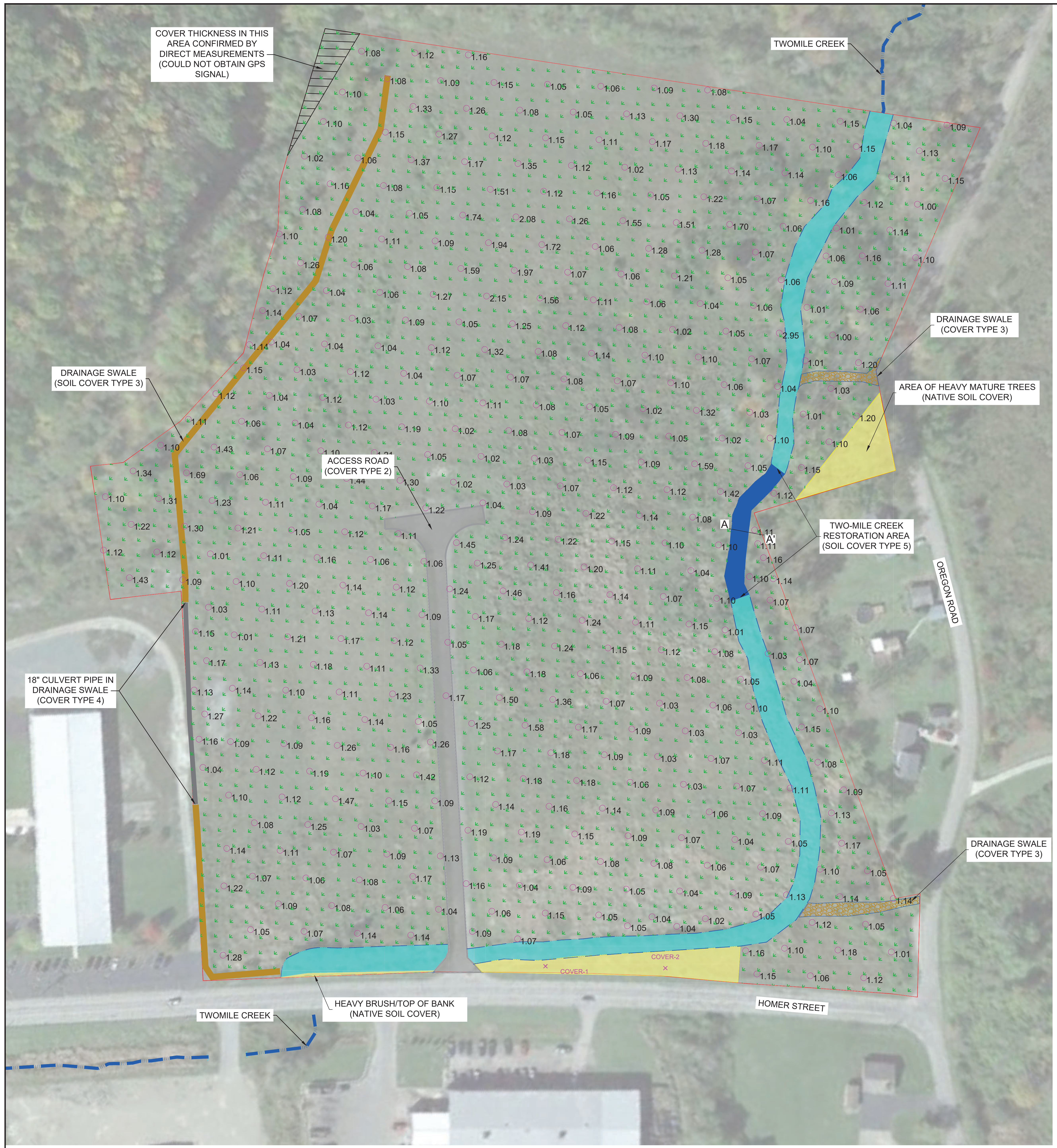
BCP SITE NO. C905045

OLEAN, NEW YORK

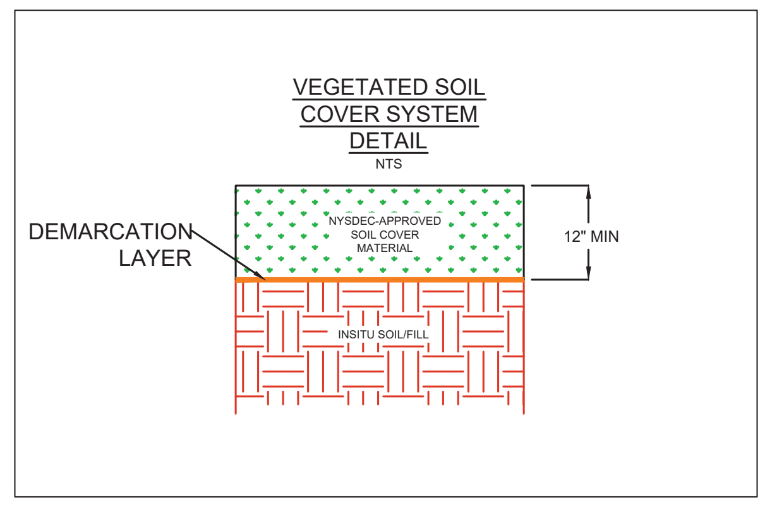
PREPARED FOR

HOMER STREET PROPERTIES, LLC

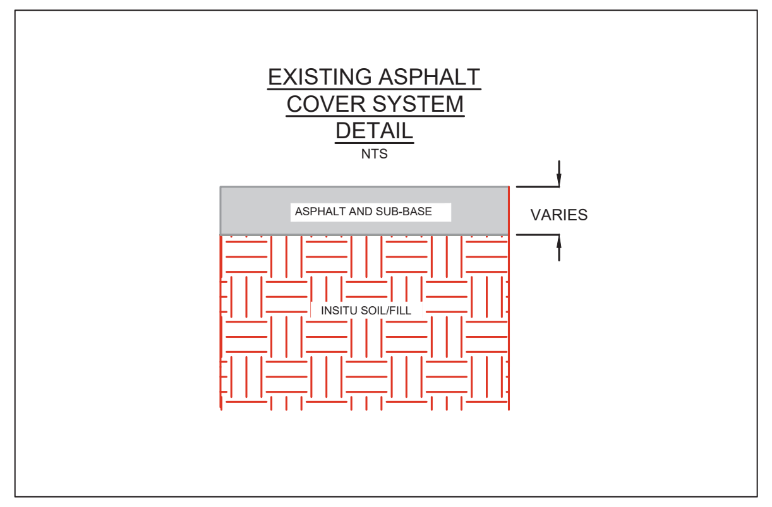
FIGURE 6



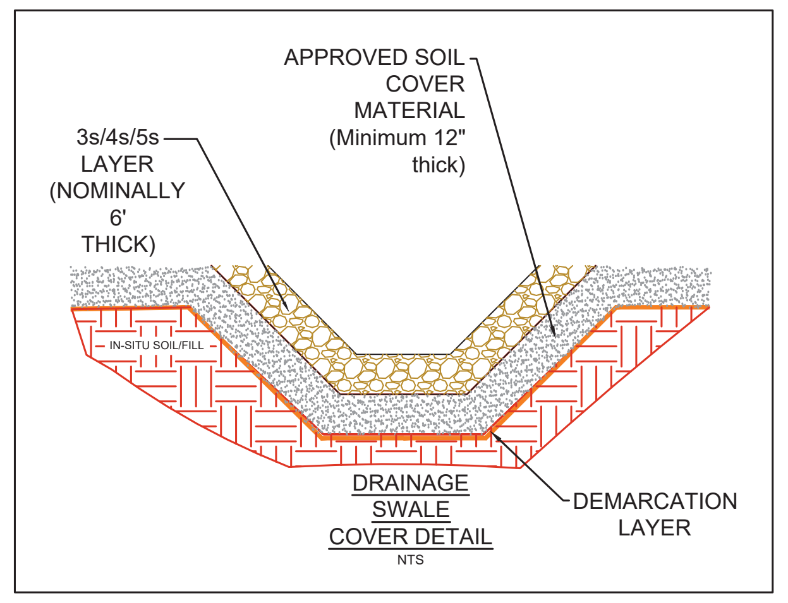
COVER TYPE 1



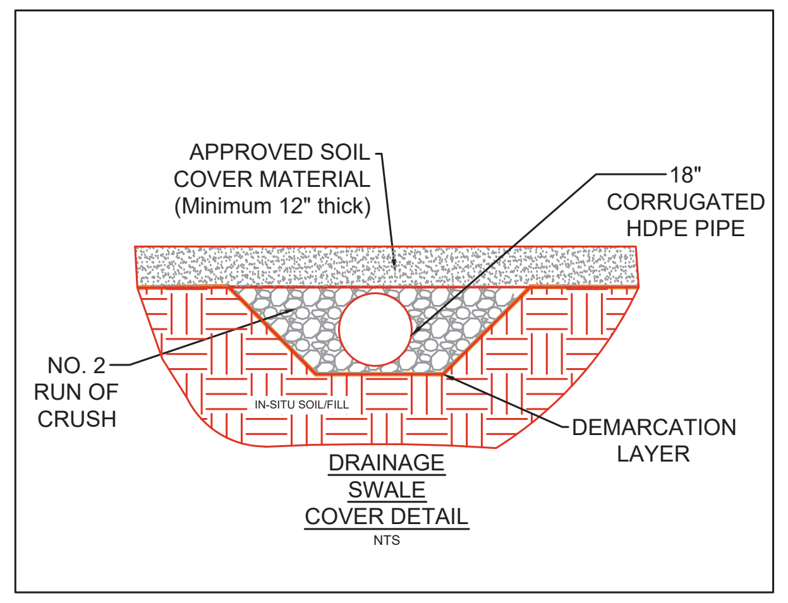
COVER TYPE 2



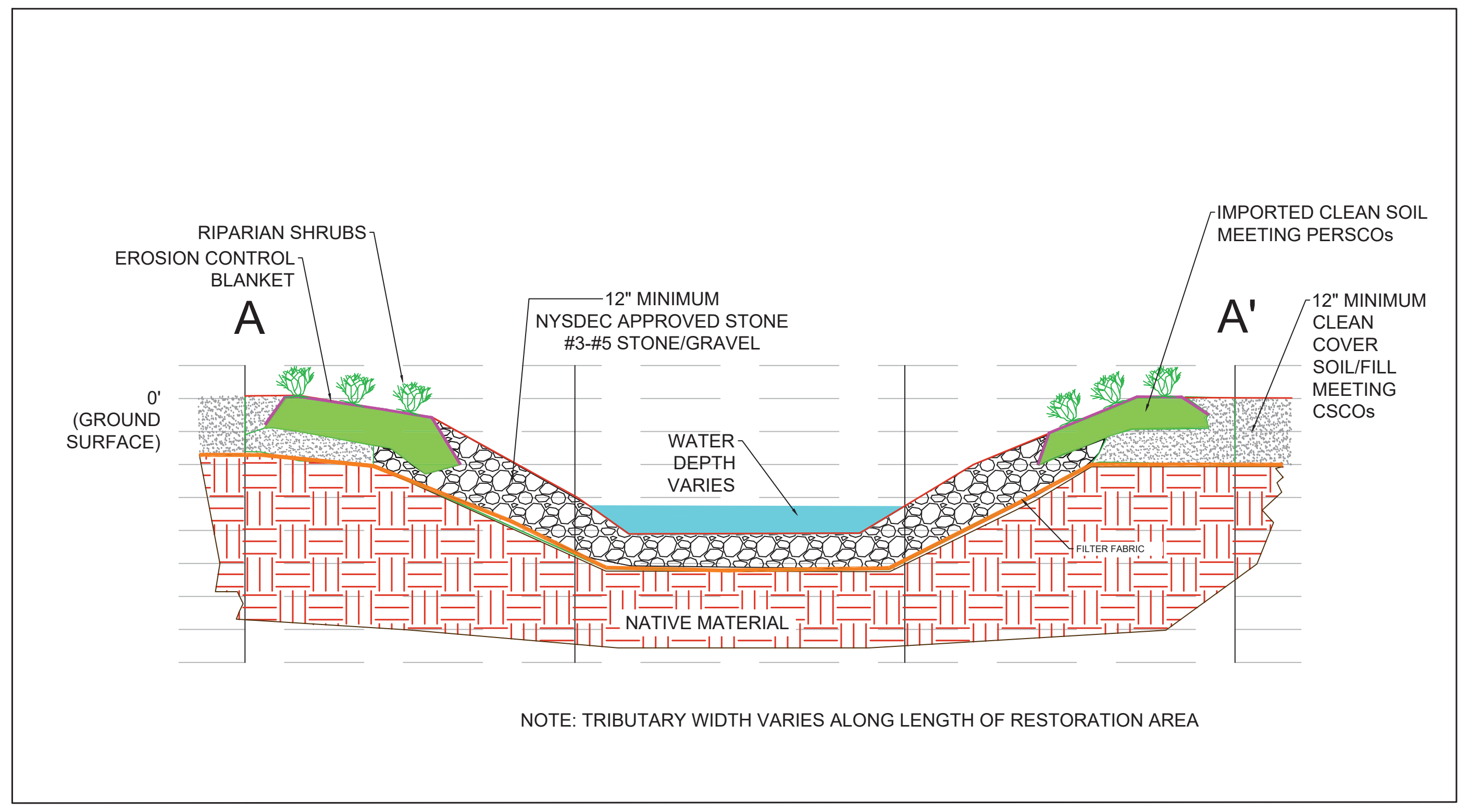
COVER TYPE 3



COVER TYPE 4



COVER TYPE 5



NOTE: TRIBUTARY WIDTH VARIES ALONG LENGTH OF RESTORATION AREA

LEGEND:

○ 1.05	COVER THICKNESS FT (SEE NOTE 3)
🟥	BCP SITE BOUNDARY
🟫	DRAINAGE SWALE
🟩	VEGETATED COVER SYSTEM (COVER TYPE 1)
⬜	EXISTING ACCESS ROAD ASPHALT COVER SYSTEM (COVER TYPE 2)
🟫	DRAINAGE SWALE (COVER TYPE 3)
▬	CULVERT IN DRAINAGE SWALE (COVER TYPE 4)
🟦	TWO-MILE CREEK RESTORATION AREA (COVER TYPE 5)
🟨	EXISTING UPPER 1' OF SOILS MEETING CSCO
🟦	LIMITS OF TWO MILE CREEK ON SITE
COVER-1 ×	COVER SOIL SAMPLE LOCATION

NOTES:
1. HORIZONTAL DATUM NAD 83; VERTICAL DATUM NAVD 88.
2. ALL MEASURMENTS IN FEET.
3. COVER THICKNESS POINTS SHOWN ARE THE RESULT OF SURFACE CREATION FROM THE TABLE REFERENCED IN NOTE 3 USING CIVIL 3D 2020, AND LAYING A 50'X50' GRID OVER THE SURFACE WITH SPOT THICKNESS IDENTIFIED.
4. ALL IMPORTED SOIL MEETS UNRESTRICTED SOIL CLEANUP OBJECTIVES (USCOs) AND PROTECTION OF ECOLOGICAL RESOURCES SCOs (PERSCOs).

PROJECT NORTH

80' 0' 80' 160'

SCALE: 1 INCH = 80 FEET
SCALE IN FEET
(approximate)

TRUE NORTH

BENCHMARK
IN ASSOCIATION WITH
TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0323-017-001

REVISIONS

NO.	BY	DATE	REMARKS

STATE OF NEW YORK
THOMAS H. FORBES
No. 70950-1
LICENSED PROFESSIONAL ENGINEER

DRAWN BY:	RFL
DATE:	NOVEMBER 2021
CHECKED BY:	
APPROVED BY:	

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SITE COVER SYSTEM

SITE MANAGEMENT PLAN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

FIGURE 7

APPENDIX A

ENVIRONMENTAL EASEMENT AND SURVEY

Cattaraugus County Clerk
Alan Bernstein

Cattaraugus County Center 303 Court Street
Little Valley, NY 14755
716-938-2297
Fax: 716-938-2773

Instrument Number
201909900

Document Type: EASEMENT
Receipt Number: 19-8184
Instrument Number: 201909900
Date/Time: 09/18/2019 11:47 AM

First Grantor: HOMER STREET PROPERTIES LLC
First Grantee: DEPARTMENT ENVIRONMENTAL

Town: TO - OLEAN (TOWN)
Town: CO - OLEAN (CITY)

Pages: 10

Mortgage Serial No.:

Transfer Tax Number: 00392

Return To:
PARALEGAL SERVICES OF BUFFALO
1133 LIBERTY BUILDING

BUFFALO NY 14202

Deed Information

Transfer Tax	$0.00

Mortgage Information

Basic Tax	
Local Tax	
Additional Tax	
Special Tax	
Total Mortgage Tax	$0.00
Taxable Amount	

State of New York
County of Cattaraugus

This sheet constitutes the Clerk endorsement required by Section 316-A(5) & Section 319 of the Real Property Law of the State of New York.

Alan Bernstein

Cattaraugus County Clerk

Please do not remove this page

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

THIS INDENTURE made this 27th day of August, 2019 between Owner(s) Homer Street Properties, LLC, having an office at 221 Homer Street, Olean, New York 14760, County of Cattaraugus, State of New York (the "Grantor"), and The People of the State of New York (the "Grantee"), acting through their Commissioner of the Department of Environmental Conservation (the "Commissioner", or "NYSDEC" or "Department" as the context requires) with its headquarters located at 625 Broadway, Albany, New York 12233,

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

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

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

WHEREAS, Grantor, is the owner of real property located at the address of Oregon Road in the Town of Olean, County of Cattaraugus and State of New York, known and designated on the tax map of the County Clerk of Cattaraugus as tax map parcel numbers: Section 94.001 Block 2 Lot 13.2, being a portion of the property conveyed to Grantor by deed dated June 18, 2014 and recorded in the Cattaraugus County Clerk's Office in Instrument No. 218987-001.

WHEREAS, Grantor, is the owner of real property located at the address of Homer Street Extension in the Town of Olean, County of Cattaraugus and State of New York, known and designated on the tax map of the County Clerk of Cattaraugus as tax map parcel numbers: Section 94.001 Block 2 Lot 13.8, being the same as that property conveyed to Grantor by deed dated March 17, 2016 and recorded in the Cattaraugus County Clerk's Office in Instrument No. 253797-002.

WHEREAS, the property subject to this Environmental Easement (the "Controlled Property") comprises approximately 24.570 +/- acres, and is hereinafter more fully described in the Land Title Survey dated June 19, 2019 prepared by Kera Ann Mariotti, L.L.S. of Canada Land Surveying, which will be attached to the Site Management Plan. The Controlled Property description is set forth in and attached hereto as Schedule A; and

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

NOW THEREFORE, in consideration of the mutual covenants contained herein and the terms and conditions of Brownfield Cleanup Agreement Index Number: C905045-10-16 as amended April 12, 2019, Grantor conveys to Grantee a permanent Environmental Easement pursuant to ECL Article 71, Title 36 in, on, over, under, and upon the Controlled Property as more fully described herein ("Environmental Easement").

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

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

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

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

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

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

(4) The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH or the Cattaraugus County Department of Health to render it safe for use as drinking water or for industrial purposes, and

the user must first notify and obtain written approval to do so from the Department;

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

(i) are in-place;

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

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

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

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

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

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

(7) the information presented is accurate and complete.

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

4. Reserved Grantor's Rights. Grantor reserves for itself, its assigns, representatives, and

successors in interest with respect to the Property, all rights as fee owner of the Property, including:

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

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

5. Enforcement

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

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

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

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

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

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

Parties shall address correspondence to:

Site Number: C905045
Office of General Counsel
NYSDEC
625 Broadway

Albany New York 12233-5500

With a copy to:

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

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

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

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

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

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

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

Remainder of Page Intentionally Left Blank

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

Homer Street Properties, LLC:

By: R. Donald Benson

Print Name: R. Donald Benson

Title: Managing Member Date: 8/16/19

Grantor's Acknowledgment

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

On the 16th day of August, in the year 20 19, before me, the undersigned, personally appeared R. Donald Benson, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Marlene F. Calabro
Notary Public - State of New York

MARLENE F CALABRO
Notary Public, State of New York
No. 01CA6351967
Qualified in Cattaraugua County
Commission Expires December 19, 2020

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

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

Grantee's Acknowledgment

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

On the 27th day of August, in the year 2019, before me, the undersigned, personally appeared Michael J. Ryan, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/ executed the same in his/her/ capacity as Designee of the Commissioner of the State of New York Department of Environmental Conservation, and that by his/her/ signature on the instrument, the individual, or the person upon behalf of which the individual acted, executed the instrument.

____
Notary Public - State of New York

David J. Chiusano
Notary Public, State of New York
No. 01CH5032146
Qualified in Schenectady County
Commission Expires August 22, 2022

SCHEDULE "A" PROPERTY DESCRIPTION

ALL THAT TRACT OR PARCEL OF LAND, situate in the Town & City of Olean, Cattaraugus County, State of New York, being part of Lot 10, Section 5, Township 2, Range 4 of the Holland Land Company's Survey, bounded and described as follows:

BEGINNING at a point in the centerline of Oregon Road at the intersection with the northwesterly bounds of Homer Street Extension;

Thence southwesterly along said bounds of Homer Street Extension, on a curve to the left, having a radius of 5746.04', an arc length of 947.05', having a chord angle of S 44-03-24 W and a chord length of 945.98' to an iron pin;

Thence N 50-15-48 W along the northeasterly bounds of lands now or formerly of State and Union, LLC., a distance of 517.02' to an iron pin;

Thence S 35-51-54 W along the westerly bounds of lands now or formerly of State and Union, LLC., a distance of 94.56' to a point;

Thence the following (8) courses through lands of Homer Street Properties, LLC.:

N 55-28-40 W, a distance of 118.95' to a point;
N 17-13-07 W, a distance of 71.03' to a point;
N 05-42-19 E, a distance of 92.34' to a point;
N 03-43-39 W, a distance of 125.44' to a point;
N 32-50-01 W, a distance of 108.82' to a point;
N 29-54-39 W, a distance of 60.90' to a point;
N 44-30-08 W, a distance of 58.77' to a point;
N 30-31-47 W, a distance of 215.20' to a point;

Thence N 51-36-00 E along the southeasterly bounds of lands now or formerly of Lewicki, a distance of 876.03' to a point in the centerline of Oregon Road;

Thence the following (2) courses along the centerline of Oregon Road:

S 23-45-45 E, a distance of 350.01' to a point; S 58-02-15 E, a distance of 134.60' to a point;

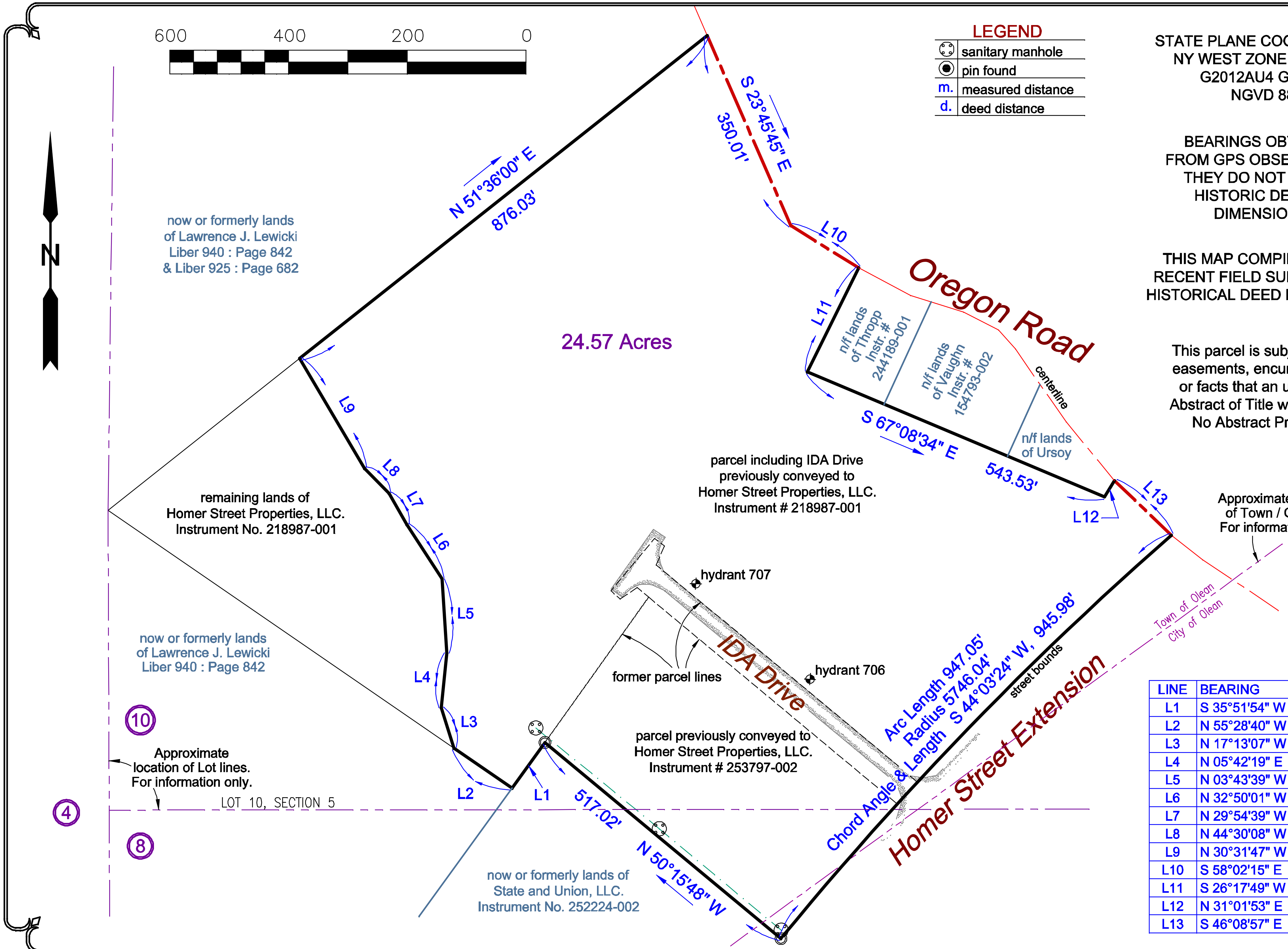
Thence S 26-17-49 W along the west bounds of lands now or formerly of Thropp, a distance of 195.27' to a point;

Thence S 67-08-34 E along the southerly bounds of lands now or formerly of Thropp, of Vaughn and of Ursoy, a distance of 543.53' to a point;

Thence N 31-01-53 E along the easterly bounds of lands now or formerly of Ursoy, a distance of 32.47' to a point in the centerline of Oregon Road;

Thence S 46-08-57 E along the centerline of Oregon Road, a distance of 132.87' to the point of beginning.

Said Parcel contains 24.57 acres.



LEGEND

⊙	sanitary manhole
◉	pin found
m.	measured distance
d.	deed distance

STATE PLANE COORDINATES
NY WEST ZONE - NAD 83
G2012AU4 GEOID
NGVD 88

BEARINGS OBTAINED FROM GPS OBSERVATION. THEY DO NOT MATCH HISTORIC DEEDED DIMENSIONS.

THIS MAP COMPILED FROM RECENT FIELD SURVEYS AND HISTORICAL DEED DIMENSIONS

This parcel is subject to any easements, encumbrances, or facts that an up to date Abstract of Title would show. No Abstract Provided.

LINE	BEARING	DISTANCE
L1	S 35°51'54" W	94.56'
L2	N 55°28'40" W	118.95'
L3	N 17°13'07" W	71.03'
L4	N 05°42'19" E	92.34'
L5	N 03°43'39" W	125.44'
L6	N 32°50'01" W	108.82'
L7	N 29°54'39" W	60.90'
L8	N 44°30'08" W	58.77'
L9	N 30°31'47" W	215.20'
L10	S 58°02'15" E	134.60'
L11	S 26°17'49" W	195.27'
L12	N 31°01'53" E	32.47'
L13	S 46°08'57" E	132.87'

Map & Survey of

Oregon Road BCP Site (Revised)

Lands Owned by

Homer Street Properties, LLC

Along

Homer Street Extension & Oregon Road

Part of Lot 10, Section 5, Township 2, Range 5 of the Holland Land Co.'s Survey

Town of Olean
Cattaraugus County, New York

Date: October 3, 2018

Scale: 1in. = 200ft.

Alteration of This Document is Illegal Under Sec. 7209 Subdivision 2 of The New York State Education Law.

Prepared By

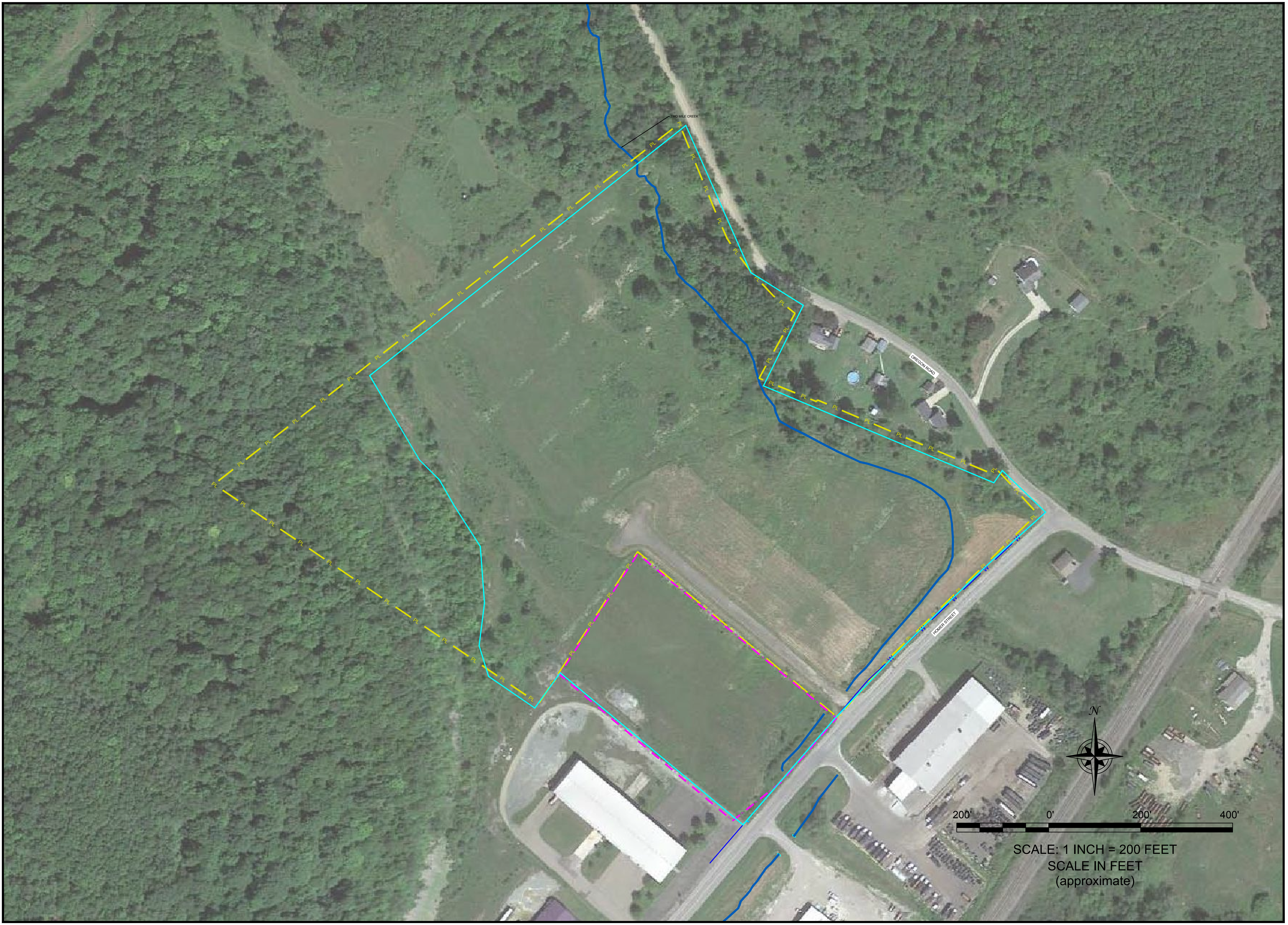
D. Michael Canada
New York State
Licensed Land Surveyor
483 North Union Street
Olean, NY 14760
N.Y.S. Lic. No.49215
716-379-7918

D. Michael Canada

Copies Invalid Unless Embossed

Job Number:
475BENSONMWRBDY

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\z_oregonrdbasemap.dwg, DWG To PDF.pc3



SCALE: 1 INCH = 200 FEET
SCALE IN FEET
(approximate)

REVISED BCP BOUNDARY

OREGON ROAD SITE

OLEAN, NEW YORK

PREPARED FOR

HOMER STREET PROPERTIES, LLC

FIGURE 1

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

JOB NO.: 0323-015-002

*<u>DISCLAIMER:</u> **PROPERTY OF BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC. & TURNKEY ENVIRONMENTAL RESTORATION, LLC** IMPORTANT: THIS DRAWING PRINT IS LOANED FOR MUTUAL ASSISTANCE AND AS SUCH IS SUBJECT TO RECALL AT ANY TIME. INFORMATION CONTAINED HEREON IS NOT TO BE DISCLOSED OR REPRODUCED IN ANY FORM FOR THE BENEFIT OF PARTIES OTHER THAN NECESSARY SUBCONTRACTORS & SUPPLIERS WITHOUT THE WRITTEN CONSENT OF BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC & TURNKEY ENVIRONMENTAL RESTORATION, LLC.*

DATE: OCTOBER 2018
DRAFTED BY: RFL

APPENDIX B

LIST OF SITE CONTACTS

APPENDIX B – LIST OF SITE CONTACTS

Name	Phone/Email Address
Site Owner and Remedial Party: Homer Street Properties, LLC	716-372-1893 dbenson@benson-construction.com
Qualified Environmental Professional: Thomas Forbes, P.E.	716-856-0599 tforbes@bm-tk.com
Environmental Professional: Mike Lesakowski	716-856-0599 mlesakowski@bm-tk.com
Remedial Party Attorney: Craig Slater, Esq.	716-865-6760 cslater@cslater.com
NYSDEC DER Region 9 Project Manager: Benjamin McPherson, P.E.	716-851-7220 benjamin.mcpherson@dec.ny.gov
NYSDEC Regional HW Engineer: Ms. Andrea Caprio, P.E.	716-851-7220 andrea.caprio@dec.ny.gov
NYSDEC Regional Materials Management Engineer: Peter Grasso	716-851-7220 peter.grasso@dec.ny.gov
NYSDEC Site Control: Ms. Kelly Lewandowski	518-402-9543 kelly.lewandowski@dec.ny.gov
NYSDOH Site Manager: Renata Ockerby	518- 402-7867 beei@health.ny.gov

APPENDIX C

RESPONSIBILITIES OF OWNER &REMEDIAL PARTY

C-1: RESPONSIBILITIES

The owner and remedial party, and the associated responsibilities for implementing the Site Management Plan ("SMP") for the Oregon Road Site (the "Site"), number C905045, is:

Homer Street Properties, LLC
1 Blue Bird Square
Olean, New York 14760

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

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

APPENDIX D

MONITORING WELL BORING
&
CONSTRUCTION LOGS

Project No: T0323-017-001

Borehole Number: MW-2R

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: NAS

Site Location: Olean, NY

Checked By: MAL

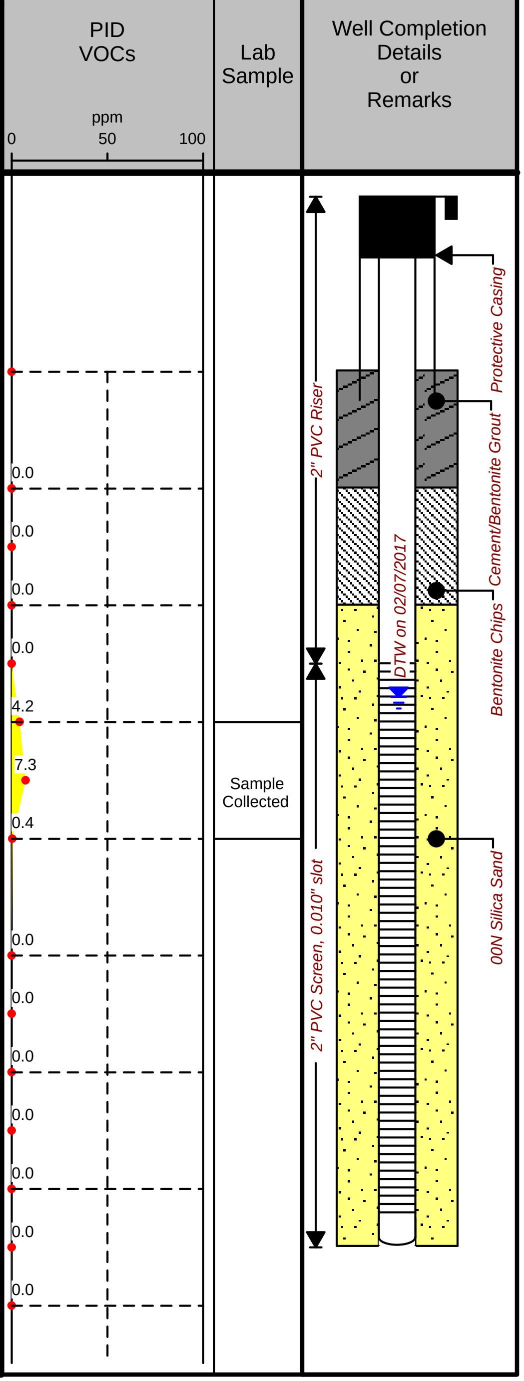
TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE

Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
-3.0		
	0.0 0.0	Ground Surface
		Topsoil Dark brown, moist, mostly low plasticity fines, little fine sand, trace fine gravel (subangular), loose
2.0	-1.8 1.8	***Silty Sand*** Brown, moist, mostly fine sand, little non-plastic fines, light brown mottling, trace fine gravel (subangular), loose
	-3.5 3.5 -4.0 4.0	***Lean Clay*** Brown, moist, moslty medium plasticity fines, little non plastic fines, few fine sand, firm
		Lean Clay As above, trace fine gravel (subangular)
	-5.8 5.8	***Lean Clay with Sand*** Grey, moist, mostly medium plasticity fines, few fine sand, medium dry strength, medium toughness, firm
7.0		***Sandy Lean Clay*** Grey, very moist at 4 fbgs, mostly medium plasticity fines, little fine to coarse sand, trace non-plastic fines, soft
	-8.0 8.0	Grading into fine gravel (subangular) at 5.75'
		Sandy Lean Clay with Gravel Grey, wet, mostly medium palsticity fines, some fine to coarse sand, little non-plastic fines, trace fine gravel (subangular),petroleum-like odor, very stiff
	-10.5 10.5	***Sandy Lean Clay with Gravel*** Light brown, wet, mostly medium plasticity fines, little fine to coarse sand, trace fine gravel (subangular), very stiff
12.0	-12.5 12.5 -13.0 13.0	***Sandy Lean Clay with Gravel*** Light brown, moist, mostly medium plasticity fines, some fine to coarse gravel, trace to few fine gravel (subangular), very stiff
		Silty Sand Light brown, wet, mostly fine to coarse sand, few non-plastic fines, dense
	-16.0 16.0	***Silty Sand*** As above, wet, trace fine gravel (subangular), dense
17.0		End of Borehole

SAMPLE

Sample No.	SPT N-Value	Recovery (ft)
S1	6	1.2
S2	6	0.9
S3	4	0.7
S4	19	1.2
S5	28	1.4
S6	44	1.4
S7	37	1.3
S8	39	1.0



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 6/25/18

Hole Size: 8.5-inch
Stick-up: 3.02'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-4

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE

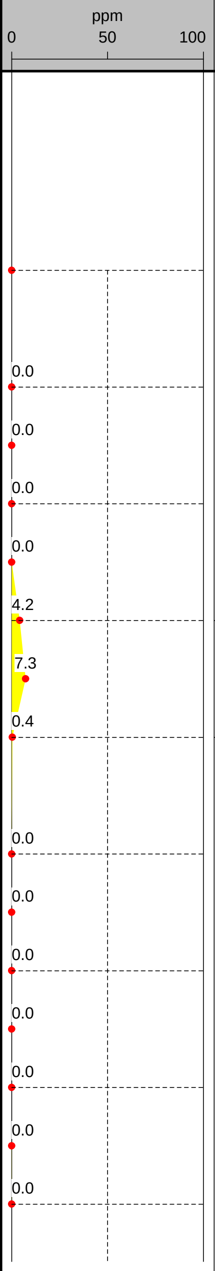
Depth (ftbgs): -3.0, 2.0, 7.0, 12.0, 17.0

Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
1466.5 / 0.0	Ground Surface
	Topsoil Dark brown, moist, mostly low plasticity fines, little fine sand, trace fine gravel (subangular), loose
1464.7 / 1.8	**Silty Sand** Brown, moist, mostly fine sand, little non-plastic fines, light brown mottling, trace fine gravel (subangular), loose
1463.0 / 3.5	**Lean Clay** Brown, moist, moslty medium plasticity fines, little non plastic fines, few fine sand, firm
1462.5 / 4.0	**Lean Clay** As above, trace fine gravel (subangular)
1460.7 / 5.8	**Lean Clay with Sand** Grey, moist, mostly medium plasticity fines, few fine sand, medium dry strength, medium toughness, firm
	Sandy Lean Clay Grey, very moist at 4 fbgs, mostly medium plasticity fines, little fine to coarse sand, trace non-plastic fines, soft Grading into fine gravel (subangular) at 5.75'
1458.5 / 8.0	**Sandy Lean Clay with Gravel** Grey, wet, mostly medium palsticity fines, some fine to coarse sand, little non-plastic fines, trace fine gravel (subangular),petroleum-like odor, very stiff
1456.0 / 10.5	**Sandy Lean Clay with Gravel** Light brown, wet, mostly medium plasticity fines, little fine to coarse sand, trace fine gravel (subangular), very stiff
1454.0 / 12.5 1453.5 / 13.0	**Sandy Lean Clay with Gravel** Light brown, moist, mostly medium plasticity fines, some fine to coarse gravel, trace to few fine gravel (subangular), very stiff
	Silty Sand Light brown, wet, mostly fine to coarse sand, few non-plastic fines, dense
1450.5 / 16.0	**Silty Sand** As above, wet, trace fine gravel (subangular), dense
	End of Borehole

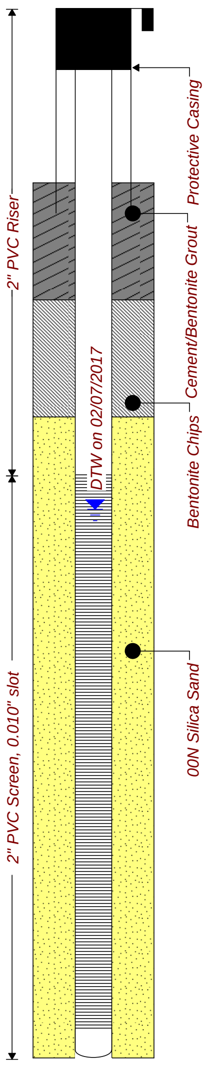
SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	Lab Sample
S1	6	1.2	
S2	6	0.9	
S3	4	0.7	
S4	19	1.2	Sample Collected
S5	28	1.4	
S6	44	1.4	
S7	37	1.3	
S8	39	1.0	

PID VOCs



Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 01/30/2017

Hole Size: 8.5-inch
Stick-up: 3'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-5

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

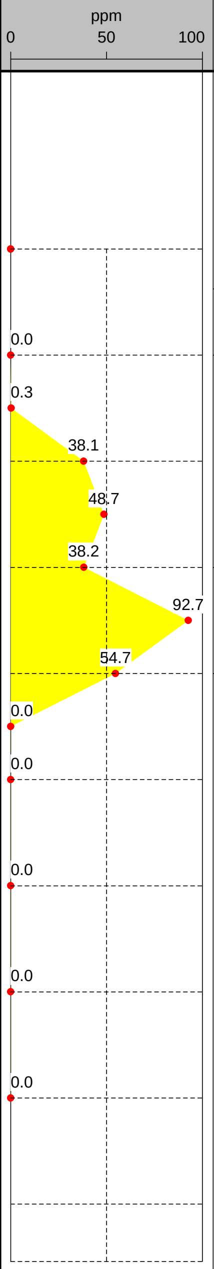
SUBSURFACE PROFILE

Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
1428.6 0.0	Ground Surface
1428.6 0.0	**Topsoil** Brown, moist, mostly low plasticity fines, few non-plastic fines, trace fine sand, trace fine gravel (subrounded), trace organic matter (rootlets), firm
1427.8 0.8	**Well Sorted Sand with Fill Material** Black and brown, moist, mostly fine sand, trace fine gravel (subangular), with trace cinders and brick, loose
1426.6 2.0	**Sandy Lean Clay with Fill Material** Grey, wet, mostly medium plasticity fines, few fine sand, wood fragment at 4', loose
1424.6 4.0	**Sandy Lean Clay** Grey, moist, moslty medium plasticity fines, little fine sand, trace non-plastic fines, medium dry strength, medium toughness, stiff, massive, petroleum-like odor, stiff
1422.6 6.0	**Poorly Sorted Gravel with Sand** Grey, wet, mostly fine gravel (subangular), little to some fine to coarse sand, trace non-plastic fines, petroelum-like odor, medium dense
1417.1 11.5	**Sandy Lean Clay** Grey, moist, moslty medium plasticity fines, little fine sand, trace non-plastic fines, medium dry strength, medium toughness, stiff, massive
1415.6 13.0	**Sandy Lean Clay with Gravel** As above, with fine gravel (subangular)
1414.1 14.5	**Sandy Lean Clay** Grey, moist, moslty medium plasticity fines, little fine sand, trace non-plastic fines, medium dry strength, medium toughness, stiff, massiv
1413.3 15.3	**Silty Sand** Light brown, wet, mostly fine sand, few non-plastic fines, medium dense
1412.6 16.0	End of Borehole

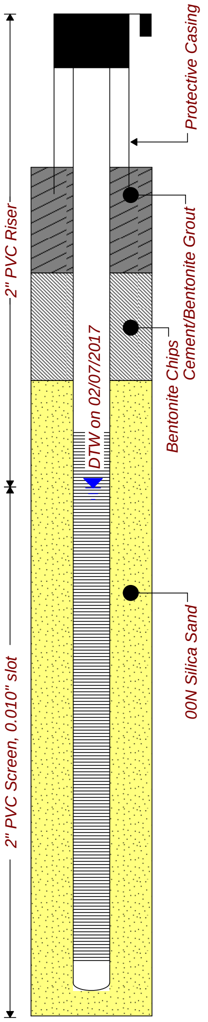
SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	Lab Sample
S1	7	1.2	Sample Collected
S2	11	0.5	
S3	9	1.9	
S4	32	1.6	Sample Collected
S5	22	1.7	
S6	26	1.6	
S7	15	1.9	
S8	12	1.4	

PID VOCs



Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 02/01 and 02/02/2017

Hole Size: 8.5-inch
Stick-up: 3.28'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-6

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

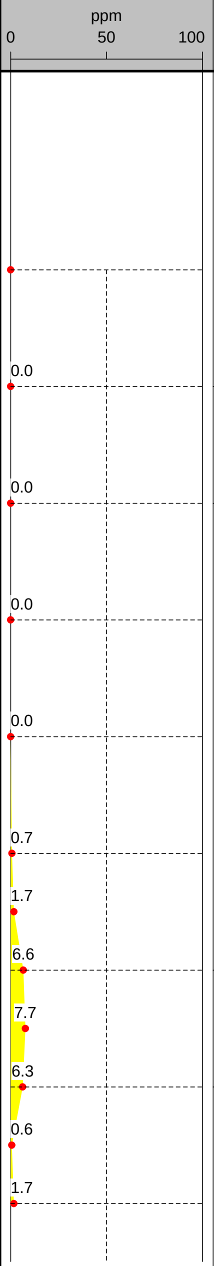
Site Location: Olean, NY

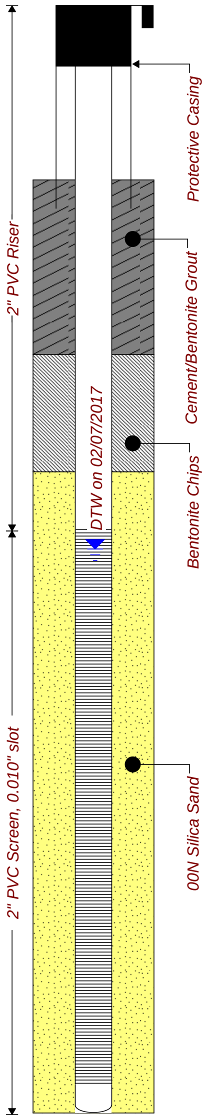
Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE / SAMPLE

Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Lab Sample
-3.0						
	1453.4 0.0	Ground Surface				
	1452.9 0.5	***Topsoil*** Brown, moist, mostly low plasticity fines, little fine sand, trace organic matter (rootlets), soft	S1	8	1.4	
2.0		***Silty Sand with Gravel*** Brown, moist, mostly fine sand, little non-plastic fines, few fine sand (subangular), loose	S2	5	1.1	Sample Collected
	1449.4 4.0	***Silty Sand*** As above, wet lens at 4'	S3	5	0.7	
7.0	1448.4 5.0	***Sandy Lean Clay*** Grey, wet, mostly medium plasticity fines, little fine to coarse sand, firm	S4	6	0.5	
	1445.4 8.0	***Sandy Lean Clay*** As above, wood fragments at 8.5 and 10 fbgs	S5	7	0.9	
	1443.4 10.0	***Sandy Lean Clay*** As above, stiff	S6	12	1	
12.0	1441.4 12.0	***Gravelly Lean Clay with Sand*** Light brown, wet, mostly medium plasticity fines, little fine gravel (subrounded), little fine sand, petroleum-like odor, very stiff	S7	20	0.7	Sample Collected
	1439.4 14.0	***Gravelly Lean Clay with Sand*** As above, hard	S8	32	0.9	
17.0	1437.4 16.0	End of Borehole				





Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 01/20/2017

Hole Size: 8.5-inch
Stick-up: 3.04'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-7

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

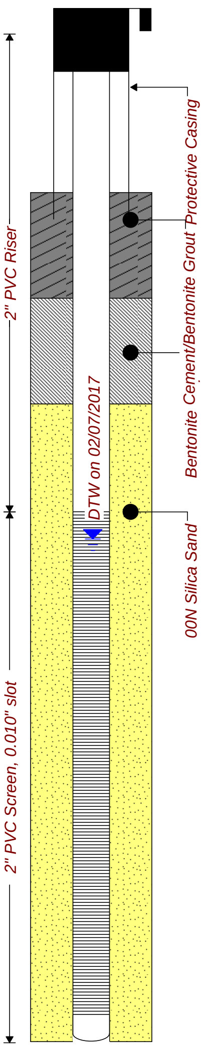
Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE			SAMPLE				PID VOCs	Lab Sample
Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	ppm 0 50 100	
-3.0								
	1458.9	Ground Surface						
	0.0	***Sandy Silt*** Light brown, moist, mostly non-plastic fines, little fine sand, trace organic matter (rootlets), loose	S1	6	0.5		0.0	
2.0	1456.4 2.5	***Sandy Lean Clay*** Reddish brown, moist, mostly medium plasticity fines, some fine sand, trace non-plastic fines, firm	S2	8	1.6		0.0	
	1454.9 4.0	***Sandy Lean Clay with Gravel*** Reddish brown, moist, mostly medium plasticity fines, little fine sand, few fine gravel (subangular), trace non-plastic fines, stiff	S3	13	1.5		0.0	
7.0			S4	60	1.1		0.0	
	1450.4 8.5	***Poorly Sorted Gravel with Sand*** Grey, wet, mostly fine gravel, some fine to coarse sand, trace medium plasticity fines, slight petroleum-like odor, dense	S5	32	1.5		1.7 0.0	Sample Collected
	1449.4 9.5	***Sandy Lean Clay with Gravel*** Light brown, moist, mostly medium plasticity fines, some fine to coarse sand, few fine to coarse gravel, trace to few non-plastic fines, hard	S6	58	1.2		0.0	
	1447.9 11.0	***Poorly Sorted Sand*** Light brown, moist, mostly fine to coarse sand, trace fine gravel, tracenon-plastic fines, very dense	S7	27	1.2		0.0	
12.0	1446.9 12.0	***Poorly Sorted Sand with Gravel*** Light brown, wet, mostly fine to coarse sand, few fine to coarse gravel (subangular), few non-plastic fines, dense	S8	23	1.1		0.0	
	1443.4 15.5	***Sandy Lean Clay with Gravel*** Light brown, wet, mostly medium plasticity fines, some fine to coarse sand, little fine gravel (subangular to subrounded), few non-plastic fines, very stiff						
17.0	1442.9 16.0	End of Borehole						

Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 01/30 and 01/31/2017

Hole Size: 8.5-inch
Stick-up: 3.49'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-8

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

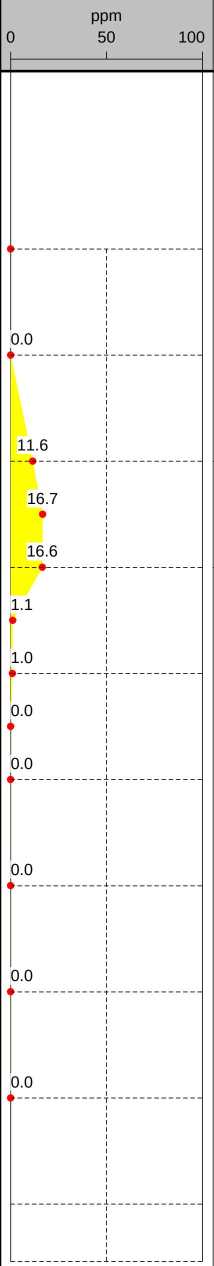
SUBSURFACE PROFILE

Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
-2.0		
	1442.4 0.0	Ground Surface
		Topsoil Light brown, moist, mostly non-plastic fines, little fine sand, trace organic matter (rootlets), loose
		Sandy Lean Clay Light brown, moist, mostly low plasticity fines, some fine sand, trace non-plastic fines, trace fine gravel (subangular), stiff
3.0	1439.4 3.0	**Sandy Lean Clay with Gravel** As above, few fine gravel (subangular)
	1438.4 4.0	**Gravelly Lean Clay with Sand** Grey, wet at 4', mostly medium plasticty fines, little fine gravel (subanguar), little fine sand, few non-plastic fines, petroleum-like odor, stiff
	1435.4 7.0	**Sandy Lean Clay with Gravel** Grey, wet, mostly medium plasticity fines, little fine sand, little to few non-plastic fines, trace fine gravel (subangular), stiff
8.0		
	1429.9 12.5	**Gravelly Lean Clay with Sand** Grey, wet, mostly medium plasticty fines, little fine gravel (subanguar), few fine sand, trace non-plastic fines, firm
13.0		
	1427.4 15.0	**Sandy Lean Clay with Gravel** Grey, wet, mostly medium plasticity fines, little fine sand, few fine gravel (subangular), trace non-plastic fines, stiff
	1426.4 16.0	End of Borehole
18.0		

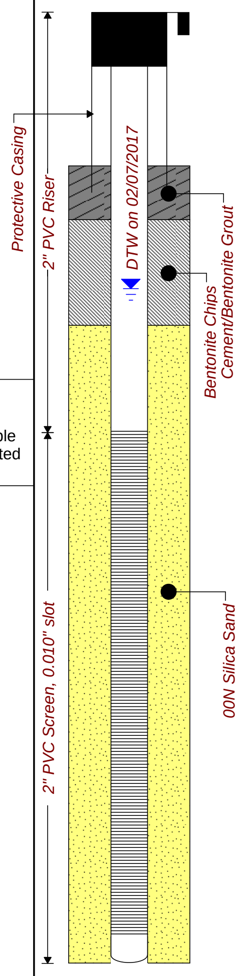
SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	Lab Sample
S1	9	1.3	
S2	19	1.1	
S3	12	0.7	Sample Collected
S4	11	1.25	
S5	9	1	
S6	8	1.8	
S7	8	1.5	
S8	10	1.8	

PID VOCs



Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 02.01/2017

Hole Size: 8.5-inch
Stick-up: 2.92'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-9

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

Site Location: Olean, NY

Checked By: MAL

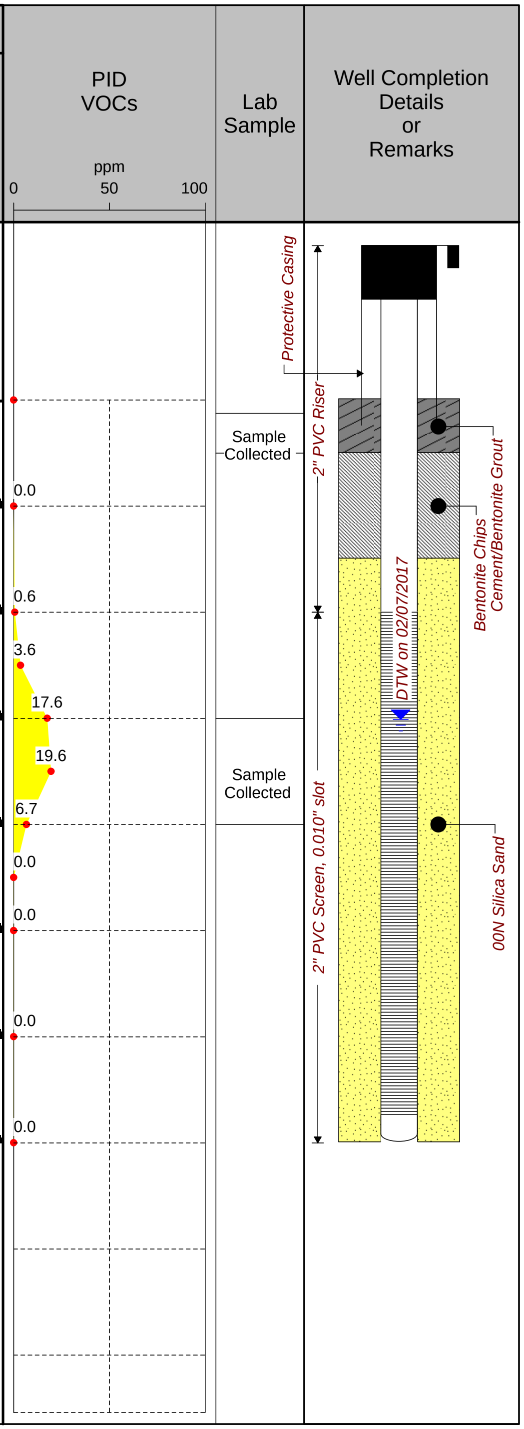
TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE

Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
-2.0		
	1441.0 0.0	Ground Surface
		Topsoil Brown, moist, mostly fine sand, little non-plastic fines, trace fine gravel (subangular), medium dense
	1440.0 1.0	**Sand with Fill** Black, moist, mostly fine sand with cinders, and brick, loose
3.0		**Poorly Sorted Sand with Gravel and Clay** Light brown, moist, wet at 4', mostly fine sand, little coarse sand, few fine gravel (subangular), few medium plasticity fines, medium dense
	1436.5 4.5	**Poorly Sorted Gravel with Sand** Grey, wet, mostly fine gravel (subangular), little to some fine to coarse sand, trace non- plastic fines, petroleum-like odor 4.5 to 8', medium dense
8.0		
	1431.0 10.0	**Well Sorted Sand with Gravel and Silt** Light brown, wet, mostly fine sand, some fine gravel (subangular), few coarse sand, few non-plastic fines, medium dense
13.0		
	1427.2 13.8	**Sandy Lean Clay** Grey, wet, mostly medium plasticity fines, little fine sand, trace non-plastic fines, very stiff
	1425.0 16.0	End of Borehole
18.0		

SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	Symbol	Lab Sample
S1	24	1.7	◩	Sample Collected
S2	22	0.9	◩	
S3	18	2	◩	
S4	21	1.2	◩	Sample Collected
S5	25	1	◩	
S6	21	0.7	◩	
S7	17	0.9	◩	



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 02/01/2017

Hole Size: 8.5-inch
Stick-up: 2.91'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-10

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

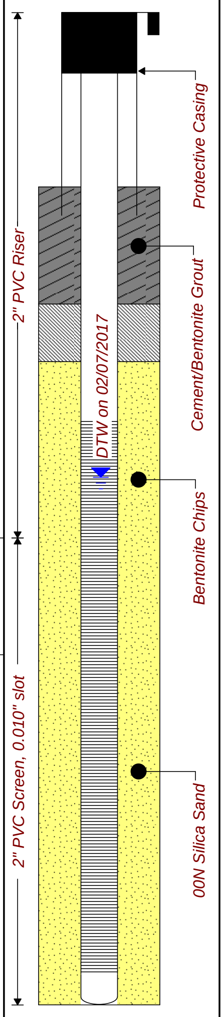
Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE			SAMPLE				PID VOCs	Lab Sample
Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	ppm 0 50 100	
-3.0								
	1436.9 0.0	Ground Surface						
		Topsoil Brown, moist, mostly low plasticity fines, little fine sand, trace organic matter (rootlets), medium dense	S1	8	1.3		0.0	
2.0	1434.9 2.0	***Silty Sand with Gravel*** Brown, moist, mostly low plasticity fines, some coarse gravel, little fine sand, medium dense, loose when disturbed	S2	9	0.7		0.0	
	1432.9 4.0	***Silty Sand with Gravel*** As above, little fine gravel (subangular)						
	1432.4 4.5	***Silty Sand*** Light brown, moist to wet at 4', mostly fine sand, little to few non-plastic fines, loose	S3	8	1.3		0.0	
	1430.9 6.0	***Poorly Sorted Gravel with Sand*** Light brown, moist, mostly fine fine gravel (subangular), some fine to coarse sand, trace non-plastic fines						
7.0	1429.9 7.0	***Silty Sand*** Light brown, moist, mostly fine sand, few to little non-plastic fines, loose	S4	9	1.7		0.0	Sample Collected
	1428.9 8.0	***Poorly Sorted Sand with Silt*** Light brown, wet at 7.5', mostly fine to coarse sand, few nonplastic fines, loose to medium dense	S5	13	1.8		0.0	
		Poorly Sorted Sand Light brown, wet, mostly fine to coarse sand, few non-plastic fines, medium dense	S6	20	1.8		0.0	
12.0	1425.4 11.5	***Poorly Sorted Sand with Gravel*** Light brown, wet, mostly fine to coarse sand, few fine gravel (subangular), medium dense to dense	S7	36	1.6		0.0	
	1422.9 14.0	End of Borehole						
17.0								

Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 01/19/2017

Hole Size: 8.5-inch
Stick-up: 3.01'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-11

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

Site Location: Olean, NY

Checked By: MAL

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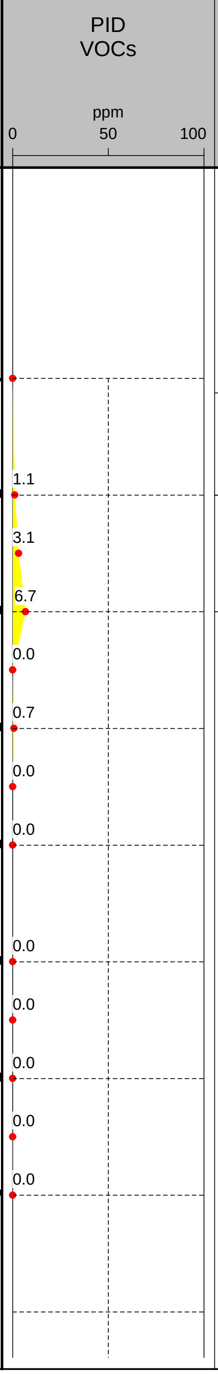
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

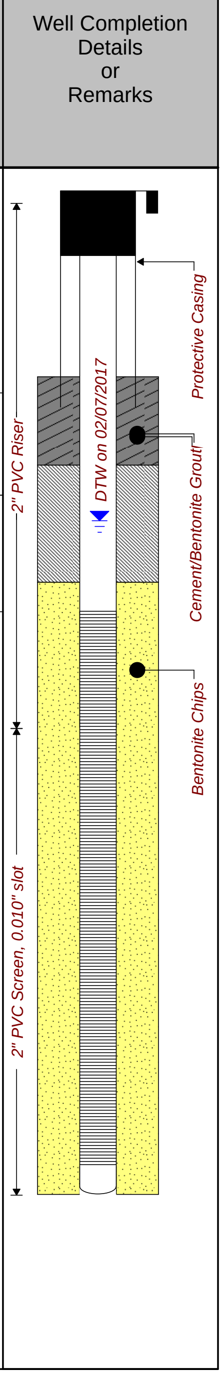
SUBSURFACE PROFILE

Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
-3.0		
	1432.8 0.0	Ground Surface
		Topsoil Brown, moist, mostly low plasticity fines, little fine sand, trace organic matter (rootlets), soft
2.0	1430.8 2.0	**Sandy Lean Clay** Grey, moist, mostly medium plasticity fines, little fine sand, trace fine gravel (subrounded), firm
		Sandy Lean Clay with Gravel Grey, moist, mostly medium plasticity fines, some fine sand, trace fine gravel (subangular), thinly bedded sand, petroleum-like odor, medium dense
	1428.8 4.0	**Poorly Sorted Gravel** Greyish brown, wet at 6 fbgs, mostly fine gravel (subangular), little to some fine to coarse sand, trace non-plastic fines, loose
7.0	1425.8 7.0	**Poorly Sorted Sand with Silt and Gravel** Light brown, wet at 9', moslty fine sand, few non-plastic fines, trace fine gravel (subangular), medium dense
	1423.8 9.0	**Poorly Sorted Sand with Silt and Gravel** Brown, mostly finesand, little non-plastic fines, trace fine gravel (subangular), medium dense
	1422.0 10.8	**Poorly Sorted Sand with Silt** Light brown, wet, moslty fine sand few non-plastic fines, trace coarse sand, medium dense
12.0	1420.8 12.0	
	1420.3 12.5	**Poorly Sorted Sand with Gravel and Silt** Brown, mostly fine sand, few non-plastic fines, trace fine gravel (subangular), medium dense
		As above, dense
	1418.8 14.0	End of Borehole

SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	Lab Sample
S1	5	1.7	Sample Collected
S2	16	1.3	Sample Collected
S3	9	1	
S4	14	1.2	
S5	24	1.6	
S6	22	1.5	
S7	22	1.8	





Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 01/19/2017

Hole Size: 8.5-inch
Stick-up: 3.22'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-12

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: JJR

Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE

Depth (ftbgs)	Elev. /Depth
-3.0	
	1428.0 0.0
	1427.5 0.5
	1427.0 1.0
2.0	1426.0 2.0
	1424.0 4.0
	1423.0 5.0
	1422.0 6.0
7.0	
	1420.5 7.5
	1420.0 8.0
	1418.0 10.0
	1416.5 11.5
12.0	1416.0 12.0
	1414.0 14.0
	1412.0 16.0

Description (ASTM D2488: Visual-Manual Procedure)

Ground Surface

Topsoil
Brown, moist, mostly low plasticity fines, little fine sand, trace fine gravel, trace organic matter (rootlets), medium dense

Silty Sand with Gravel
Brown, moist, mostly low plasticity fines, some coarse gravel, little fine sand, trace organic matter, medium dense, loose when disturbed

Lean Clay with Sand
Grey/blue, moist, mostly low to medium plasticity fines, little fine sand, trace fine gravel, very stiff

Lean Clay with Sand
Grey, moist, mostly medium plasticity fines, little fine sand, trace fine gravel, thinly bedded, medium toughness, medium dry strengt, firm

Lean Clay
Reddish brown, wet at 4', mostly medium plasticity fines, trace fine gravel (sub-rounded), low dry strength, low toughness, firm

Organic Sandy Lean Clay
Black, moist, mostly medium plasticity fines, little fine sand, low dry strength, low toughness, firm

Lean Clay
Grey, moist, mostly medium plasticity fines, light brown mottling, trace bedded fine sand, firm

Poorly Graded Sand with Clay
Grey, moist, mostly fine sand, little low plasticity fines, light brown mottling, loose

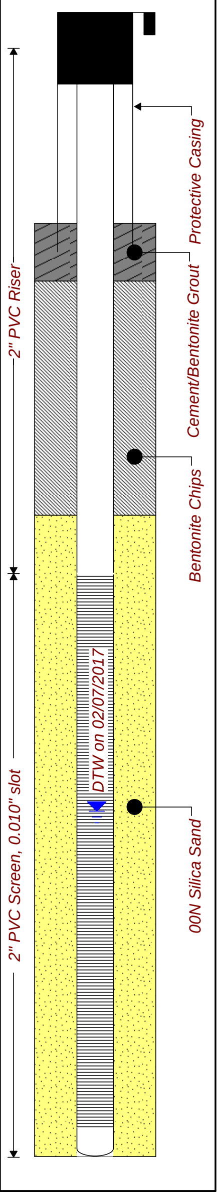
Lean Clay
Grey, moist, mostly medium plasticity fines, little non-plastic fines, medium toughness, medium dry strength, firm to stiff

Poorly Graded Sand with Clay
Grey, moist, mostly fine sand, little low plasticity fines, light brown mottling, loose

SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	Symbol	PID VOCs ppm (0 / 50 / 100)	Lab Sample
S1	22	0.9	◩	0.0	
S2	6	1.8	◩	0.0	
S3	5	1.9	◩	0.0	
S4	9	2	◩	0.0	
S5	10	2	◩	0.0	
S6	12	2	◩	0.0	Sample Collected
S7	35	1.1	◩	0.0	
S8	56	0.9	◩	0.0	

Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 6/22/18

Hole Size: 8.5-inch
Stick-up: 3.62'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-13

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: NAS

Site Location: Olean, NY

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

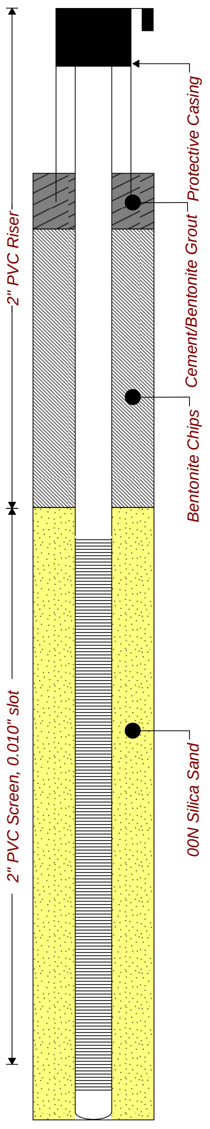
SUBSURFACE PROFILE

Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
-3.0		
	1442.8 0.0	Ground Surface
		Topsoil Brown, moist, mostly low plasticity fines, little fine sand, trace fine gravel, trace organic matter (rootlets), medium dense
2.0		***Silty Sand with Gravel*** Tan, moist, mostly low plasticity fines, some coarse gravel, little fine sand, trace organic matter, medium dense, loose when disturbed, no odors
	1438.8 4.0	***Sandy Lean Clay with gravel*** Tannish grey, moist to wet (8.5'), mostly medium plasticity fines, little fine sand, some well sorted gravel, thinly bedded, medium toughness, firm, no odors
7.0		
12.0		
17.0	1425.8 17.0	End of Borehole

SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	PID VOCs ppm (0–50–100)	Lab Sample
S1	18	2	0.0	
S2	27	2	0.0	
S3	19	2	0.0	
S4	27	1	0.0	
S5	18	1	0.0	
S6	15	1.5	0.0	Sample Collected
S7	17	2	0.0	
S8	15	2	0.0	

Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 6/22/18

Hole Size: 8.5-inch
Stick-up: 3'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-017-001

Borehole Number: MW-15

Project: Oregon Road Site Remedial Investigation

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: NAS

Site Location: Olean, NY

Checked By: MAL

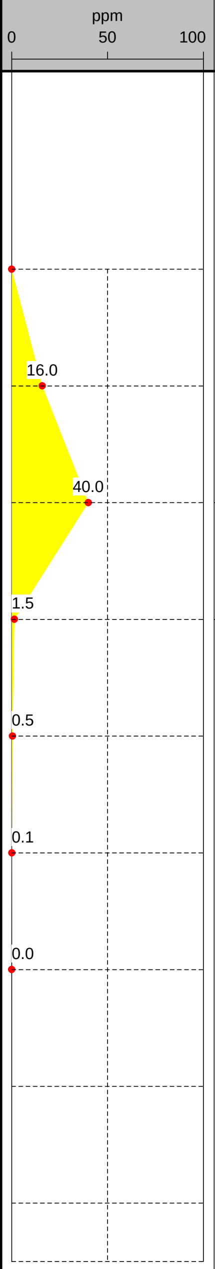
TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

SUBSURFACE PROFILE

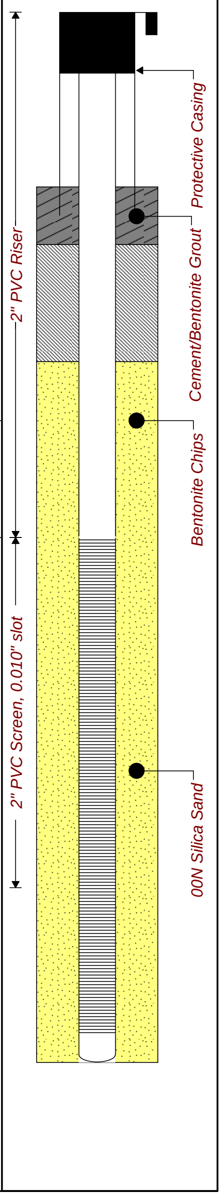
Depth (ftbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
-3.0		
	0.0 0.0	Ground Surface
	-1.0 1.0	***Topsoil*** Brown, moist, mostly low plasticity fines, little fine sand, trace fine gravel, trace fine organic matter (rootlets), medium dense
2.0	-2.0 2.0	***Silty Sand with Gravel*** Tan, moist, mostly low plasticity fines, some subangular gravel, little fine sand,trace organic matter medium dense, loose when disturbed, no odors
		Wood wood, organic matter
		Sandy Lean Clay with gravel Greyish black, moist, mostly medium plasticity fines, some subrounded gravel, petroleum-like odors
7.0	-8.0 8.0	***Well sorted gravel with sand*** Grey, wet, mostly well sorted gravel, sone well graded sands, slight petroleum-like odors
	-10.0 10.0	As Above, no odors
12.0		
	-15.0 15.0	End of Borehole
17.0		

SAMPLE

Sample No.	SPT N-Value	Recovery (ft)	PID VOCs ppm	Lab Sample
S1	18	2	16.0	
S2	27	2	40.0	
S3	19	2	1.5	Sample Collected
S4	27	1	0.5	
S5	18	1	0.1	
S6	15	1.5	0.0	



Well Completion Details or Remarks



Drilled By: Nature's Way Drilling
Drill Rig Type: Diedrich D50 Track Mounted Drill Rig
Drill Method: 4.25-inch HSA w/ Continuous 2" Split Spoon
Comments:
Drill Date(s): 6/22/18

Hole Size: 8.5-inch
Stick-up: 3'
Datum: NAVD 88

Sheet: 1 of 1

Project No: T0323-020-001

Borehole Number: MW-16

Project: Oregon Road Site

A.K.A.:

Client: Homer Street Properties, LLC

Logged By: CMS

Site Location: Olean, New York

Checked By: MAL

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0635

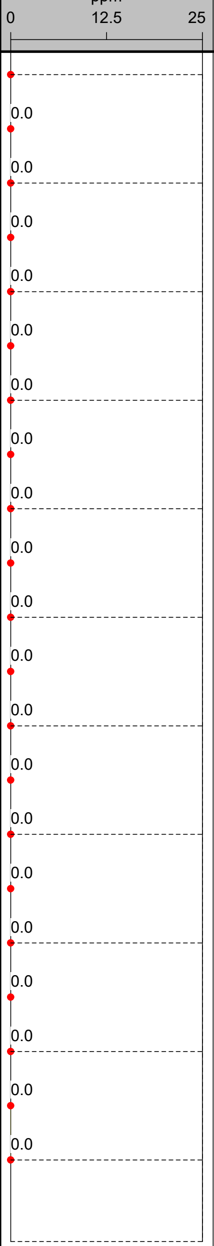
SUBSURFACE PROFILE

Depth (fbgs)	Elev. /Depth	Description (ASTM D2488: Visual-Manual Procedure)
0.0	0.0	Ground Surface
	0.0 0.0	**Asphalt and Subbase**
	-2.0 2.0	**Poorly Graded Sand and Gravel** Brown, moist, mosly fine sand, some sub-rounded gravel, some angular broken rock, no odor.
5.0	-4.0 4.0	**Lean Clay** Grey and reddish brown (mottling), some fine sand and silt, dense, no odor.
	-8.6 8.6	Dark brown sand lens from 8.6-9 fbgs.
10.0	-9.8 9.8	**Poorly Graded Clayey Sand** Reddish brown, moist, mostly fine sand, some medium plastic fines, some sub-rounded gravel, no odor.
	-12.0 12.0	Lean clay lens from 12-12.75 fbgs.
15.0	-12.8 12.8	**Poorly Graded Gravel with Sand** Grey, moist to wet at 16 fbgs, mostly sub-rounded gravel and fine sand, trace medium plastic fines, dense, no odor.
	-16.5 16.5	Lean clay lens from 16.5-17.25 fbgs.
20.0	-20.0 20.0	End of Borehole

SAMPLE

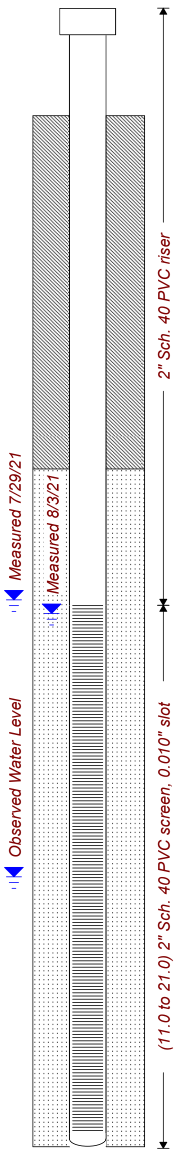
Sample No.	SPT N-Value	Recovery (%)
1		35%
2		100%
3		71%
4		71%
5		65%

PID VOCs



Lab Sample

Well Completion Details or Remarks



Drilled By: Trec Environmental
Drill Rig Type: Geoprobe 6620DT
Drill Method: Direct push and 4.25" auger
Comments:
Drill Date(s): 7/19/21

Hole Size: 8.25"
Stick-up:
Datum:
Sheet: 1 of 1

APPENDIX E

EXCAVATION WORK PLAN

BROWNFIELD CLEANUP PROGRAM SITE MANAGEMENT PLAN

APPENDIX E
EXCAVATION WORK PLAN

OREGON ROAD SITE
NYSDEC SITE NUMBER: C905045
OLEAN, NEW YORK

December 2021 0311-020-001

Prepared for:

Homer Street Properties. LLC
One Blue Bird Square
Olean, New York

Prepared By:

BENCHMARK

In Association With:

TURNKEY
ENVIRONMENTAL
RESTORATION, LLC

SITE MANAGEMENT PLAN
APPENDIX E: EXCAVATION PLAN
Oregon Road Site
BCP Site No. C905045

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E-1 NOTIFICATION

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table 1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information.

Table 1: Notifications*

NYSDEC Project Manager – Region 9 Mr. Benjamin McPherson	716-851-7220 benjamin.mcpherson@dec.ny.gov
NYSDEC Regional HW Engineer – Region 9 Ms. Andrea Caprio, P.E.	716-851-7220 andrea.caprio@dec.ny.gov
NYSDEC Site Control Ms. Kelly Lewandowski, P.E.	518-402-9543 Kelly.lewandowski@dec.ny.gov
NYSDOH Public Health Specialist Ms. Renata Ockerby	518-402-7867 beei@health.ny.gov

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

This notification will include:

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

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

E-2 SOIL SCREENING METHODS

Visual, olfactory and instrument-based (e.g. photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided below.

E-3 SOIL STAGING METHODS

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

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

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

E-4 MATERIALS EXCAVATION AND LOAD-OUT

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

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

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

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

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

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

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

E-5 MATERIALS TRANSPORT OFF-SITE

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

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

Truck transport routes shall be selected to involve the shortest commute through residential neighborhoods as feasible. All trucks loaded with site materials will exit the vicinity of the site using only these approved truck routes. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

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

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

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

E-6 MATERIALS DISPOSAL OFF-SITE

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

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

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

E-7 MATERIALS REUSE ON-SITE

'Reuse on-site' means reuse on-site of material that originates at the site and which does not leave the Site during the excavation. The criteria under which soil/fill originating on-Site may be used on-Site are presented below.

- **Excavated, Non-Impacted On-Site Soil/Fill:** Non-impacted soil/fill (i.e., soil/fill that does not exhibit visible evidence of contamination, and is not grossly contaminated (as described in Part 375), and does not exhibit PID readings that exceed 25 parts per million (ppm) that is excavated from the Site, may be used on-Site as subgrade backfill beneath the cover system without special handling. The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-Site.
- **Excavated, Potentially Impacted on-Site Soil/Fill:** Potentially impacted soil/fill (i.e., soils that exhibit field visual and/or olfactory evidence of contamination, or with elevated PID readings (above 25 ppm) may not be used on-Site unless tested and determined to meet the chemical criteria for Commercial Use SCOs per 6NYCRR Part 375. Potentially impacted material will be segregated, as described above, and sampled to determine acceptance for reuse. The material reuse analyses will be discussed with the Department, and may include those constituents identified in 6NYCRR Part 375 for VOCs, SVOCs, metals, PCBs, pesticides and herbicides, in accordance with applicable USEPA SW846 analytical methodology. Grossly contaminated soil (GCS), defined as soil exhibiting the presence of mobile petroleum product, will be deemed unacceptable for reuse without additional analysis and properly disposed.

The qualified environmental professional will ensure that procedures defined for materials reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. No grossly-impacted materials shall be reused onsite; such materials must be disposed of offsite in accordance with applicable local, state, and federal regulations.

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

E-8 FLUIDS MANAGEMENT

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

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

E-9 COVER SYSTEM RESTORATION

After the completion of soil removal and any other invasive activities the cover system will be restored in a manner that complies with the RAWP. The existing cover system is comprised of a minimum of 12-inches of clean soil/stone or hardscape, including asphalt pavement, concrete covered sidewalks and buildings. The demarcation layer, consisting of orange snow fencing or similar material will be placed to provide a visual reference to the top of the remaining contamination zone, the zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface type will be included in the subsequent Periodic Review Report and in an updated SMP.

E-10 BACKFILL FROM OFF-SITE SOURCES

All materials proposed for import onto the site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the site. A Request to Import/Reuse Fill or Soil form, which can be found at

http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

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

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d).

The criteria under which off-site material may be used as backfill are presented below.

- **Off-Site Soil/Fill:** Off-Site soil/fill may be used as backfill provided that it originates from known sources having no evidence of disposal or releases of hazardous substances; hazardous, toxic or radioactive wastes; or petroleum, and is tested and meet all of the criteria in accordance with Appendix 5 of DER-10 for a Commercial Use Site. In addition, no off-Site materials meeting the definition of a solid waste as defined in 6 NYCRR, Part 360-1.2 (a) shall be used as backfill.
- **Other Off-Site Material:** Material other than soil may be imported as backfill, without chemical testing, provided it contains less than 10% (by weight) material that would pass through a size 80 sieve: 1) Rock or stone, consisting of virgin material from a permitted mine or quarry; 2) Recycled concrete, brick, or asphalt from a NYSDEC-registered or permitted C&D debris processing facility (as specified in Section 360-16.1 of 6 NYCRR Part 360) that conforms to Section 304 of the New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002). As stated in Section 360-16.4(b)(2), the facility may only accept recognizable, uncontaminated, non-pulverized C&D debris or C&D debris from other authorized C&D processing facilities. According to Section 360-16.2(c), "uncontaminated" means C&D debris that is not mixed or commingled with other solid waste at the point of generation, processing, or disposal, and that is not contaminated with spills of a petroleum product, hazardous waste, or industrial waste.

Off-Site borrow soils shall be tested to assure conformance with the criteria identified above. If an off-Site soil/fill borrow source is of unknown origin or originates from a commercial or urban site, then a tiered approach based on the volume of impacted soil/fill being excavated will be used to determine the frequency of characterization sampling in accordance with DER-10, Section 5.4 and Table 5.4(e)10.

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

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

E-11 STORMWATER POLLUTION PREVENTION

If future site activities include large excavation, details of storm water pollution prevention will be included in the applicable notification provided to the Department. If required by the Department as part of the planned future excavation activities, barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the site and available for inspection by the NYSDEC. All necessary repairs shall be made immediately.

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

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

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

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

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

E-12 EXCAVATION CONTINGENCY PLAN

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

Sampling will be performed on product, sediment and surrounding soils, etc. as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed in accordance with 6NYCRR Part 375 and consultation with the Department.

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

E-13 COMMUNITY AIR MONITORING PLAN

The Community Air Monitoring Plan (CAMP) will follow the guidance provided in the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan found in Appendix 1A of NYSDEC's DER-10 *Technical Guidance for Site Investigation and Remediation*. The CAMP for this Site is included as Attachment C of the HASP (see Appendix F). The CAMP will be implemented for all intrusive activities beneath the cover system performed at the site. The upwind and downwind monitoring locations required in the generic CAMP will be determined based on the prevailing wind direction at the start of work. Air sampling locations will be adjusted on a daily or more frequent basis based on actual wind directions and work locations. VOC monitoring will be performed using a PID or other equipment that is capable of calculating 15-minute running average concentrations. All air monitoring equipment will be calibrated at least daily. The 15-minute average concentration will be compared to the levels specified below.

Alternatively, the upwind monitoring location may be removed, as long as the background contribution is considered to be 0.0 ppm.

E-14 ODOR CONTROL PLAN

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include: limiting exposed face of the excavation area, reduction in work hours and/or specific work activities (e.g. load out of material), proof rolling excavation, and application of odor control agents (e.g. spray-foam).

If nuisance odors are identified at the site boundary, or if odor complaints are received, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation

Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

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

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

E-15 DUST CONTROL PLAN

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

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.
- Covering or proof-rolling excavated areas and materials after excavation activity ceases.
- Reducing the excavation size and/or number of excavations

E-16 OTHER NUISANCES

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

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

APPENDIX F

HEALTH AND SAFETY PLAN (HASP)
COMMUNITY AIR MONITORING PLAN (CAMP)

SITE HEALTH AND SAFETY PLAN
for
BROWNFIELD CLEANUP PROGRAM REMEDIAL ACTIVITIES

OREGON ROAD SITE
BCP SITE NO. C 905045
OLEAN, NEW YORK

December 2021 T0311-020-001

Prepared for:

Homer Street Properties, LLC

Prepared By:

BENCHMARK

Benchmark Civil/Environmental Engineering & Geology, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
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In Association With:

TURNKEY ENVIRONMENTAL RESTORATION, LLC

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2558 Hamburg Turnpike, Suite 300
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OREGON ROAD SITE
BCP SITE NO. C905045
HEALTH AND SAFETY PLAN FOR REMEDIAL ACTIVITIES

ACKNOWLEDGEMENT

Plan Reviewed by (initial):

Corporate Health and Safety Director: Thomas H. Forbes, P.E.

Project Manager: Michael A. Lesakowski

Designated Site Safety and Health Officer: Lori E. Riker

Acknowledgement:
I acknowledge that I have reviewed the information contained in this site-specific Health and Safety Plan, and understand the hazards associated with performance of the field activities described herein. I agree to comply with the requirements of this plan.

NAME (PRINT)	SIGNATURE	DATE

OREGON ROAD SITE
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HEALTH AND SAFETY PLAN FOR REMEDIAL ACTIVITIES

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1.0 INTRODUCTION

1.1 General

In accordance with OSHA requirements contained in 29 CFR 1910.120, this Health and Safety Plan (HASP) describes the specific health and safety practices and procedures to be employed by Benchmark Civil/Environmental Engineering & Geology, PLLC and TurnKey Environmental Restoration, LLC employees (referred to jointly hereafter as "Benchmark-TurnKey") during Site Management (SM) activities at the Oregon Road Site (Site) located in Olean, Cattaraugus County, New York. This HASP presents procedures for Benchmark-TurnKey employees who will be involved with SM field activities; it does not cover the activities of other contractors, subcontractors, or other individuals on the Site. These firms will be required to develop and enforce their own HASPs as discussed in Section 2.0. Benchmark-TurnKey accepts no responsibility for the health and safety of contractor, subcontractor, or other personnel.

This HASP presents information on known Site health and safety hazards using available historical information, and identifies the equipment, materials and procedures that will be used to eliminate or control these hazards. Environmental monitoring will be performed during the course of field activities to provide real-time data for on-going assessment of potential hazards.

1.2 Background

The Site consists of two parcels, located at the northwest corner of Oregon Road and Homer Street (Tax ID No. 94.001-2-13.2 and 94.001-2-13.8), totaling approximately ±24.57 acres, located in the Town of Olean, Cattaraugus County, New York. The Site is currently vacant with green areas and paved asphalt access road.

The Site was used for oil storage from at least the late 1800s, likely associated with the former Vacuum Oil and subsequently Standard Oil refiner in Olean. The tanks appear to have been removed in the 1960s. Historically, nearby adjacent properties were also developed and used in association with oil refining operations and petroleum storage. The Site is currently vacant land.

1.3 Known and Suspected Environmental Conditions

Previous investigations confirmed that historic operation as an oil storage facility have impacted that Site, which required remediation prior to redevelopment. Previous investigation findings include:

- On-Site soil/fill materials are impacted with arsenic and semi-volatile organic compounds (SVOC) tentatively identified compounds above (TICs) exceeding Part 375 Commercial Soil Cleanup Objectives (CSCOs). Per- and polyfluoroalkyl substances (PFAS) were identified on-site, concentrations proximate wells MW-12 and MW-13 were an order of magnitude higher than other locations. Synthethis precipitating leaching procedure (SPLP) concentrations at these two locations also exceeded the NYSDEC guidance levels.

The Remedial Investigation (RI) was performed in support of the BCP to determine the nature and extent of impacts from these known and suspect environmental conditions on this parcel. Findings of the RI include:

Underground Piping Assessment

Apparent abandoned underground petroleum piping was encountered in several test pits during the RI. Most of the piping was found on the northern and eastern portions of the Site; however, additional piping was found on the southern portion of the Site. Pipe diameters ranged between 4 and 8-inches.

Due to many of the encountered pipes being formerly cut off or capped with metal plating, most of the pipes were tapped and found to be empty. One sample of liquid pipe contents was collected for waste characterization and was not characteristically hazardous. The following compounds were detected: 1,2,4-trimethylbenzene (39 ug/L), benzene (4.88 ug/L), and cyclohexane (108 ug/L), methylcyclohexane (111 ug/L); and the liquid was not ignitable (flashpoint>200 degrees F) or corrosive (pH = 5.78 SU)

Groundwater

During the historic and RI sampling event, petroleum-like odors were noted in monitoring wells MW-1 through MW-4, MW-6, MW-8, MW-9, and MW-11. Apparent petroleum product was observed floating on the water during drilling of historic temporary well MW-2. Petroleum impacts observed in the groundwater monitoring wells is reasonably attributable to the GCS present on-site.

VOC-TICs were detected up to 334 ug/L and SVOC-TICs were detected up to 3,946 ug/L indicating weather petroleum impacts. PFAS were detected at concentrations exceeding action levels at MW-10, MW-12, and MW-13.

1.4 Parameters of Interest

Based on the previous investigations, previous Site uses, and RA activities, constituents of potential concern (COPCs) in soil and groundwater at the Site include:

- **Subsurface Soil/Fill –** GCS, arsenic, SVOCs, and PFAS.
- **Groundwater –** VOCs plus TICs, SVOCs plus TICs and PFAS.

1.5 Overview of Remedial Activities

Benchmark-TurnKey personnel was on-site to observe and perform remedial activities in accordance with the Department-approved RAWP. The field activities completed as part of the remedial are described below.

1. Removal and disposal/recycling of approximately 4,188 linear feet (LF) of subsurface piping. Extraction and proper disposal off-site the contents of the piping. Piping extending beyond the property line were cut, capped, and located by GPS.
2. Excavation and off-site disposal of approximately 33,768 tons of GCS and approximately 816 tons of SVOC-impacted soil/fill to meet SSALs.
3. Stabilization of PFAS-impacted soil/fill in-situ to meet NYSDEC leachability guidance levels.
4. Installation of an activated liquid carbon barrier downgradient of well MW-12 to address PFAS-impacted groundwater. Installation of monitoring well MW-16 downgradient of the activated liquid carbon barrier.
5. Management of impacted groundwater and stormwater during remedial activities.
6. Reconstruction the portion of the on-site tributary that flows into Two Mile Creek proximate the GCS area and restoration to either its previously existing condition or a state that provides improved habitat.
7. Re-grading the Site to improve redevelopment opportunities and raising the on-site tributary to Two Mile Creek top-of-bank grades to reduce potential flooding.
8. Waste characterization sampling.
9. Post-excavation sampling.
10. Soil/stone cover placement.
11. Implementation of the Site Management Plan (SMP). The SMP includes:
    a. Institutional Controls and Engineering Controls (IC/EC) Engineering controls include any physical barrier or method employed to actively or passively contain, stabilize, or monitor contaminants; restrict the movement of contaminants; or eliminate potential exposure pathways to contaminants.

Institutional controls at the site will include groundwater use restrictions and land use restrictions of the Site to Commercial use;

b. Excavation Work Plan to assure that future intrusive activities and soil/fill handling at the Site are completed in a safe and environmentally responsible manner;

c. Site Monitoring Plan that includes: provisions for a Site-wide inspection program to assure that the IC/ECs have not been altered and remain effective; and,

d. Environmental Easement filed with Cattaraugus County.

2.0 ORGANIZATIONAL STRUCTURE

This section of the HASP describes the lines of authority, responsibility, and communication as they pertain to health and safety functions at the Site. The purpose of this chapter is to identify the personnel who impact the development and implementation of the HASP and to describe their roles and responsibilities. This chapter also identifies other contractors and subcontractors involved in work operations and establish the lines of communications among them for health and safety matters. The organizational structure described in this chapter is consistent with the requirements of 29 CFR 1910.120(b)(2). This section will be reviewed by the Project Manager and updated as necessary to reflect the current organizational structure at this Site.

2.1 Roles and Responsibilities

Benchmark-TurnKey personnel on the Site must comply with the minimum requirements of this HASP. The specific responsibilities and authority of management, safety and health, and other personnel on this Site are detailed in the following paragraphs.

2.1.1 Corporate Health and Safety Director

The Benchmark-TurnKey Corporate Health and Safety Director is ***Mr. Thomas H. Forbes, P.E.*** The Corporate Health and Safety Director responsible for developing and implementing the Health and Safety program and policies for Benchmark Civil/Environmental Engineering & Geology, PLLC and TurnKey Environmental Restoration, LLC, and consulting with corporate management to ensure adequate resources are available to properly implement these programs and policies. The Corporate Health and Safety Director coordinates Benchmark-TurnKey's Health and Safety training and medical monitoring programs and assists project management and field staff in developing site-specific health and safety plans.

2.1.2 Project Manager

The Project Manager for this Site is ***Mr. Michael A. Lesakowski.*** The Project Manager has the responsibility and authority to direct all Benchmark-TurnKey work operations at the Site. The Project Manager coordinates safety and health functions with the Site Safety and Health Officer, and bears ultimate responsibility for proper implementation of this HASP. He may delegate authority to expedite and facilitate any application of the program, including modifications to the overall project approach as necessary to circumvent unsafe work conditions. Specific duties of the Project Manager include:

- Preparing and coordinating the Site work plan.
- Providing Benchmark-TurnKey workers with work assignments and overseeing their performance.
- Coordinating health and safety efforts with the Site Safety and Health Officer (SSHO).
- Reviewing the emergency response coordination plan to assure its effectiveness.
- Serving as the primary liaison with Site contractors and the property owner.

2.1.3 Site Safety and Health Officer

The Site Safety and Health Officer (SSHO) for this Site is ***Ms. Lori Riker***. The SSHO reports to the Project Manager. The SSHO is on-site or readily accessible to the Site during work operations and has the authority to halt Site work if unsafe conditions are detected. The specific responsibilities of the SSHO are:

- Managing the safety and health functions for Benchmark-TurnKey personnel on the Site.
- Serving as the point of contact for safety and health matters.
- Ensuring that Benchmark-TurnKey field personnel working on the Site have received proper training (per 29 CFR Part 1910.120€), that they have obtained medical clearance to wear respiratory protection (per 29 CFR Part 1910.134), and that they are properly trained in the selection, use and maintenance of personal protective equipment, including qualitative respirator fit testing.
- Performing or overseeing Site monitoring as required by the HASP.
- Assisting in the preparation and review of the HASP.
- Maintaining site-specific safety and health records as described in this HASP.
- Coordinating with the Project Manager, Site Workers, and Contractor’s SSHO as necessary for safety and health efforts.

2.1.4 Site Workers

Site workers are responsible for: complying with this HASP or a more stringent HASP, if appropriate (i.e., Contractor and Subcontractor’s HASP); using proper PPE;

reporting unsafe acts and conditions to the SSHO; and following the safety and health instructions of the Project Manager and SSHO.

2.1.5 Other Site Personnel

Other Site personnel who will have health and safety responsibilities will include the construction and redevelopment contractor, who will be responsible for developing, implementing, and enforcing a Health and Safety Plan equally stringent or more stringent than Benchmark-TurnKey's HASP. Benchmark-TurnKey assumes no responsibility for the health and safety of anyone outside its direct employ. Each Contractor's HASP shall cover all non- Benchmark/TurnKey Site personnel. Each Contractor shall assign a SSHO who will coordinate with Benchmark-TurnKey's SSHO as necessary to ensure effective lines of communication and consistency between contingency plans.

In addition to Benchmark-TurnKey and Contractor personnel, other individuals who may have responsibilities in the work zone include subcontractors and governmental agencies performing Site inspection work (i.e., the New York State Department of Environmental Conservation (NYSDEC)). The Contractor shall be responsible for ensuring that these individuals have received OSHA-required training (29 CFR 1910.120€), including initial, refresher and site-specific training, and shall be responsible for the safety and health of these individuals while they are on-site.

3.0 HAZARD EVALUATION

Due to the presence of certain contaminants at the Site, the possibility exists that workers will be exposed to hazardous substances during field activities. The principal points of exposure would be through direct contact with and incidental ingestion of soil, and through the inhalation of contaminated particles or vapors. Other points of exposure may include direct contact with groundwater. In addition, the use of drilling and/or medium to large-sized construction equipment (e.g., excavator) will also present conditions for potential physical injury to workers. Further, since work will be performed outdoors, the potential exists for heat/cold stress to impact workers, especially those wearing protective equipment and clothing. Adherence to the medical evaluations, worker training relative to chemical hazards, safe work practices, proper personal protection, environmental monitoring, establishment work zones and Site control, appropriate decontamination procedures and contingency planning outlined herein will reduce the potential for chemical exposures and physical injuries.

3.1 Chemical Hazards

As discussed in Section 1.3, historic activities have potentially resulted in impacts to Site soils and groundwater. Table 1 lists exposure limits for airborne concentrations of the COPCs identified in Section 1.4 of this HASP. Brief descriptions of the toxicology of the prevalent COPCs and related health and safety guidance and criteria are provided below.

1. **Polycyclic Aromatic Hydrocarbons (PAHs)** are formed as a result of the pyrolysis and incomplete combustion of organic matter such as fossil fuel. PAH aerosols formed during the combustion process disperse throughout the atmosphere, resulting in the deposition of PAH condensate in soil, water and on vegetation. In addition, several products formed from petroleum processing operations (e.g., roofing materials and asphalt) also contain elevated levels of PAHs. Hence, these compounds are widely dispersed in the environment. PAHs are characterized by a molecular structure containing three or more fused, unsaturated carbon rings. Seven of the PAHs are classified by USEPA as probable human carcinogens (USEPA Class B2). These are benzo(a)pyrene; benzo(a)anthracene; benzo(b)fluoranthene; benzo(k) fluoranthene; chrysene; dibenz(a,h)anthracene; and indeno(1,2,3-cd)pyrene. The primary route of exposure to PAHs is through incidental ingestion and inhalation of contaminated particulates. PAHs are characterized by an organic odor, and exist as oily liquids in pure form. Acute exposure symptoms may include acne-type blemishes in areas of the skin exposed to sunlight.

2. **Petroleum Hydrocarbons:**
   - **2-Butonone (MEK) (CAS #78-93-3)** is a colorless fairly volatile liquid with a pleasant pungent odor. Acute inhalation exposure to MEK in humans results in irritation to the eyes, nose, and throat. Limited information is available on the chronic (long-term) effects of MEK in humans; chronic inhalation studies in animals have reported slight neurological, liver, kidney, and respiratory effects.
   - **1,3,5-Trimethylbenzene (CAS #108-67-8)** is a colorless, odorless flammable liquid. The substance is irritating to the eyes, the skin and the respiratory tract. If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis. The substance may cause effects on the central nervous system.
   - **Isopropylbenzene (CAS #98-82-8)** is a colorless, gasoline-like odor flammable liquid. Acute exposure typically results in irritation of the eyes, mucous membranes and upper respiratory tract. Can be absorbed through the skin. Possible central nervous system depressant. Symptoms may include irritation, dizziness, nausea, lack of coordination and narcosis.
   - **N-Propylbenzene (CAS #103-65-1)** is a colorless to pale yellow flammable liquid. Inhalation or contact may irritate or burn skin and eyes. In case fire, smoke-vapor may produce irritating, corrosive and/or toxic gases. Vapors may cause dizziness or suffocation.
   - **Benzene (CAS #71-43-2)** is a clear, colorless, highly flammable and volatile liquid with a sweet gasoline-like odor. Exposure to benzene causes neurological symptoms and affects the bone marrow causing aplastic anemia, excessive bleeding and damage to the immune system. Benzene is a known human carcinogen and is linked to an increased risk of developing lymphatic and hematopoietic cancers, acute myelogenous leukemia, as well as chronic lymphocytic leukemia.
   - **Ethylbenzene (CAS #100-41-4)** is a component of automobile gasoline. Over-exposure may cause kidney, skin liver and/or respiratory disease. Signs of exposure may include dermatitis, irritation of the eyes and mucus membranes, headache. Narcosis and coma may result in more severe cases.
   - **Toluene (CAS #108-88-3)** is a common component of paint thinners and automobile fuel. Acute exposure predominantly results in central nervous system depression. Symptoms include headache, dizziness, fatigue, muscular weakness, drowsiness, and coordination loss. Repeated exposures may cause removal of lipids from the skin, resulting in dry, fissured dermatitis.
   - **Xylenes (o, m, and p) (CAS #95-47-6, 108-38-3, and 106-42-3)** are colorless, flammable liquids present in paint thinners and fuels. Acute exposure may cause central nervous system depression, resulting in headache, dizziness, fatigue, muscular weakness, drowsiness, and coordination loss. Repeated exposures may also cause removal of lipids from the skin, producing

dry, fissured dermatitis. Exposure of high concentrations of vapor may cause eye irritation and damage, as well as irritation of the mucus membranes.

3. **Arsenic (CAS #7440-38-2)** is a naturally occurring element and is usually found combined with one or more elements, such as oxygen or sulfur. Inhalation is a more important exposure route than ingestion. First phase exposure symptoms include nausea, vomiting, diarrhea, and pain in the stomach. Prolonged contact is corrosive to the skin and mucus membranes. Arsenic is considered a Group A human carcinogen by the USEPA. Exposure via inhalation is associated with an increased risk of lung cancer. Exposure via the oral route is associated with an increased risk of skin cancer.

4. **Per- and Polyfluoroalkyl Substances (PFAS)** are a family of human-made chemicals that are found in a wide range of products used by consumers and industry. PFAS have been used in a variety of applications including stain- and water-resistant fabrics and carpeting, cleaning products, paints, and fire-fighting foams. While the science surrounding potential health effects of PFAS is developing, current evidence suggests that the bioaccumulation of certain PFAS may cause serious health conditions.

With respect to the anticipated remedial activities discussed in Section 1.5, possible routes of exposure to the above-mentioned contaminants are presented in Table 2. The use of proper respiratory equipment, as outlined in Section 8.0 of this HASP, will minimize the potential for exposure to airborne contamination. Exposure to contaminants through dermal and other routes will also be minimized through the use of protective clothing (Section 8.0), safe work practices (Section 6.0), and proper decontamination procedures (Section 13.0).

3.2 Physical Hazards

Remedial field activities at the Oregon Road Site may present the following physical hazards:

- Physical injury during heavy construction equipment use, such as backhoes, excavators, and drilling equipment.
- Heat/cold stress to employees during the summer/winter months (see Section 11).
- Slip and fall injuries due to rough, uneven terrain and/or open excavations.

These hazards represent only some of the possible means of injury that may be present during remedial operations and sampling activities at the Site. Since it is impossible to list all potential sources of injury, it shall be the responsibility of each individual to exercise proper care and caution during all phases of the work.

4.0 TRAINING

4.1 Site Workers

Personnel performing remedial activities at the Site (such as, but not limited to, equipment operators and general laborers) and who may be exposed to hazardous substances, health hazards, or safety hazards and their supervisors/managers responsible for the Site shall receive training in accordance with 29 CFR 1910.120(e) before they are permitted to engage in operations in the exclusion zone or contaminant reduction zone. This training includes an initial 40-hour Hazardous Waste Site Worker Protection Course, an 8-hour Annual Refresher Course subsequent to the initial 40-hour training, and 3 days of actual field experience under the direct supervision of a trained, experienced supervisor. Additional site-specific training shall also be provided by the SSHO prior to the start of field activities. A description of topics to be covered by this training is provided below.

4.1.1 Initial and Refresher Training

Initial and refresher training is conducted by a qualified instructor as specified under OSHA 29 CFR 1910.120(e)(5) and is specifically designed to meet the requirements of OSHA 29 CFR 1910.120(e)(3) and 1910.120(e)(8). The training covers, as a minimum, the following topics:

- OSHA HAZWOPER regulations.
- Site safety and hazard recognition, including chemical and physical hazards.
- Medical monitoring requirements.
- Air monitoring, permissible exposure limits, and respiratory protection level classifications.
- Appropriate use of personal protective equipment (PPE), including chemical compatibility and respiratory equipment selection and use.
- Work practices to minimize risk.
- Work zones and Site control.
- Safe use of engineering controls and equipment.
- Decontamination procedures.
- Emergency response and escape.

- Confined space entry procedures.
- Heat and cold stress monitoring.
- Elements of a Health and Safety Plan.
- Spill containment.

Initial training also incorporates workshops for PPE and respiratory equipment use (Levels A, B and C), and respirator fit testing. Records and certification received from the course instructor documenting each employee's successful completion of the training identified above are maintained on file at Benchmark-TurnKey's Buffalo, NY office. Contractors and Subcontractors are required to provide similar documentation of training for all their personnel who will be involved in on-site work activities.

Any employee who has not been certified as having received health and safety training in conformance with 29 CFR 1910.120(e) is prohibited from working in the exclusion and contamination reduction zones, or to engage in any on-site work activities that may involve exposure to hazardous substances or wastes.

4.1.2 Site Training

Site workers are given a copy of the HASP and provided a site-specific briefing prior to the commencement of work to ensure that employees are familiar with the HASP and the information and requirements it contains. The Site briefing shall be provided by the SSHO prior to initiating field activities and shall include:

- Names of personnel and alternates responsible for Site safety and health.
- Safety, health and other hazards present on the Site.
- The site lay-out including work zones and places of refuge.
- The emergency communications system and emergency evacuation procedures.
- Use of PPE.
- Work practices by which the employee can minimize risks from hazards.
- Safe use of engineering controls and equipment on the site.
- Medical surveillance, including recognition of symptoms and signs of over-exposure as described in Chapter 5 of this HASP.
- Decontamination procedures as detailed in Chapter 12 of this HASP.

- The emergency response plan as detailed in Chapter 15 of this HASP.
- Confined space entry procedures, if required, as detailed in Chapter 13 of this HASP.
- The spill containment program as detailed in Chapter 9 of this HASP.
- Site control as detailed in Chapter 11 of this HASP.

Supplemental health and safety briefings will also be conducted by the SSHO on an as-needed basis during the course of the work. Supplemental briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing Site characterization and analysis. Conditions for which the SSHO may schedule additional briefings include, but are not limited to: a change in Site conditions (e.g., based on monitoring results); changes in the work schedule/plan; newly discovered hazards; and safety incidents occurring during Site work.

4.2 Supervisor Training

On-site safety and health personnel who are directly responsible for or who supervise the safety and health of workers engaged in hazardous waste operations (i.e., SSHO) shall receive, in addition to the appropriate level of worker training described in Section 4.1, above, 8 additional hours of specialized supervisory training, in compliance with 29 CFR 1910.120(e)(4).

4.3 Emergency Response Training

Emergency response training is addressed in Appendix A of this HASP, Emergency Response Plan.

4.4 Site Visitors

Each Contractor's SSHO will provide a site-specific briefing to Site visitors and other non- Benchmark-TurnKey personnel who enter the Site beyond the Site entry point. The site-specific briefing will provide information about Site hazards, the Site layout including work zones and places of refuge, the emergency communications system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

Site visitors will not be permitted to enter the exclusion zone or contaminant reduction zones unless they have received the level of training required for Site workers as described in Section 4.1.

5.0 MEDICAL MONITORING

Medical monitoring examinations are provided to Benchmark-TurnKey employees as stipulated under 29 CFR Part 1910.120(f). These exams include initial employment, annual and employment termination physicals for Benchmark-TurnKey employees involved in hazardous waste site field operations. Post-exposure examinations are also provided for employees who may have been injured, received a health impairment, or developed signs or symptoms of over-exposure to hazardous substances or were accidentally exposed to substances at concentrations above the permissible exposure limits without necessary personal protective equipment. Such exams are performed as soon as possible following development of symptoms or the known exposure event.

Medical evaluations are performed by Health Works, an occupational health care provider under contract with Benchmark-TurnKey. Health Works is located in Seneca Square Plaza, 1900 Ridge Road, West Seneca, New York 14224. The facility can be reached at (716) 823-5050 to schedule routine appointments or post-exposure examinations.

Medical evaluations are conducted according to the Benchmark-TurnKey Medical Monitoring Program and include an evaluation of the workers' ability to use respiratory protective equipment. The examinations include:

- Occupational/medical history review.
- Physical exam, including vital sign measurement.
- Spirometry testing.
- Eyesight testing.
- Audio testing (minimum baseline and exit, annual for employees routinely exposed to greater than 85db).
- EKG (for employees >40 years age or as medical conditions dictate).
- Chest X-ray (baseline and exit, and every 5 years).
- Blood biochemistry (including blood count, white cell differential count, serum multiplastic screening).
- Medical certification of physical requirements (i.e., sight, musculoskeletal, cardiovascular) for safe job performance and to wear respiratory protection equipment.

The purpose of the medical evaluation is to determine an employee's fitness for duty on hazardous waste sites; and to establish baseline medical data.

In conformance with OSHA regulations, Benchmark-TurnKey will maintain and preserve medical records for a period of 30 years following termination of employment. Employees are provided a copy of the physician's post-exam report, and have access to their medical records and analyses.

6.0 SAFE WORK PRACTICES

Benchmark-TurnKey employees shall conform to the following safe work practices during on-site work activities conducted within the exclusion and contamination reduction zones:

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth contact is strictly prohibited.
- The hands and face must be thoroughly washed upon leaving the work area and prior to engaging in any activity indicated above.
- Respiratory protective equipment and clothing must be worn by all personnel entering the Site as required by the HASP or as modified by the Site safety officer. Excessive facial hair (i.e., beards, long mustaches, or sideburns) that interferes with the satisfactory respirator-to-face seal is prohibited.
- Contact with surfaces/materials either suspected or known to be contaminated will be avoided to minimize the potential for transfer to personnel, cross contamination and need for decontamination.
- Medicine and alcohol can synergize the effects of exposure to toxic chemicals. Due to possible contraindications, use of prescribed drugs should be reviewed with the Benchmark-TurnKey occupational physician. Alcoholic beverage and illegal drug intake are strictly forbidden during the workday.
- Personnel shall be familiar with standard operating safety procedures and additional instructions contained in this Health and Safety Plan.
- On-site personnel shall use the “buddy” system. No one may work alone (i.e., out of earshot or visual contact with other workers) in the exclusion zone.
- Personnel and equipment in the contaminated area shall be minimized, consistent with effective Site operations.
- Employees have the obligation to immediately report and if possible, correct unsafe work conditions.
- Use of contact lenses on-site will not be permitted. Spectacle kits for insertion into full-face respirators will be provided for Benchmark-TurnKey employees, as requested and required.

The recommended specific safety practices for working around the contractor’s equipment (e.g., backhoes, bulldozers, excavators, drill rigs etc.) are as follows:

- Although the Contractor and subcontractors are responsible for their equipment and safe operation of the Site, Benchmark-TurnKey personnel are also responsible for their own safety.
- Subsurface work will not be initiated without first clearing underground utility services.
- Heavy equipment should not be operated within 20 feet of overhead wires. This distance may be increased if windy conditions are anticipated or if lines carry high voltage. The Site should also be sufficiently clear to ensure the project staff can move around the heavy machinery safely.
- Care should be taken to avoid overhead wires when moving heavy-equipment from location to location.
- Hard hats, safety boots and safety glasses should be worn in the vicinity of heavy equipment. Hearing protection is also recommended.
- The work Site should be kept neat. This will prevent personnel from tripping and will allow for fast emergency exit from the Site.
- Proper lighting must be provided when working at night.
- Construction activities should be discontinued during an electrical storm or severe weather conditions.
- The presence of combustible gases should be checked before igniting any open flame.
- Personnel shall stand upwind of any construction operation when not immediately involved in sampling/logging/observing activities.
- Personnel will not approach the edge of an unsecured trench/excavation closer than two feet.

7.0 COVID-19 SAFE WORK PROCEDURES

All Benchmark -TurnKey employees shall conform to the following daily protocols during all on-site work activities for the duration of the COVID-19 outbreak:

- Benchmark/TurnKey personnel shall complete and electronically submit to the corporate Health and Safety Director and/or his designee the daily health assessment form included as Attachment D. Any positive responses shall require evaluation prior to reporting for work.
- Visitors shall complete a paper copy of the health assessment form included in Attachment D prior to accessing the work area or field trailer. The form shall be completed in advance when possible; otherwise it shall be completed in the visitors personal vehicle or outside the work area with instruction that any positive responses require evaluation by Benchmark's corporate Health and Safety Director prior to allowing access to the Site. A visitor sign-in sheet will be filled out and maintained, with visitor health assessment forms, in the field trailer.
- Benchmark-TurnKey will ensure that there is an adequate supply of personal protective equipment (PPE), hand washing, and disinfecting chemicals at the Site. Supplies will be checked on a regular basis to avoid running out.
- All Benchmark-TurnKey employees must comply with the minimum 6-foot social distancing whenever possible. When this cannot be accomplished, PPE (masks; gloves and eye protection as needed) will be worn. Pre-shift or tailgate meetings will be held in a space large enough that employees can be 6 feet apart.
- For use in reducing exposure to COVID-19 the following face masks shall be used inside of equipment cabs and in the trailer:
    - Disposable surgical masks
    - KN-95
    - N-95
    - Self-made face mask provided it covers the nose and mouth
- All shared spaces, tools and equipment will be disinfected at a minimum of once per shift or at the beginning and end of each shift or before equipment or space is shared by another employee. Heavy equipment and vehicles

should also be disinfected at a minimum of the same frequency. This includes steering wheels, door handles, and all controls. Disinfection can be accomplished with a variety of different chemicals. Disinfectant wipes (ex. Chlorox wipes) or spray (ex. Lysol) are acceptable as is 70% alcohol or bleach solution (1/4 cup bleach to 1-gallon water). Nitrile gloves and safety glasses are required during the handing of disinfection chemicals. At no time is it permitted to mix cleaning chemicals. Only one cleaner is to be used at a time. The CDC guidance on cleaning hard, non-porous surfaces is included below:

  - Follow labeled instructions on all containers.
  - Clean surface with soap and water to remove all visible debris and stains.
  - Rinse surface with clean water and wipe with clean towel.
  - Apply the disinfectant. To effectively kill the virus, make sure the surface stays wet with the disinfectant for at least 10 minutes before wiping with a clean towel.
  - Rinse with water and allow surface to air dry.
  - Remove gloves and discard.
  - Wash hands after removing gloves and handling any contaminated material, trash, or waste.

- Social distancing practices will be followed, and masks will be worn at all times if more than one person is inside the field trailer. A portable restroom will be set up on-site for Benchmark-TurnKey employee use. All surfaces in the field trailer and portable restroom will be disinfected at a minimum of once per shift or at the beginning and end of each shift or before equipment or space is shared by another employee.

8.0 PERSONAL PROTECTIVE EQUIPMENT

8.1 Equipment Selection

Personal protective equipment (PPE) will be donned when work activities may result in exposure to physical or chemical hazards beyond acceptable limits, and when such exposure can be mitigated through appropriate PPE. The selection of PPE will be based on an evaluation of the performance characteristics of the PPE relative to the requirements and limitations of the Site, the task-specific conditions and duration, and the hazards and potential hazards identified at the Site.

Equipment designed to protect the body against contact with known or suspect chemical hazards are grouped into four categories according to the degree of protection afforded. These categories designated A through D consistent with United States Environmental Protection Agency (USEPA) Level of Protection designation, are:

- **Level A:** Should be selected when the highest level of respiratory, skin and eye protection is needed.
- **Level B:** Should be selected when the highest level of respiratory protection is needed, but a lesser level of skin protection is required. Level B protection is the minimum level recommended on initial Site entries until the hazards have been further defined by on-site studies. Level B (or Level A) is also necessary for oxygen-deficient atmospheres.
- **Level C:** Should be selected when the types of airborne substances are known, the concentrations have been measured and the criteria for using air-purifying respirators are met. In atmospheres where no airborne contaminants are present, Level C provides dermal protection only.
- **Level D:** Should not be worn on any Site with elevated respiratory or skin hazards. This is generally a work uniform providing minimal protection.

OSHA requires the use of certain PPE under conditions where an immediate danger to life and health (IDLH) may be present. Specifically, OSHA 29 CFR 1910.120(g)(3)(iii) requires use of a positive pressure self-contained breathing apparatus, or positive pressure air-line respirator equipped with an escape air supply when chemical exposure levels present a substantial possibility of immediate serious injury, illness, or death, or impair the ability to escape. Similarly, OSHA 29 CFR 1910.120(g)(3)(iv) requires donning totally-encapsulating chemical protective suits (with a protection level equivalent to Level A protection) in conditions where skin absorption of a hazardous substance may result in a substantial possibility of immediate serious illness, injury, or death, or impair the ability to escape.

In situations where the types of chemicals, concentrations, and possibilities of contact are unknown, the appropriate level of protection must be selected based on professional experience and judgment until the hazards can be further characterized. The individual components of clothing and equipment must be assembled into a full protective ensemble to protect the worker from site-specific hazards, while at the same time minimizing hazards and drawbacks of the personal protective gear itself. Ensemble components are detailed below for levels A/B, C, and D protection.

8.2 Protection Ensembles

8.2.1 Level A/B Protection Ensemble

Level A/B ensembles include similar respiratory protection; however Level A provides a higher degree of dermal protection than Level B. Use of Level A over Level B is determined by: comparing the concentrations of identified substances in the air with skin toxicity data, and assessing the effect of the substance (by its measured air concentrations or splash potential) on the small area of the head and neck unprotected by Level B clothing. The recommended PPE for level A/B is:

- Pressure-demand, full-face piece self-contained breathing apparatus (MSHA/NIOSH approved) or pressure-demand supplied-air respirator with escape self-contained breathing apparatus (SCBA).
- Chemical-resistant clothing. For Level A, clothing consists of totally-encapsulating chemical resistant suit. Level B incorporates hooded one-or two-piece chemical splash suit.
- Inner and outer chemical resistant gloves.
- Chemical-resistant safety boots/shoes.
- Hardhat.

8.2.2 Level C Protection Ensemble

Level C protection is distinguished from Level B by the equipment used to protect the respiratory system, assuming the same type of chemical-resistant clothing is used. The main selection criterion for Level C is that conditions permit wearing an air-purifying device.

The device (when required) must be an air-purifying respirator (MSHA/NIOSH approved) equipped with filter cartridges. Cartridges must be able to remove the substances encountered. Respiratory protection will be used only with proper fitting, training, and the approval of a qualified individual. In addition, an air-purifying respirator can be used only if: oxygen content of the atmosphere is at least 19.5% in volume; substances are identified and concentrations measured; substances have adequate warning properties; the individual passes a qualitative fit-test for the mask; and an appropriate cartridge/canister is used, and its service limit concentration is not exceeded. Recommended PPE for Level C conditions includes:

- Full-face piece, air-purifying respirator equipped with MSHA and NIOSH approved organic vapor/acid gas/dust/mist combination cartridges or as designated by the SSHO.
- Chemical-resistant clothing (hooded, one or two-piece chemical splash suit or disposable chemical-resistant one-piece suit).
- Inner and outer chemical-resistant gloves.
- Chemical-resistant safety boots/shoes.
- Hardhat.

An air-monitoring program is part of all response operations when atmospheric contamination is known or suspected. It is particularly important that the air be monitored thoroughly when personnel are wearing air-purifying respirators. Continual surveillance using direct-reading instruments is needed to detect any changes in air quality necessitating a higher level of respiratory protection.

8.2.3 Level D Protection Ensemble

As indicated above, Level D protection is primarily a work uniform. It can be worn in areas where only boots can be contaminated, where there are no inhalable toxic substances and where the atmospheric contains at least 19.5% oxygen. Recommended PPE for Level D includes:

- Coveralls.
- Safety boots/shoes.
- Safety glasses or chemical splash goggles.

- Hardhat.
- Optional gloves; escape mask; face shield.

8.2.4 Recommended Level of Protection for Site Tasks

Based on current information regarding both the contaminants suspected to be present at the Site and the various tasks that are included in the remedial activities, the minimum required levels of protection for these tasks shall be as identified in Table 3. These requirements must be followed in addition to the COVID-19 PPE requirements as discussed in Section 7.0.

9.0 EXPOSURE MONITORING

9.1 General

Based on the results of historic sample analysis and the nature of the proposed work activities at the Site, the possibility exists that organic vapors and/or particulates may be released to the air during intrusive construction activities. Ambient breathing zone concentrations may at times, exceed the permissible exposure limits (PELs) established by OSHA for the individual compounds (see Table 1), in which case respiratory protection will be required. Respiratory and dermal protection may be modified (upgraded or downgraded) by the SSHO based upon real-time field monitoring data. Weekly CAMP summary tables will be provided to the NYSDOH project manager on a weekly basis. Both the Department and NYSDOH project managers will be notified of any CAMP exceedances that required corrections actions or shut down of work within one business day.

9.1.1 On-Site Work Zone Monitoring

Benchmark-TurnKey personnel will conduct routine, real-time air monitoring during intrusive construction phases such as excavation, backfilling, drilling, etc. The work area will be monitored at regular intervals using a photoionization detector (PID) and a particulate meter. Observed values will be recorded and maintained as part of the permanent field record.

Additional air monitoring measurements may be made by Benchmark-TurnKey personnel to verify field conditions during subcontractor oversight activities. Monitoring instruments will be protected from surface contamination during use. Additional monitoring instruments may be added if the situations or conditions change. Monitoring instruments will be calibrated in accordance with manufacturer's instructions before use.

Due to the proximity of the GCS excavation to the off-site residential properties, a permanent CAMP station will be located along this portion of the site boundary. The contractor will have an odor and dust suppressant on-site and ready for use during excavation and backfilling activities as soon as odors or particulates are detected.

9.1.2 Off-Site Community Air Monitoring

In addition to on-Site monitoring within the work zone(s), continuous monitoring at the downwind portion of the Site perimeter will be conducted for volatile organic compounds and particulates. Upwind volatile organic compounds will be monitored at the start of each workday and periodically throughout the day. Upwind monitoring for particulates will be continuous while intrusive activities are ongoing. This will provide a real-time method for determination of vapor and/or particulate releases to the surrounding community as a result of ground intrusive investigation work.

Ground intrusive activities are defined in the Generic Community Air Monitoring Plan and attached as Appendix C. Ground intrusive activities include soil/piping excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells. Non-intrusive activities include the collection of soil and sediment samples or the collection of groundwater samples from existing wells. Continuous monitoring is required for ground intrusive activities and periodic monitoring is required for non-intrusive activities. Periodic monitoring consists of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring while bailing a well, and taking a reading prior to leaving a sampling location. This may be upgraded to continuous if the sampling location is in close proximity to individuals not involved in the Site activity (i.e., on a curb of a busy street). The action levels below will be used during periodic monitoring.

9.2 Monitoring Action Levels

9.2.1 On-Site Work Zone Action Levels

The PID, or other appropriate instrument(s), will be used by Benchmark-TurnKey personnel to monitor organic vapor concentrations as specified in this HASP. In addition, fugitive dust/particulate concentrations will be monitored during major soil intrusion (i.e., well/boring installation) using a real-time particulate monitor as specified in this plan. In the absence of such monitoring, appropriate respiratory protection for particulates shall be donned. Sustained readings obtained in the breathing zone may be interpreted (with regard to other Site conditions) as follows for Benchmark-TurnKey personnel:

- Total atmospheric concentrations of unidentified vapors or gases ranging from 0 to 1 ppm above background on the PID) - Continue operations under Level D (see Appendix A).
- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings from >1 ppm to 5 ppm above background on the PID (vapors not

suspected of containing high levels of chemicals toxic to the skin) - Continue operations under Level C (see Appendix A).

- Total atmospheric concentrations of unidentified vapors or gases yielding sustained readings of >5 ppm to 50 ppm above background on the PID - Continue operations under Level B (see Attachment 1), re-evaluate and alter (if possible) construction methods to achieve lower vapor concentrations.
- Total atmospheric concentrations of unidentified vapors or gases above 50 ppm on the PID - Discontinue operations and exit the work zone immediately.

The particulate monitor will be used to monitor respirable dust concentrations during intrusive activities and during handling of Site soil/fill. Action levels based on the instrument readings shall be as follows:

- Less than 50 mg/m3 - Continue field operations.
- 50-150 mg/m3 - Don dust/particulate mask or equivalent
- Greater than 150 mg/m3 - Don dust/particulate mask or equivalent. Initiate engineering controls to reduce respirable dust concentration (viz., wetting of excavated soils or tools at discretion of Site Health and Safety Officer).

Readings from the field equipment will be recorded and documented on the appropriate Project Field Forms. Instruments will be calibrated before use on a daily basis and the procedure will be documented on the appropriate Project Field Forms.

9.2.2 Community Air Monitoring Action Levels

In addition to the action levels prescribed in Section 9.2.1 for Benchmark-TurnKey personnel on-site, the following criteria shall also be adhered to for the protection of downwind receptors consistent with NYSDOH requirements (Appendix C):

o **ORGANIC VAPOR PERIMETER MONITORING:**

- If the sustained ambient air concentration of organic vapors at the downwind perimeter of the exclusion zone exceeds 5 ppm above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the sustained organic vapor decreases below 5 ppm over background, work activities can resume with continued monitoring.

  - If the sustained ambient air concentration of organic vapors at the downwind perimeter of the exclusion zone are greater than 5 ppm over background but less than 25 ppm for the 15-minute average, activities can resume provided that: the organic vapor level 200 feet downwind of the working site or half the distance to the nearest off-site residential or commercial structure, whichever is less, but in no case less than 20 feet, is below 5 ppm over background; and more frequent intervals of monitoring, as directed by the Site Health and Safety Officer, are conducted.
  - If the sustained organic vapor level is above 25 ppm at the perimeter of the exclusion zone for the 15-minute average, the Site Health and Safety Officer must be notified and work activities shut down. The Site Health and Safety Officer will determine when re-entry of the exclusion zone is possible and will implement downwind air monitoring to ensure vapor emissions do not impact the nearest off-site residential or commercial structure at levels exceeding those specified in the ***Organic Vapor Contingency Monitoring Plan*** below. All readings will be recorded and will be available for NYSDEC and New York State Department of Health (NYSDOH) personnel to review.

- **ORGANIC VAPOR CONTINGENCY MONITORING PLAN:**
  - If the sustained organic vapor level is greater than 5 ppm over background 200 feet downwind from the work area or half the distance to the nearest off-site residential or commercial property, whichever is less, all work activities must be halted.
  - If, following the cessation of the work activities or as the result of an emergency, sustained organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest off-site residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest off-site residential or commercial structure (20-foot zone).
  - If efforts to abate the emission source are unsuccessful and if sustained organic vapor levels approach or exceed 5 ppm above background within the 20-foot zone for more than 30 minutes, or are sustained at levels greater than 10 ppm above background for longer than one minute, then the ***Major Vapor Emission Response Plan*** (see below) will automatically be placed into effect.

- **MAJOR VAPOR EMISSION RESPONSE PLAN:**

  Upon activation, the following activities will be undertaken:

  1. All Emergency Response Contacts as listed in this Health and Safety Plan and the Emergency Response Plan (Appendix A) will be advised.
  2. The local police authorities will immediately be contacted by the Site Health and Safety Officer and advised of the situation.

3. Frequent air monitoring will be conducted at 30-minute intervals within the 20-foot zone. If two sustained successive readings below action levels are measured, air monitoring may be halted or modified by the Site Health and Safety Officer.

The following personnel are to be notified in the listed sequence in the event that a Major Vapor Emission Plan is activated:

Responsible Person	Contact	Phone Number
SSHO	Police	911
SSHO	State Emergency Response Hotline	(800) 457-7362

Additional emergency numbers are listed in the Emergency Response Plan included as Appendix A.

o **EXPLOSIVE VAPORS:**

- Sustained atmospheric concentrations of greater than 10% LEL in the work area - Initiate combustible gas monitoring at the downwind portion of the Site perimeter.
- Sustained atmospheric concentrations of greater than 10% LEL at the downwind Site perimeter – Halt work and contact local Fire Department.

o **AIRBORNE PARTICULATE COMMUNITY AIR MONITORING**

- Respirable (PM-10) particulate monitoring will be performed on a continuous basis at the upwind and downwind perimeter of the exclusion zone. The monitoring will be performed using real-time monitoring equipment capable of measuring PM-10 and integrating over a period of 15-minutes for comparison to the airborne particulate action levels. The equipment will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities. All readings will be recorded and will be available for NYSDEC and NYSDOH review. Readings will be interpreted as follows:
- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (ug/m^3) greater than the background (upwind perimeter) reading 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 provided that the downwind PM-10 particulate levels do not exceed 150 ug/m^3 above the upwind level and that visible dust is not migrating from the work area.

- If, after implementation of dust suppression techniques downwind PM-10 levels are greater than 150 ug/m^3 above the upwind level, work activities must be stopped and dust suppression controls re-evaluated. Work can resume provided that supplemental dust suppression measures and/or other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 ug/m^3 of the upwind level and in preventing visible dust migration.

Pertinent emergency response information including the telephone number of the Fire Department is included in the Emergency Response Plan (Appendix A).

10.0 SPILL RELEASE/RESPONSE

This chapter of the HASP describes the potential for and procedures related to spills or releases of known or suspected petroleum and/or hazardous substances on the Site. The purpose of this Section of the HASP is to plan appropriate response, control, counter-measures and reporting, consistent with OSHA requirements in 29 CFR 1910.120(b)(4)(ii)(J) and (j)(1)(viii). The spill containment program addresses the following elements:

- Potential hazardous material spills and available controls.
- Initial notification and evaluation.
- Spill response.
- Post-spill evaluation.

10.1 Potential Spills and Available Controls

An evaluation was conducted to determine the potential for hazardous material and oil/petroleum spills at this Site. For the purpose of this evaluation, hazardous materials posing a significant spill potential are considered to be:

- CERCLA Hazardous Substances as identified in 40 CFR Part 302, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).
- Extremely Hazardous Substances as identified in 40 CFR Part 355, Appendix A, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).
- Hazardous Chemicals as defined under Section 311(e) of the Emergency Planning and Community Right-To-Know Act of 1986, where such chemicals are present or will be stored in excess of 10,000 lbs.
- Toxic Chemicals as defined in 40 CFR Part 372, where such chemicals are present or will be stored in excess of 10,000 lbs.
- Chemicals regulated under 6NYCRR Part 597, where such materials pose the potential for release in excess of their corresponding Reportable Quantity (RQ).

Oil/petroleum products are considered to pose a significant spill potential whenever the following situations occur:

- The potential for a "harmful quantity" of oil (including petroleum and non-petroleum-based fuels and lubricants) to reach navigable waters of the U.S. exists (40

CFR Part 112.4). Harmful quantities are considered by USEPA to be volumes that could form a visible sheen on the water or violate applicable water quality standards.

- The potential for any amount of petroleum to reach any waters of NY State, including groundwater, exists. Petroleum, as defined by NY State in 6NYCRR Part 612, is a petroleum-based heat source, energy source, or engine lubricant/maintenance fluid.
- The potential for any release, to soil or water, of petroleum from a bulk storage facility regulated under 6NYCRR Part 612. A regulated petroleum storage facility is defined by NY State as a site having stationary tank(s) and intra-facility piping, fixtures and related equipment with an aggregate storage volume of 1,100 gallons or greater.

10.2 Initial Spill Notification and Evaluation

Any worker who discovers a hazardous substance or oil/petroleum spill will immediately notify the Project Manager and SSHO. The worker will, to the best of his/her ability, report the material involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, if any, and any associated injuries. The Emergency Response Plan presented in Attachment H2 of this HASP will immediately be implemented if an emergency release has occurred.

Following initial report of a spill, the Project Manager will make an evaluation as to whether the release exceeds RQ levels. If an RQ level is exceeded, the Project Manager will notify the Site owner and NYSDEC at 1-800-457-7362 within 2 hours of spill discovery. The Project Manager will also determine what additional agencies (e.g., USEPA) are to be contacted regarding the release, and will follow-up with written reports as required by the applicable regulations.

10.3 Spill Response

For spill situations, the following general response guidelines will apply:

- Only those personnel involved in overseeing or performing containment operations will be allowed within the spill area. If necessary, the area will be roped, ribboned, or otherwise blocked off to prevent unauthorized access.
- Appropriate PPE, as specified by the SSHO, will be donned before entering the spill area.
- Ignition points will be extinguished/removed if fire or explosion hazards exist.

- Surrounding reactive materials will be removed.
- Drains or drainage in the spill area will be blocked to prevent inflow of spilled materials or applied materials.

For minor spills, the Contractor will maintain a Spill Control and Containment Kit in the Field Office or other readily accessible storage location. The kit will consist of, at a minimum, a 50 lb. bag of "speedy dry" granular absorbent material, absorbent pads, shovels, empty 5-gallon pails and an empty open-top 55-gallon drum. Spilled materials will be absorbed, and shoveled into a 55-gallon drum for proper disposal (NYSDEC approval will be secured for on-site treatment of the impacted soils/absorbent materials, if applicable). Impacted soils will be hand-excavated to the point that no visible signs of contamination remains, and will be drummed with the absorbent.

In the event of a major release or a release that threatens surface water, a spill response contractor will be called to the Site. The response contractor may use heavy equipment (e.g., excavator, backhoe, etc.) to berm the soils surrounding the spill Site or create diversion trenching to mitigate overland migration or release to navigable waters. Where feasible, pumps will be used to transfer free liquid to storage containers. Spill control/cleanup contractors in the Western New York area that may be contacted for assistance include:

- The Environmental Service Group of NY, Inc.: (716) 695-6720
- Environmental Products and Services, Inc.: (716) 447-4700
- Op-Tech: (716) 873-7680

10.4 Post-Spill Evaluation

If a reportable quantity of hazardous material or oil/petroleum is spilled as determined by the Project Manager, a written report will be prepared as indicated in Section 10.2. The report will identify the root cause of the spill, type and amount of material released, date/time of release, response actions, agencies notified and/or involved in cleanup, and procedures to be implemented to avoid repeat incidents. In addition, all re-useable spill cleanup and containment materials will be decontaminated, and spill kit supplies/disposable items will be replenished.

11.0 HEAT/COLD STRESS MONITORING

Since some of the work activities at the Site will be scheduled for both the summer and winter months, measures will be taken to minimize heat/cold stress to Benchmark-TurnKey employees. The Site Safety and Health Officer and/or his or her designee will be responsible for monitoring Benchmark-TurnKey field personnel for symptoms of heat/cold stress.

11.1 Heat Stress Monitoring

Personal protective equipment may place an employee at risk of developing heat stress, a common and potentially serious illnesses often encountered at construction, landfill, waste disposal, industrial or other unsheltered sites. The potential for heat stress is dependent on a number of factors, including environmental conditions, clothing, workload, physical conditioning and age. Personal protective equipment may severely reduce the body's normal ability to maintain temperature equilibrium (via evaporation and convection), and require increased energy expenditure due to its bulk and weight.

Proper training and preventive measures will mitigate the potential for serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress, the following steps should be taken:

- Adjust work schedules.
- Modify work/rest schedules according to monitoring requirements.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat (i.e., eight fluid ounces must be ingested for approximately every 1 lb of weight lost). The normal thirst mechanism is not sensitive enough to ensure that enough water will be consumed to replace lost perspiration. When heavy sweating occurs, workers should be encouraged to drink more.
- Train workers to recognize the symptoms of heat related illness.

Heat-Related Illness - Symptoms:

- Heat rash may result from continuous exposure to heat or humid air.
- Heat cramps are caused by heavy sweating with inadequate electrolyte replacement. Signs and symptoms include: muscle spasms; pain in the hands, feet and abdomen.
- Heat exhaustion occurs from increased stress on various body organs including inadequate blood circulation due to cardiovascular insufficiency or dehydration. Signs and symptoms include: pale, cool, moist skin; heavy sweating; dizziness; nausea; fainting.
- Heat stroke is the most serious form of heat stress. Temperature regulation fails and the body temperature rises to critical levels. Immediate action must be taken to cool the body before serious injury and death occur. Competent medical help must be obtained. Signs and symptoms are: red, hot, usually dry skin; lack of or reduced perspiration; nausea; dizziness and confusion; strong, rapid pulse; coma.

The monitoring of personnel wearing protective clothing should commence when the ambient temperature is 70 degrees Fahrenheit or above. For monitoring the body's recuperative ability to excess heat, one or more of the following techniques should be used as a screening mechanism.

- Heart rate may be measured by the radial pulse for 30 seconds as early as possible in the resting period. The rate at the beginning of the rest period should not exceed 100 beats per minute. If the rate is higher, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest periods stay the same, If the pulse rate is 100 beats per minute at the beginning of the nest rest period, the following work cycle should be further shortened by 33%.
- Body temperature may be measured orally with a clinical thermometer as early as possible in the resting period. Oral temperature at the beginning of the rest period should not exceed 99.6 degrees Fahrenheit. If it does, the next work period should be shortened by 10 minutes (or 33%), while the length of the rest period remains the same. However, if the oral temperature exceeds 99.6 degrees Fahrenheit at the beginning of the next period, the work cycle may be further shortened by 33%. Oral temperature should be measured at the end of the rest period to make sure that it has dropped below 99.6 degrees Fahrenheit. No Benchmark-TurnKey employee will be permitted to continue wearing semi-permeable or impermeable garments when his/her oral temperature exceeds 100.6 degrees Fahrenheit.

11.2 Cold Stress Monitoring

Exposure to cold conditions may result in frostbite or hypothermia, each of which progresses in stages as shown below.

- **Frostbite** occurs when body tissue (usually on the extremities) begins to freeze. The three states of frostbite are:
    1. **Frost nip** - This is the first stage of the freezing process. It is characterized by a whitened area of skin, along with a slight burning or painful sensation. Treatment consists of removing the victim from the cold conditions, removal of boots and gloves, soaking the injured part in warm water (102 to 108 degrees Fahrenheit) and drinking a warm beverage. Do not rub skin to generate friction/ heat.
    2. **Superficial Frostbite** - This is the second stage of the freezing process. It is characterized by a whitish gray area of tissue, which will be firm to the touch but will yield little pain. The treatment is identical for Frost nip.
    3. **Deep Frostbite** - In this final stage of the freezing process the affected tissue will be cold, numb and hard and will yield little to no pain. Treatment is identical to that for Frost nip.

- **Hypothermia** is a serious cold stress condition occurring when the body loses heat at a rate faster than it is produced. If untreated, hypothermia may be fatal. The stages of hypothermia may not be clearly defined or visible at first, but generally include:
    1. Shivering
    2. Apathy (i.e., a change to an indifferent or uncaring mood)
    3. Unconsciousness
    4. Bodily freezing

  Employees exhibiting signs of hypothermia should be treated by medical professionals. Steps that can be taken while awaiting help include:

    1. Remove the victim from the cold environment and remove wet or frozen clothing. (Do this carefully as frostbite may have started.)
    2. Perform active re-warming with hot liquids for drinking (Note: do not give the victim any liquid containing alcohol or caffeine) and a warm water bath (102 to 108 degrees Fahrenheit).
    3. Perform passive re-warming with a blanket or jacket wrapped around the victim.

In any potential cold stress situation, it is the responsibility of the Site Health and Safety Officer to encourage the following:

- Education of workers to recognize the symptoms of frostbite and hypothermia.
- Workers should dress warmly, with more layers of thin clothing as opposed to one thick layer.
- Personnel should remain active and keep moving.
- Personnel should be allowed to take shelter in a heated areas, as necessary.
- Personnel should drink warm liquids (no caffeine or alcohol if hypothermia has set in).
- For monitoring the body's recuperation from excess cold, oral temperature recordings should occur:
    - At the Site Safety Technicians discretion when suspicion is based on changes in a worker's performance or mental status.
    - At a workers request.
    - As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind chill less than 20 degrees Fahrenheit or wind chill less than 30 degrees Fahrenheit with precipitation).
    - As a screening measure, whenever anyone worker on-site develops hypothermia.

Any person developing moderate hypothermia (a core body temperature of 92 degrees Fahrenheit) will not be allowed to return to work for 48 hours without the recommendation of a qualified medical doctor.

12.0 WORK ZONES AND SITE CONTROL

Work zones around the areas designated for construction activities will be established on a daily basis and communicated to employees and other Site users by the SSHO. It shall be each Contractor's Site Safety and Health Officer's responsibility to ensure that Site workers are aware of the work zone boundaries and to enforce proper procedures in each area. The zones will include:

- Exclusion Zone ("Hot Zone"): The area where contaminated materials may be exposed, excavated or handled and all areas where contaminated equipment or personnel may travel. Flagging tape will delineate the zone. Personnel entering the Exclusion Zone must wear the prescribed level of personal protective equipment identified in Section 8.
- Contamination Reduction Zone: The zone where decontamination of personnel and equipment takes place. Any potentially contaminated clothing, equipment and samples must remain in the Contamination Reduction Zone until decontaminated.
- Support Zone: The part of the site that is considered non-contaminated or "clean." Support equipment will be located in this zone, and personnel may wear normal work clothes within this zone.

In the absence of other task-specific work zone boundaries established by the SSHO, the following boundaries will apply to investigation and construction activities involving disruption or handling of Site soils or groundwater:

- Exclusion Zone: 50-foot radius from the outer limit of the sampling/construction activity.
- Contaminant Reduction Zone: 100-foot radius from the outer limit of the sampling/construction activity.
- Support Zone: Areas outside the Contaminant Reduction Zone.

Access of non-essential personnel to the Exclusion and Contamination Reduction Zones will be strictly controlled by the SSHO. Only personnel who are essential to the completion of the task will be allowed access to these areas and only if they are wearing the prescribed level of protection. Entrance of personnel must be approved by the SSHO.

The SSHO will maintain a Health and Safety Logbook containing the names of Benchmark-TurnKey workers and their level of protection. The zone boundaries may be changed by the SSHO as environmental conditions warrant, and to respond to the necessary changes in work locations on-site.

13.0 DECONTAMINATION

13.1 Decontamination for Benchmark-TurnKey Employees

The degree of decontamination required is a function of a particular task and the environment within which it occurs. The following decontamination procedure will remain flexible, thereby allowing the decontamination crew to respond appropriately to the changing environmental conditions that may arise at the Site. Benchmark-TurnKey personnel on-site shall follow the procedure below, or the Contractor's procedure (if applicable), whichever is more stringent.

Station 1 - Equipment Drop: Deposit visibly contaminated (if any) re-useable equipment used in the contamination reduction and exclusion zones (tools, containers, monitoring instruments, radios, clipboards, etc.) on plastic sheeting.

Station 2 - Boots and Gloves Wash and Rinse: Scrub outer boots and outer gloves. Deposit tape and gloves in waste disposal container.

Station 3 - Tape, Outer Boot and Glove Removal: Remove tape, outer boots and gloves. Deposit tape and gloves in waste disposal container.

Station 4 - Canister or Mask Change: If worker leaves exclusive zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot cover donned, and worker returns to duty.

Station 5 - Outer Garment/Face Piece Removal: Protective suit removed and deposited in separate container provided by Contractor. Face piece or goggles are removed if used. Avoid touching face with fingers. Face piece and/or goggles deposited on plastic sheet. Hard hat removed and placed on plastic sheet.

Station 6 - Inner Glove Removal: Inner gloves are the last personal protective equipment to be removed. Avoid touching the outside of the gloves with bare fingers. Dispose of these gloves in waste disposal container.

Following PPE removal, personnel shall wash hands, face and forearms with absorbent wipes. If field activities proceed for duration of 6 consecutive months or longer, shower facilities will be provided for worker use in accordance with OSHA 29 CFR 1910.120(n).

13.2 Decontamination for Medical Emergencies

In the event of a minor, non-life-threatening injury, personnel should follow the decontamination procedures as defined, and then administer first-aid.

In the event of a major injury or other serious medical concern (e.g., heat stroke), immediate first-aid is to be administered and the victim transported to the hospital in lieu of further decontamination efforts unless exposure to a Site contaminant would be considered "Immediately Dangerous to Life or Health."

13.3 Decontamination of Field Equipment

The Contractor in accordance with his approved Health and Safety Plan in the Contamination Reduction Zone will conduct decontamination of heavy equipment. As a minimum, this will include manually removing heavy soil contamination, followed by steam cleaning on an impermeable pad.

Benchmark-TurnKey personnel will conduct decontamination of tools used for sample collection purposes. It is expected that tools will be constructed of nonporous, nonabsorbent materials (i.e., metal), which will aid in the decontamination effort. Any tool or part of a tool made of porous, absorbent material (i.e., wood) will be placed into suitable containers and prepared for disposal.

Decontamination of bailers, split-spoons, spatula knives, and other tools used for environmental sampling and examination shall be as follows:

- Disassemble the equipment
- Water wash to remove visible foreign matter.
- Wash with detergent.
- Rinse parts with distilled-deionized water.
- Allow to air dry.
- Wrap parts in aluminum foil or polyethylene.

14.0 CONFINED SPACE ENTRY

OSHA 29 CFR 1910.146 identifies a confined space as a space that is large enough and so configured that an employee can physically enter and do assigned work, has limited or restricted means for entry and exit, and is not intended for continuous employee occupancy. Confined spaces include, but are not limited to, trenches, storage tanks, process vessels, pits, sewers, tunnels, underground utility vaults, pipelines, sumps, wells, and excavations.

Confined space entry by Benchmark-TurnKey employees is not anticipated to be necessary to complete the remedial activities identified in Section 2.0. In the event that the scope of work changes or confined space entry appears necessary, the Project Manager will be consulted to determine if feasible engineering alternatives to confined space entry can be implemented. If confined space entry by Benchmark-TurnKey employees cannot be avoided through reasonable engineering measures, task-specific confined space entry procedures will be developed and a confined-space entry permit will be issued through Benchmark-TurnKey's corporate Health and Safety Director. Benchmark-TurnKey employees shall not enter a confined space without these procedures and permits in place.

15.0 FIRE PREVENTION AND PROTECTION

15.1 General Approach

Recommended practices and standards of the National Fire Protection Association (NFPA) and other applicable regulations will be followed in the development and application of Project Fire Protection Programs. When required by regulatory authorities, the project management will prepare and submit a Fire Protection Plan for the approval of the contracting officers, authorized representative or other designated official. Essential considerations for the Fire Protection Plan will include:

- Proper Site preparation and safe storage of combustible and flammable materials.
- Availability of coordination with private and public fire authorities.
- Adequate job-site fire protection and inspections for fire prevention.
- Adequate indoctrination and training of employees.

15.2 Equipment and Requirements

Fire extinguishers will be provided by each Contractor and are required on heavy equipment and in each field trailer. Fire extinguishers will be inspected, serviced, and maintained in accordance with the manufacturer's instructions. As a minimum, extinguishers shall be checked monthly and weighed semi-annually, and recharged if necessary. Recharge or replacement shall be mandatory immediately after each use.

15.3 Flammable and Combustible Substances

Storage, handling or use of flammable and combustible substances will be under the supervision of qualified persons. Tanks, containers, and pumping equipment, whether portable or stationary, used for the storage and handling of flammable and combustible liquids, will meet the recommendations of the National Fire Protection Association.

15.4 Hot Work

If the scope of work necessitates welding or blowtorch operation, the hot work permit presented in Appendix B will be completed by the SSHO and reviewed/issued by the Project Manager.

16.0 EMERGENCY INFORMATION

In accordance with OSHA 29 CFR Part 1910, an Emergency Response Plan is attached to this HASP as Appendix A. The hospital route map is presented within Appendix A as Figure 1.

17.0 REFERENCES

1. New York State Department of Environmental Conservation. *DER-10; Technical Guidance for Site Investigation and Remediation.* May 2010.

TABLES

TABLE 1
TOXICITY DATA FOR CONSTITUENTS OF POTENTIAL CONCERN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Parameter	Synonyms	CAS No.	Code	Concentration Limits[1]		
				PEL	TLV	IDLH
Volatile Organic Compounds (VOCs): ppm						
2-Butanone	Methyl Ethyl Ketone, MEK	78-93-3	*none*	200	200	3000
1,2,4-Trimethylbenzene	Methylzylene	95-63-6	*none*	25	25	ND
1,3,5-Trimethylbenzene	Trimethyl benzene	108-67-8	*none*	25	25	ND
Isopropylbenzene	Cumene, 2-Phenylpropane	98-82-8	*none*	50	50	900
N-Propylbenzene	Propyl Benzene	103-65-1	*none*	--	--	ND
Benzene	Benzol, Phenyl hydride	71-43-2	Ca	1	0.5	500
Ethylbenzene	Ethylbenzol, Phenylethane	100-41-4	*none*	100	100	800
Toluene	Methyl benzene, Methyl benzol	108-88-3	C-300	200	50	500
Xylene, Total	o-, m-, p-isomers	1330-20-7	*none*	100	100	900
Semi-volatile Organic Compounds (SVOCs)*[2] *: ppm						
Acenaphthene	*none*	83-32-9	*none*	--	--	--
Acenaphthylene	*none*	208-96-8	*none*	--	--	--
Anthracene	*none*	120-12-7	*none*	--	--	--
Benzo(a)anthracene	*none*	56-55-3	*none*	--	--	--
Benzo(a)pyrene	*none*	50-32-8	*none*	--	--	--
Benzo(b)fluoranthene	*none*	205-99-2	*none*	--	--	--
Benzo(ghi)perylene	*none*	191-24-2	*none*	--	--	--
Benzo(k)fluoranthene	*none*	207-08-9	*none*	--	--	--
Chrysene	*none*	218-01-9	*none*	--	--	--
Dibenz(a,h)anthracene	*none*	53-70-3	*none*	--	--	--
Fluoranthene	*none*	206-44-0	*none*	--	--	--
Fluorene	*none*	86-73-7	*none*	--	--	--
Indeno(1,2,3-cd)pyrene	*none*	193-39-5	*none*	--	--	--
Naphthalene	Naphthalin, Tar camphor, White tar	91-20-3	*none*	10	10	250
Phenanthrene	*none*	85-01-8	*none*	--	--	--
Pyrene	*none*	129-00-0	*none*	--	--	--
***Inorganic Compounds*[2] *: mg/m*^{3}**						
Arsenic	*none*	7440-38-2	Ca	0.01	0.01	5

Notes:

1. Concentration limits as reported by NIOSH Pocket Guide to Chemical Hazards, February 2004 (NIOSH Publication No. 97-140, fourth printing with changes and updates).
2. " -- " = concentration limit not available; exposure should be minimized to the extent feasible through appropriate engineering controls & PPE.

Explanation:

Ca = NIOSH considers constituent to be a potential occupational carcinogen.

C-## = Ceiling Level equals the maximum exposure concentration allowable during the work day.

IDLH = Immediately Dangerous to Life or Health.

ND indicates that an IDLH has not been determined.

TLV = Threshold Limit Value, established by American Conference of Industrial Hygienists (ACGIH), equals the maximum exposure concentration allowable for 8 hours/day @ 40 hours/week.

TLVs are the amounts of chemicals in the air that almost all healthy adult workers are predicted to be able to tolerate without adverse effects. There are three types.

TLV-TWA (TLV-Time-Weighted Average) which is averaged over the normal eight-hour day/forty-hour work week. (Most TLVs.)

TLV-STEL or Short Term Exposure Limits are 15 minute exposures that should not be exceeded for even an instant. It is not a stand alone value but is accompanied by the TLV-TWA.

TLV-C or Ceiling limits are the concentration that should not be exceeded during any part of the working exposure.

Unless the initials "STEL" or "C" appear in the Code column, the TLV value should be considered to be the eight-hour TLV-TWA.

PEL = Permissible Exposure Limit, established by OSHA, equals the maximium exposure conconcentration allowable for 8 hours per day @ 40 hours per week

TABLE 2
POTENTIAL ROUTES OF EXPOSURE TO THE CONSTITUENTS OF POTENTIAL CONCERN
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Activity [1]	Direct Contact with Soil/Fill	Inhalation of Vapors or Dust	Direct Contact with Water
Remedial Action Tasks			
1. In-Situ Stabilization of PFAS impacted Soil/Fill	x	x	x
2. Removing and disposing/recycling subsurface piping	x	x	x
3. Excavation of SVOC-Impacted Soil/Fill, Off-Site Disposal, & Backfill	x	x	x
4. GCS Excavation and Off-Site Disposal, & Backfill (including associated creek excavation and reconstruction)	x	x	x
5. Post-Excavation Sampling	x	x	x
7. Waste Characterization Sampling	x	x	x

Notes:

1. Activity as described in Section 1.5 of the Health and Safety Plan.

TABLE 3
REQUIRED LEVELS OF PROTECTION FOR REMEDIAL TASKS
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Activity	Respiratory Protection [1]	Clothing	Gloves [2]	Boots [2, 3]	Other Required PPE/ Modifications [2, 4]
Redevelopment Tasks					
1. Test Pit Excavations that penetrate the Cover System to remove soil beneath	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	HH SGSS
2. Import of Backfill Materials for use as Fill at the Site requiring Analytical Sampling	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	SGSS
3. Export of Materials from the Site that will require Analytical Sampling	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	HH SGSS
4. Groundwater Monitoring	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	SGSS
5. Post-Excavation Sampling	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	SGSS
6. Waste Characterization Sampling	Level D (upgrade to Level C if necessary)	Work Uniform or Tyvek	L/N	outer: L inner: STSS	SGSS

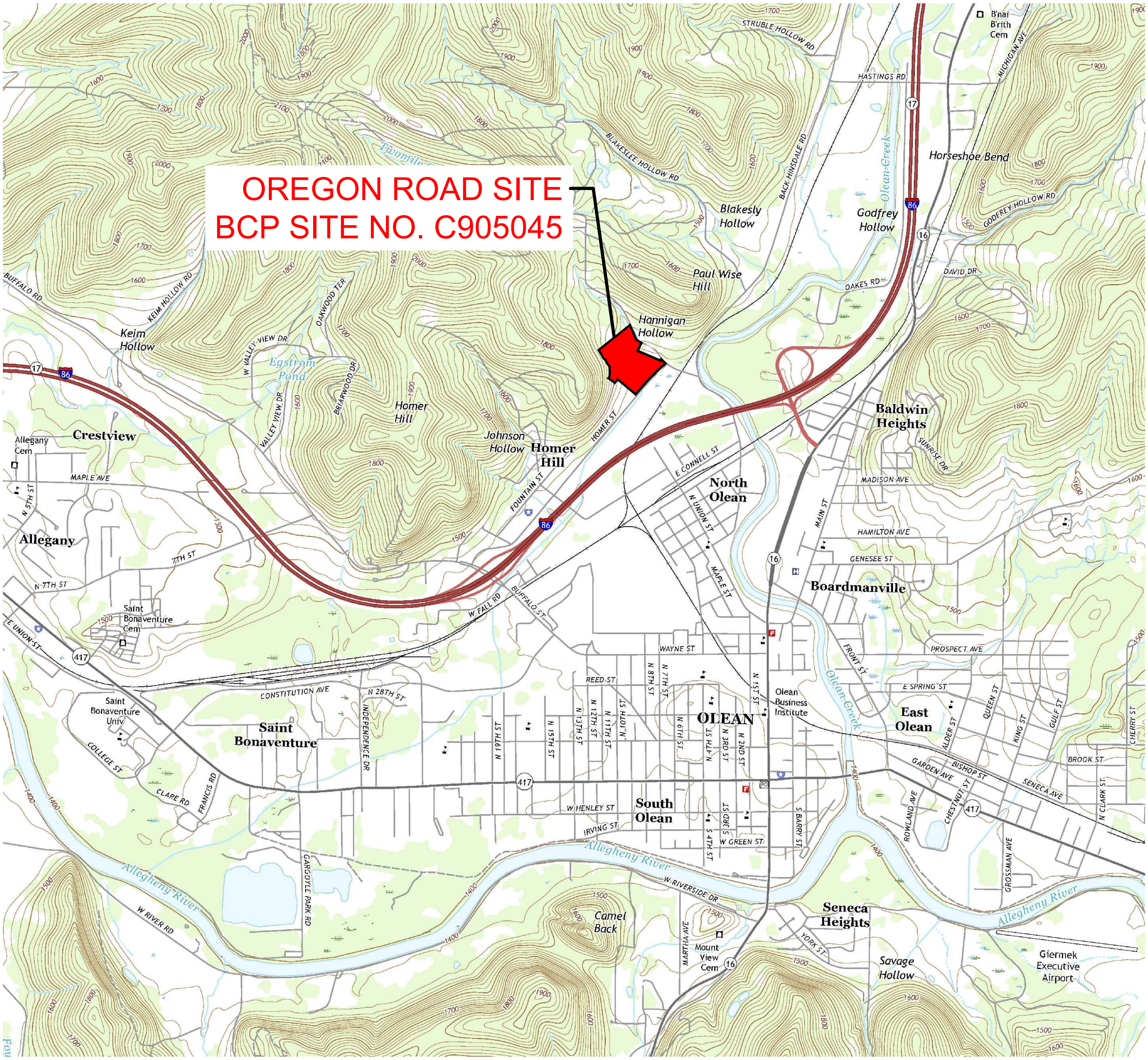
Notes:

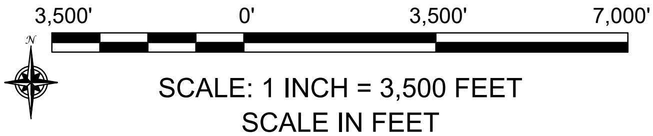
1. Respiratory equipment shall conform to guidelines presented in Section 7.0 of this HASP. The Level C requirement is an air-purifying respirator equiped with organic compound/acid gas/dust cartridge.
2. HH = hardhat; L= Latex; L/N = latex inner glove, nitrile outer glove; N = Nitrile; S = Saranex; SG = safety glasses; SGSS = safety glasses with sideshields; STSS = steel toe safety shoes.
3. Latex outer boot (or approved overboot) required whenever contact with contaminated materials may occur. SSHO may downgrade to STSS (steel-toed safety shoes) if contact will be limited to cover/replacement soils.
4. Dust masks shall be donned as directed by the SSHO (site safety and health officer) or site safety technician whenever potentially contaminated airborne particulates (i.e., dust) are present

FIGURES

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\HASP\Figure 1; Site Location and Vicinity Map.dwg

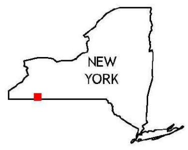
FIGURE 1





SCALE: 1 INCH = 3,500 FEET
SCALE IN FEET
(approximate)

NOTE: BASE MAP USGS OLEAN, NY QUADRANGLE 2016



QUADRANGLE LOCATION

BENCHMARK IN ASSOCIATION WITH TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

PROJECT NO.: 0311-020-001

DATE: JULY 2021

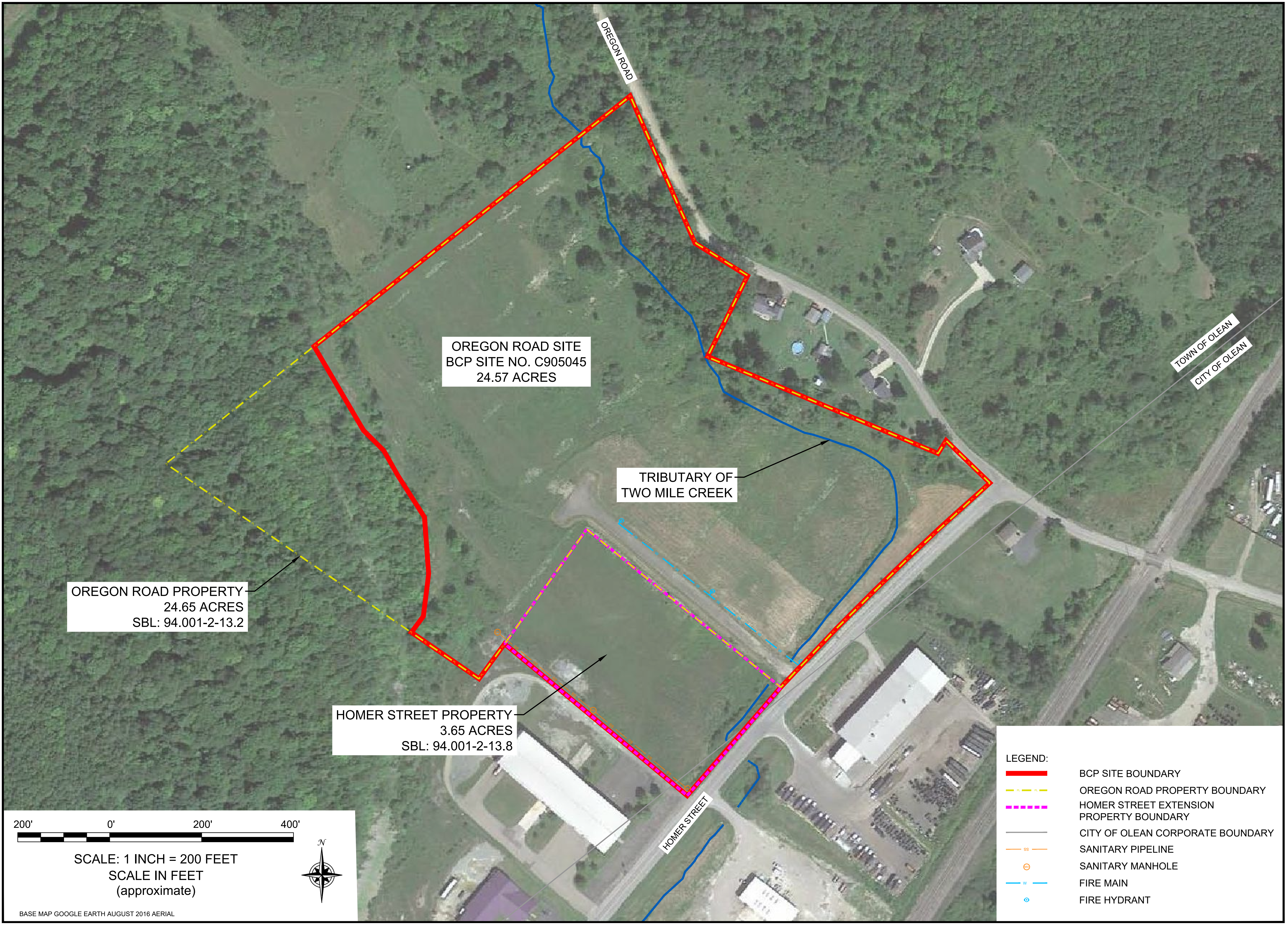
DRAFTED BY: CMS

SITE LOCATION & VICINITY MAP

SITE HEALTH AND SAFETY PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\HASP\Figure 2; Site Plan (Aerial).dwg



DATE: JULY 2021
DRAFTED BY: CMS

SITE PLAN (AERIAL)

SITE HEALTH AND SAFETY PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK
PREPARED FOR
HOMER STREET PROPERTIES, LLC

BENCHMARK IN ASSOCIATION WITH TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218,
(716) 856-0599

JOB NO.: 0311-020-001

FIGURE 2

*__DISCLAIMER:__ **PROPERTY OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC. & TURNKEY ENVIRONMENTAL RESTORATION, LLC** __IMPORTANT:__ THIS DRAWING PRINT IS LOANED FOR MUTUAL ASSISTANCE AND AS SUCH IS SUBJECT TO RECALL AT ANY TIME. INFORMATION CONTAINED HEREON IS NOT TO BE DISCLOSED OR REPRODUCED IN ANY FORM FOR THE BENEFIT OF PARTIES OTHER THAN NECESSARY SUBCONTRACTORS & SUPPLIERS WITHOUT THE WRITTEN CONSENT OF BENCHMARK CIVIL/ENVIRONMENTAL ENGINEERING & GEOLOGY, PLLC & TURNKEY ENVIRONMENTAL RESTORATION, LLC.*

ATTACHMENT A

EMERGENCY RESPONSE PLAN

EMERGENCY RESPONSE PLAN
for
BROWNFIELD CLEANUP PROGRAM REMEDIAL ACTIVITIES

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

December 2021 T0311-020-001

Prepared for:

Homer Street Properties, LLC

Prepared By:

BENCHMARK

Benchmark Civil/Environmental Engineering & Geology, PLLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
(716) 856-0599

In Association With:

TURNKEY ENVIRONMENTAL RESTORATION, LLC

TurnKey Environmental Restoration, LLC
2558 Hamburg Turnpike, Suite 300
Buffalo, NY 14218
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OREGON ROAD SITE
BCP SITE NO. C905045
HEALTH AND SAFETY PLAN FOR SITE MANAGEMENT ACTIVITIES
ATTACHMENT A: EMERGENCY RESPONSE PLAN

TABLE OF CONTENTS

LIST OF FIGURES

1.0 GENERAL

This report presents the site-specific Emergency Response Plan (ERP) referenced in the Site Health and Safety Plan (HASP) prepared for Remedial activities at the Oregon Road Site (BCP Site No. C905045) in Olean, New York. This attachment of the HASP describes potential emergencies that may occur at the Site; procedures for responding to those emergencies; roles and responsibilities during emergency response; and training all workers must receive in order to follow emergency procedures. This ERP also describes the provisions this Site has made to coordinate its emergency response planning with other contractors on-site and with off-site emergency response organizations.

This ERP is consistent with the requirements of 29 CFR 1910.120(l) and provides the following site-specific information:

- Pre-emergency planning.
- Personnel roles, lines of authority, and communication.
- Emergency recognition and prevention.
- Safe distances and places of refuge.
- Evacuation routes and procedures.
- Decontamination procedures.
- Emergency medical treatment and first aid.
- Emergency alerting and response procedures.
- Critique of response and follow-up.
- Emergency personal protective equipment (PPE) and equipment.

2.0 PRE-EMERGENCY PLANNING

This Site has been evaluated for potential emergency occurrences, based on site hazards, the required work tasks, the site topography, and prevailing weather conditions. The results of that evaluation indicate the potential for the following site emergencies to occur at the locations indicated.

Type of Emergency:

1. Medical, due to physical injury

Source of Emergency:

1. Slip/trip/fall

Location of Source:

1. Non-specific

3.0 ON-SITE EMERGENCY RESPONSE EQUIPMENT

Emergency procedures may require specialized equipment to facilitate worker rescue, contamination control and reduction, or post-emergency clean up. Emergency response equipment available on the Site is listed below. The equipment inventory and storage locations are based on the potential emergencies described above. This equipment inventory is designed to meet on-site emergency response needs and any specialized equipment needs that off-site responders might require because of the hazards at this Site but not ordinarily stocked.

Any additional personal protective equipment (PPE) required and stocked for emergency response is also listed in below. During an emergency, the Emergency Response Coordinator (ERC) is responsible for specifying the level of PPE required for emergency response. At a minimum, PPE used by emergency responders will comply with Section 7.0, Personal Protective Equipment, of this HASP. Emergency response equipment is inspected at regular intervals and maintained in good working order. The equipment inventory is replenished as necessary to maintain response capabilities.

Emergency Equipment	Quantity	Location
First Aid Kit	1	Site Vehicle
Chemical Fire Extinguisher	2 (minimum)	Heavy equipment and Site Vehicle

Emergency PPE	Quantity	Location
Full-face respirator	1 for each worker	Site Vehicle
Chemical-resistant suits	4 (minimum)	Site Vehicle

4.0 EMERGENCY PLANNING MAPS

An area-specific map of the Site will be developed on a daily basis during performance of field activities. The map will be marked to identify critical on-site emergency planning information, including: emergency evacuation routes, a place of refuge, an assembly point, and the locations of key site emergency equipment. Site zone boundaries will be shown to alert responders to known areas of contamination. There are no major topographical features, however the direction of prevailing winds/weather conditions that could affect emergency response planning are also marked on the map. The map will be posted at site-designated place of refuge and inside the Benchmark-TurnKey personnel field vehicle.

5.0 EMERGENCY CONTACTS

The following identifies the emergency contacts for this ERP.

Emergency Telephone Numbers:

Project Manager: ***Michael Lesakowski***
Work: (716) 856-0599
Mobile: (716) 818-3954

Corporate Health and Safety Director: ***Thomas H. Forbes***
Work: (716) 856-0599
Mobile: (716) 864-1730

Site Safety and Health Officer (SSHO): ***Lori Riker***
Work: (716) 856-0599
Mobile: (716) 844-1699

Alternate SSHO: ***Nathan Munley***
Work: (716) 856-0635
Mobile: (716) 289-1072

OLEAN GENERAL HOSPITAL (ER):	(716) 373-2600
FIRE:	911
AMBULANCE:	911
OLEAN POLICE:	911
STATE EMERGENCY RESPONSE HOTLINE:	(800) 457-7362
NATIONAL RESPONSE HOTLINE:	(800) 424-8802
NYSDOH:	(716) 847-4385
NYSDEC:	(716) 851-7220
NYSDEC 24-HOUR SPILL HOTLINE:	(800) 457-7252

The Site location is:

Northwestern Corner of Homer Street and Oregon Road
Olean, New York 14760
Site Phone Number: (Insert Cell Phone or Field Trailer): ____________________

6.0 EMERGENCY ALERTING & EVACUATION

Internal emergency communication systems are used to alert workers to danger, convey safety information, and maintain site control. Any effective system can be employed. Two-way radio headsets or field telephones are often used when work teams are far from the command post. Hand signals and air-horn blasts are also commonly used. Every system must have a backup. It shall be the responsibility of each contractor's SSHO to ensure personnel entering the site understand an adequate method of internal communication. Unless personnel are otherwise informed, the following signals shall be used.

1. Emergency signals by portable air horn, siren, or whistle: two short blasts, personal injury; continuous blast, emergency requiring site evacuation.
2. Visual signals: hand gripping throat, out of air/cannot breathe; hands on top of head, need assistance; thumbs up, affirmative/everything is OK; thumbs down, no/ negative; grip partner's wrist or waist, leave area immediately.

If evacuation notice is given, site workers leave the worksite with their respective buddies, if possible, by way of the nearest exit. Emergency decontamination procedures detailed in Section 12.0 of the HASP are followed to the extent practical without compromising the safety and health of site personnel. The evacuation routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by rehearsals and inputs from emergency response organizations. Wind direction indicators are located so that workers can determine a safe up wind or cross wind evacuation route and assembly area if not informed by the emergency response coordinator at the time the evacuation alarm sounds. Since work conditions and work zones within the site may be changing on daily basis, it shall be the responsibility of the construction SSHO to review evacuation routes and procedures as necessary and to inform all Benchmark-TurnKey workers of any changes.

Personnel exiting the site will gather at a designated assembly point. To determine that everyone has successfully exited the site, personnel will be accounted for at the assembly site. If any worker cannot be accounted for, notification is given to the SSHO (***Lori Riker*** or ***Nathan Munley***) so that appropriate action can be initiated. Contractors and subcontractors on this site have coordinated their emergency response plans to ensure that these plans are compatible and that source(s) of potential emergencies are recognized, alarm systems are clearly understood, and evacuation routes are accessible to all personnel relying upon them.

7.0 EXTREME WEATHER CONDITIONS

In the event of adverse weather conditions, the SSHO in conjunction with the Contractor's SSHO will determine if engineering operations can continue without sacrificing the health and safety of site personnel. Items to be considered prior to determining if work should continue include but are not limited to:

- Potential for heat/cold stress.
- Weather-related construction hazards (e.g., flooding or wet conditions producing undermining of structures or sheeting, high wind threats, etc.).
- Limited visibility.
- Potential for electrical storms.
- Limited site access/egress (e.g., due to heavy snow)

8.0 EMERGENCY MEDICAL TREATMENT & FIRST AID

Personnel Exposure:

The following general guidelines will be employed in instances where health impacts threaten to occur acute exposure is realized:

- Skin Contact: Use copious amounts of soap and water. Wash/rinse affected area for at least 15 minutes. Decontaminate and provide medical attention. Eyewash stations will be provided on site. If necessary, transport to Hospital.
- Inhalation: Move to fresh air and, if necessary, transport to Hospital.
- Ingestion: Decontaminate and transport to Hospital.

Personal Injury:

Minor first-aid will be applied on-site as deemed necessary. In the event of a life threatening injury, the individual should be transported to Hospital via ambulance. The SSHO will supply available chemical specific information to appropriate medical personnel as requested.

First aid kits will conform to Red Cross and other applicable good health standards, and shall consist of a weatherproof container with individually sealed packages for each type of item. First aid kits will be fully equipped before being sent out on each job and will be checked weekly by the SSHO to ensure that the expended items are replaced.

Directions to Olean General Hospital (see Figure 1):

The following directions describe the best route from the Site to Olean General Hospital located 1.7 miles away:

- Head **northeast** on **Homer Street** toward **Oregon Road**
- Turn **right** onto **Oregon Road**
- Turn **right** onto **River Street**
- Continue onto **E Forest Avenue**
- Turn **left** onto **N Union Street**
- At the traffic circle, take the **2nd exit** onto **Main Street**
- Olean General Hospital is located at **515 Main Street, Olean, New York**

9.0 EMERGENCY RESPONSE CRITIQUE & RECORD KEEPING

Following an emergency, the SSHO and Project Manager shall review the effectiveness of this Emergency Response Plan (ERP) in addressing notification, control and evacuation requirements. Updates and modifications to this ERP shall be made accordingly. It shall be the responsibility of each contractor to establish and assure adequate records of the following:

- Occupational injuries and illnesses.
- Accident investigations.
- Reports to insurance carrier or State compensation agencies.
- Reports required by the client.
- Records and reports required by local, state, federal and/or international agencies.
- Property or equipment damage.
- Third party injury or damage claims.
- Environmental testing logs.
- Explosive and hazardous substances inventories and records.
- Records of inspections and citations.
- Safety training.

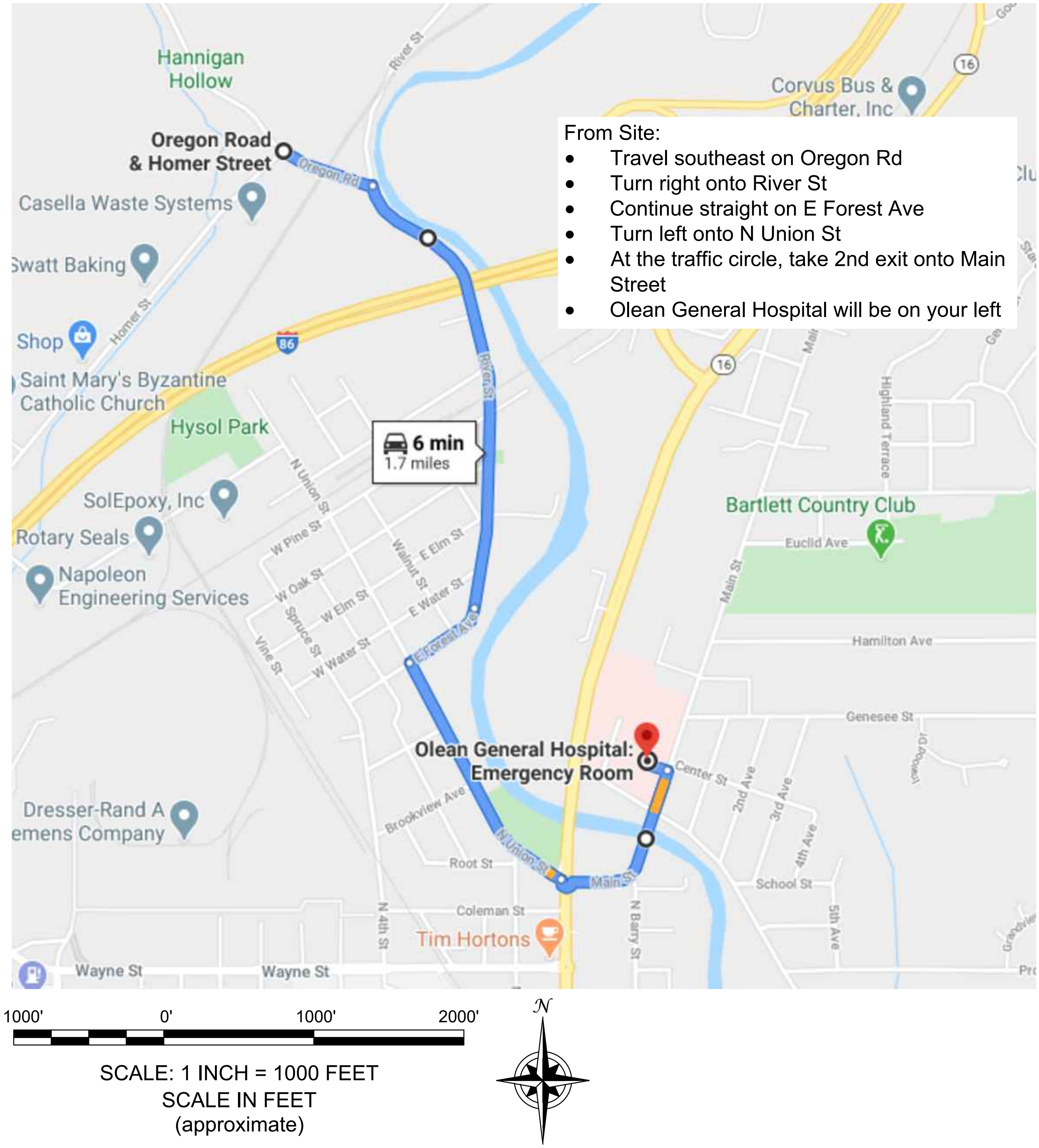
10.0 EMERGENCY RESPONSE TRAINING

Persons who enter the worksite, including visitors, shall receive a site-specific briefing about anticipated emergency situations and the emergency procedures by the SSHO. Where this site relies on off-site organizations for emergency response, the training of personnel in those off-site organizations has been evaluated and is deemed adequate for response to this site.

FIGURE

F:\CAD\TurnKey\Homer Street Properties, LLC\Oregon Road\2021 SMP\Figure A1; Hospital Route Map.dwg

FIGURE A1



From Site:

- Travel southeast on Oregon Rd
- Turn right onto River St
- Continue straight on E Forest Ave
- Turn left onto N Union St
- At the traffic circle, take 2nd exit onto Main Street
- Olean General Hospital will be on your left

SCALE: 1 INCH = 1000 FEET
SCALE IN FEET
(approximate)

BENCHMARK IN ASSOCIATION WITH TURNKEY ENVIRONMENTAL RESTORATION, LLC

2558 HAMBURG TURNPIKE, SUITE 300, BUFFALO, NY 14218, (716) 856-0599

PROJECT NO.: 0311-020-001

DATE: JULY 2021

DRAFTED BY: CMS

HOSPITAL ROUTE MAP

EMERGENCY RESPONSE PLAN

OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

PREPARED FOR
HOMER STREET PROPERTIES, LLC

ATTACHMENT B

HOT WORK PERMIT FORM

HOT WORK PERMIT

PART 1 - INFORMATION

Issue Date:

Date Work to be Performed: Start: Finish (permit terminated):

Performed By:

Work Area:

Object to be Worked On:

PART 2 - APPROVAL

(for 1, 2 or 3: mark Yes, No or NA)*

Will working be on or in: Finish (permit terminated):

1. Metal partition, wall, ceiling covered by combustible material? yes no
2. Pipes, in contact with combustible material? yes no
3. Explosive area? yes no

* = If any of these conditions exist (marked "yes"), a permit will not be issued without being reviewed and approved by Thomas H. Forbes (Corporate Health and Safety Director). Required Signature below.

PART 3 - REQUIRED CONDITIONS**

(Check all conditions that must be met)

	PROTECTIVE ACTION		PROTECTIVE EQUIPMENT
	Specific Risk Assessment Required		Goggles/visor/welding screen
	Fire or spark barrier		Apron/fireproof clothing
	Cover hot surfaces		Welding gloves/gauntlets/other:
	Move movable fire hazards, specifically		Wellintons/Knee pads
	Erect screen on barrier		Ear protection: Ear muffs/Ear plugs
	Restrict Access		B.A.: SCBA/Long Breather
	Wet the ground		Respirator: Type:
	Ensure adequate ventilation		Cartridge:
	Provide adequate supports		Local Exhaust Ventilation
	Cover exposed drain/floor or wall cracks		Extinguisher/Fire blanket
	Fire watch (must remain on duty during duration of permit)		Personal flammable gas monitor
	Issue additional permit(s):		

Other precautions:

** Permit will not be issued until these conditions are met.

SIGNATURES

Orginating Employee: Date:

Project Manager: Date:

Part 2 Approval: Date:

ATTACHMENT C

NYSDOH GENERIC COMMUNITY AIR MONITORING PLAN

Appendix C1
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. “Periodic” monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, 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 C2
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

   (a) Objects to be measured: Dust, mists or aerosols;
   (b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
   (c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
   (d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
   (e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
   (f) Particle Size Range of Maximum Response: 0.1-10;
   (g) Total Number of Data Points in Memory: 10,000;
   (h) Logged Data: Each data point with average concentration, time/date and data point number
   (i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
   (j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
   (k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
   (l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
   (m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

APPENDIX G

QUALITY ASSURANCE PROJECT PLAN

QUALITY ASSURANCE PROJECT PLAN
For BCP ACTIVITIES

OREGON ROAD SITE
OLEAN, NEW YORK
BCP SITE NO. C905045

December 2021 0311-020-001

Prepared for:

Homer Street Properties, LLC

QUALITY ASSURANCE PROJECT PLAN (QAPP)
OREGON ROAD SITE

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QUALITY ASSURANCE PROJECT PLAN (QAPP)
OREGON ROAD SITE

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1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) is an appendix to the Site Management Plan (SMP), which is required as an element of the remedial program at the Oregon Road Site (hereinafter referred to as the "Site") under the New York State (NYS) Brownfield Cleanup Program (BCP), administered by New York State Department of Environmental Conservation (NYSDEC). The site was remediated in accordance with Brownfield Cleanup Agreement (BCA) Index# C905045-10-16, which was executed in December 1, 2016.

1.1 Site Location and Description

The Site consists of two (2) parcels totaling 24.57-acres, located in the City/Town of Olean, Cattaraugus County, New York and are identified on the Cattaraugus County Tax Map as:

- **Oregon Road Property (a portion of), S.B.L. #94.001-2-13.2**
- **Homer Street Property, S.B.L. #94.001-2-13.8**

The Site is currently improved with an asphalt access road running through the center of the Site. The remainder of the Site is greenspace and. Two-Mile Creek runs along the eastern and southern portions of the Site and a man-made drainage ditch runs along the western portion of the Site where it intersects Two-Mile Creek and eventually crosses Homer Street to the south.

1.2 Site Environmental History

The Site was historically developed for the oil industry and used as a petroleum storage tank farm as part of a greater oil refining operation in the City/Town of Olean, New York.

Previous environmental investigations completed at the Site have revealed evidence of environmental contamination related to the former uses of the Site. Elevated photoionization detector (PID) readings and elevated levels of semi-volatile organic compounds (SVOCs), per- and polyfluoroalkyl substances (PFAS), and metals have been detected on Site at concentrations exceeding regulatory guidelines. To a lesser extent, volatile organic compounds (VOCs) were also detected in certain areas slightly exceeding regulatory guidelines.

According to historic records, tanks appear to have been removed in the 1960s; however numerous underground pipes remained on-Site, the majority of which were removed during remedial activities.

1.3 Scope of the QAPP

This QAPP was prepared to provide quality assurance (QA) guidelines to be implemented post-remedial activities. The QAPP will assure the accuracy and precision of data collection during post-remedial Site characterization and data interpretation. The QAPP identifies procedures for sample collection to mitigate the potential for cross-contamination, as well as analytical requirements necessary to allow for independent data validation. The QAPP has been prepared in accordance with USEPA's Requirements for Quality Assurance Project Plans for Environmental Data Operations; the EPA Region II CERCLA Quality Assurance Manual, and NYSDEC's DER-10 Technical Guidance for Site Investigation and Remediation (May 2010). This document may be modified for subsequent phases of investigative work, as necessary.

The QAPP provides:

- A means to communicate to the persons executing the various activities exactly what is to be done, by whom, and when;
- A culmination to the planning process that ensures that the program includes provisions for obtaining quality data (e.g., suitable methods of field operations);
- A document that can be used by the Project Manager's and QA Officer to assess if the activities planned are being implemented and their importance for accomplishing the goal of quality data;
- A plan to document and track project data and results; and,
- Detailed descriptions of the data documentation materials and procedures, project files, and tabular and graphical reports.

The QAPP is primarily concerned with the quality assurance and quality control aspects of the procedures involved in the collection, preservation, packaging, and transportation of samples; field testing; record keeping; data management; chain-of-custody procedures; laboratory analyses; and other necessary matters to assure that the investigation activities, once completed, will yield data whose integrity can be defended.

QA refers to the conduct of all planned and systematic actions necessary to perform satisfactorily all task-specific activities and to provide information and data confidence as a result of such activities. The QA for task-specific activities includes the development of procedures, auditing, monitoring and surveillance of the performance.

QC refers to the activity performed to determine if the work activities conform to the requirements. This includes activities such as inspections of the work activities in the field (e.g., verification that the items and materials installed conform to applicable codes and design specifications). QA is an overview monitoring of the performance of QC activities through audits rather than first time inspections.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITY

The principal organizations involved in verifying achievement of data collection goals for the Site include: the New York State Department of Environmental Conservation (NYSDEC), New York State Department of Health (NYSDOH), Homer Street Properties, LLC (Volunteer), Benchmark Civil/Environmental Engineering and Geology, PLLC (Benchmark), in association with TurnKey Environmental Restoration, LLC (TurnKey) (Volunteer's Consultant), the independent environmental laboratory, and the independent third party data validator. Roles, responsibilities, and required qualifications of these organizations are discussed in the following subsections.

2.1 NYSDEC and NYSDOH

It is the responsibility of the NYSDEC, in conjunction with the New York State Department of Health (NYSDOH), to review the project documents for completeness and conformance with the site-specific cleanup objectives and to make a decision to accept or reject these documents based on this review. The NYSDEC also has the responsibility and authority to review and approve all QA documentation collected during brownfield cleanup construction and to confirm that the QA Plan was followed.

2.2 Property Owner

Homer Street Properties, LLC (Owner), or holder of the certificate of completion (COC) will be responsible for complying with the QA requirements as specified herein and for monitoring and controlling the quality of the Brownfield cleanup activities either directly or through their designated environmental consultant and/or legal counsel. The Owner will also have the authority to select Contractor(s) to assist them in fulfilling these responsibilities. The Owner is responsible for implementing the project and has the authority to commit the resources necessary to meet project objectives and requirements.

2.3 Project Manager

The Project Manager has the responsibility for ensuring that the project meets the overall project objectives, reports directly to the Owner, coordinates with the

NYSDEC/NYSDOH Project Coordinators, and is responsible for technical and project oversight. The PM will:

- Define project objectives and develop a detailed work plan schedule.
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task.
- Acquire and apply technical and corporate resources as needed to assure performance within budget and schedule constraints.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Review the work performed on each task to assure its quality, responsiveness, and timeliness.
- Review and analyze overall task performance with respect to planned requirements and authorizations.
- Review and approve all deliverables before their submission to NYSDEC.
- Develop and meet ongoing project and/or task staffing requirements, including mechanisms to review and evaluate each task product.
- Ultimately be responsible for the preparation and quality of interim and final reports.
- Represent the project team at meetings.

2.4 Field Team Leader:

The Field Team Leader (FTL) has the responsibility for implementation of specific project tasks identified at the Site, and is responsible for the supervision of project field personnel, subconsultants, and subcontractors. The FTL reports directly to the Project Manager. The FTL will:

- Define daily develop work activities.
- Orient field staff concerning the project's special considerations.
- Monitor and direct subcontractor personnel.
- Review the work performed on each task to ensure its quality, responsiveness, and timeliness.

- Assure that field activities, including sample collection and handling, are carried out in accordance with this QAPP.

2.5 Quality Assurance (QA) Officer

The QA Officer will have direct access to corporate executive staff as necessary, to resolve any QA dispute, and is responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations and policies, and NYSDEC requirements. Specific functions and duties include:

- Performing QA audits on various phases of the field operations.
- Reviewing and approving QA plans and procedures.
- Providing QA technical assistance to project staff.
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Manager for technical operations.
- Responsible for assuring third party data review of all sample results from the analytical laboratory.

2.6 Laboratory Responsibilities

Any environmental laboratory used for sample analysis for this Site must be an independent, NYSDOH Environmental Laboratory Approval Program (ELAP)-certified facility approved to perform the analyses prescribed herein.

- *Laboratory Director:*

  The Laboratory Director is a technical advisor and is responsible for summarizing and reporting overall unit performance. Responsibilities of the Laboratory Director include:

  - Provide technical, operational, and administrative leadership.
  - Allocation and management of personnel and equipment resources.
  - Quality performance of the facility.
  - Certification and accreditation activities.

  - Blind and reference sample analysis.

- *Quality Assurance Manager (QA Manager):*

  The QA Manager has the overall responsibility for data after it leaves the laboratory. The QA Manager will be independent of the laboratory but will communicate data issues through the Laboratory Director. In addition, the QA Manager will:

  - Oversee laboratory QA.
  - Oversee QA/QC documentation.
  - Conduct detailed data review.
  - Determine whether to implement laboratory corrective actions, if required.
  - Define appropriate laboratory QA procedures.
  - Prepare laboratory SOPs.

3.0 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

The overall objectives and criteria for assuring quality for this effort are discussed below. This QAPP addresses how the acquisition and handling of samples and the review and reporting of data will be documented. The objectives of this QAPP are to address the following:

- The procedures to be used to collect, preserve, package, and transport soil, groundwater, and air samples.
- Field data collection.
- Record keeping.
- Data management.
- Chain-of-custody procedures.
- Precision, accuracy, completeness, representativeness, for sample analysis and data management under EPA analytical methods.

3.1 Level of QC Effort for Sample Parameters

Field blank, method blank, trip blank, field duplicate, laboratory duplicate, laboratory control, standard reference materials (SRM) and matrix spike samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs. QC samples are discussed below.

- Field and trip blanks consisting of distilled water will be submitted to the analytical laboratories to provide the means to assess the quality of the data resulting from the field-sampling program. Field (equipment) blank samples are analyzed to check for procedural chemical constituents at the facility that may cause sample contamination. Trip blanks are used to assess the potential for contamination of samples due to contaminant migration during sample shipment and storage.
- Method blank samples are generated within the laboratory and used to assess contamination resulting from laboratory procedures.
- Duplicate samples are analyzed to check for sampling and analytical reproducibility.
- MS/MSD and MS/Duplicate samples provide information about the effect of the sample matrix on the digestion and measurement methodology. Depending

> on site-specific circumstances, one MS/MSD or MS/Duplicate should be collected for every 20 or fewer investigative samples to be analyzed for organic and inorganic chemicals of a given matrix.

The general level of QC effort will be one field (blind) duplicate and one field blank (when non-dedicated equipment is used) for every 20 or fewer investigative samples of a given matrix. Additional sample volume will also be provided to the laboratory to allow one site-specific MS/MSD or MS/Duplicate for every 20 or fewer investigative samples of a given matrix. One trip blank consisting of distilled, deionized water will be included along with each sample delivery group of aqueous VOC samples.

4.0 SAMPLE CUSTODY PROCEDURES

Sample custody is controlled and maintained through the chain-of-custody procedures. Chain of custody is the means by which the possession and handling of samples will be tracked from the source (field) to their final disposition, the laboratory. A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it in a vehicle or room. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site.

4.1 Field Custody Procedures

Sample custody is controlled and maintained through the chain-of-custody procedures. Chain of custody is the means by which the possession and handling of samples will be tracked from the source (field) to their final disposition, the laboratory. A sample is considered to be in a person's custody if it is in the person's possession or it is in the person's view after being in his or her possession or it was in that person's possession and that person has locked it in a vehicle or room. Sample containers will be cleaned and preserved at the laboratory before shipment to the Site.

4.1.1 Sample Storage

Samples are stored in secure limited-access areas. Walk-in coolers or refrigerators are maintained at 4°C, ± 2°C, or as required by the applicable regulatory program. The temperatures of all refrigerated storage areas are monitored and recorded a minimum of once per day. Deviations of temperature from the applicable range require corrective action, including moving samples to another storage location if necessary. Sample parameter lists, holding times and sample container requirements are summarized on Table 1.

4.1.2 Sample Custody

Sample custody is defined by this document as when any of the following occur:

- It is in someone's actual possession.
- It is in someone's view after being in his or her physical possession.

- It was in someone's possession and then locked, sealed, or secured in a manner that prevents unsuspected tampering.
- It is placed in a designated and secured area.

Samples are removed from storage areas by the sample custodian or analysts and transported to secure laboratory areas for analysis. Access to the laboratory and sample storage areas is restricted to laboratory personnel and escorted visitors only; all areas of the laboratory are therefore considered secure. If required by the applicable regulatory program, internal chain-of-custody is documented in a log by the person moving the samples between laboratory and storage areas.

Laboratory documentation used to establish COC and sample identification may include the following:

- Field COC forms or other paperwork that arrives with the sample.
- The laboratory COC.
- Sample labels or tags are attached to each sample container.
- Sample custody seals.
- Sample preparation logs (i.e., extraction and digestion information) recorded in hardbound laboratory books that are filled out in legible handwriting, and signed and dated by the chemist.
- Sample analysis logs (e.g., metals, GC/MS, etc.) information recorded in hardbound laboratory books that are filled out in legible handwriting, and signed and dated by the chemist.
- Sample storage log (same as the laboratory COC).
- Sample disposition log, which documents sample disposal by a contracted waste disposal company.

4.1.3 Sample Tracking

All samples are maintained in the appropriate coolers prior to and after analysis. The analysts remove and return their samples as needed. Samples that require internal COC are relinquished to the analysts by the sample custodians. The analyst and sample custodian must sign the original COC relinquishing custody of the samples from the sample custodian to the analyst. When the samples are returned, the analyst will sign the original COC returning sample custody to the sample custodian. Sample extracts are relinquished to the instrumentation analysts by the preparatory analysts. Each preparation department tracks internal COC through their logbooks/spreadsheets.

Any change in the sample during the time of custody will be noted on the COC (e.g., sample breakage or depletion).

5.0 CALIBRATION PROCEDURES AND FREQUENCY

This section describes the calibration procedures and the frequency at which these procedures will be performed for both field and laboratory instruments.

5.1 Field Instrument Calibration

Quantitative field data to be obtained during groundwater sampling include pH, turbidity, specific conductance, temperature, dissolved oxygen and depth to groundwater. Quantitative water level measurements will be obtained with an electronic sounder or steel tape, which require no calibration. Quantitative field data to be obtained during soil sampling and soil vapor intrusion sampling include screening for the presence of volatile organic constituents using a photoionization detector (PID).

5.2 Preventative Maintenance

Each piece of field equipment is checked according to its routine maintenance schedule and before field activities begin. Field equipment that may be used at the Site includes:

- Photoionization detector (PID)
- Water quality meters (includes pH, turbidity, temperature, Eh, and specific conductance)
- Electric water level indicator
- Helium Detector

Field personnel will report all equipment maintenance and/or replacement needs to the Project QA Officer and will record the information on the daily field record.

6.0 DATA VALIDATION AND REPORTING

All data generated through field activities, or by the laboratory operation shall be reduced and validated (as required in the SMP) before reported.

6.1 Data Usability Evaluation

If requested by the NYSDEC, data evaluation will be performed by a third-party data validator using the most current methods and quality control criteria from the USEPA's Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review*, and Contract Laboratory Program*, National Functional Guidelines for Inorganic Data Review.*

6.1.1 Procedures Used to Evaluate Field Data Usability

The performance of all field activities, calibration checks on all field instruments at the beginning of each day of use, manual checks of field calculations, checking for transcription errors and review of field log books is the responsibility of the Field Team Leader.

6.1.2 Procedures Used to Evaluate Laboratory Data Usability

Data evaluation will be performed by the third-party data validator using the most current methods and quality control criteria from the USEPA's Contract Laboratory Program (CLP) *National Functional Guidelines for Organic Data Review*, and Contract Laboratory Program*, National Functional Guidelines for Inorganic Data Review.* The data review guidance will be used only to the extent that it is applicable to the SW-846 methods; SW-846 methodologies will be followed primarily and given preference over CLP when differences occur. Also, results of blanks, surrogate spikes, MS/MSDs, and laboratory control samples will be reviewed/evaluated by the data validator. All sample analytical data for each sample matrix shall be evaluated. The third-party data validation expert will also evaluate the overall completeness of the data package. Completeness checks will be administered on all data to determine whether deliverables specified in this QAPP are present. The reviewer will determine whether all required items are present and request copies of missing deliverables.

6.2 Data Reporting

6.2.1 Field Data Reporting

All field documents will be accounted for when they are completed. Accountable documents include items such as field notebooks, sample logs, field data records, photographs, data packages, computer disks, and reports.

6.2.2 Laboratory Data Reporting

Analytical data will be summarized in tabular format with such information as sample identification, sample matrix description, parameters analyzed and their corresponding detected concentrations, and the detection limit. Analytical results will be incorporated into reports as data tables, maps showing sampling locations and analytical results, and supporting text.

7.0 CORRECTIVE ACTION

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out of quality control performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. All corrective action proposed and implemented should be documented in the regular quality assurance reports to management. Corrective action should be implemented only after approval by the Project Manager, or his/her designee. If immediate corrective action is required, approvals secured by telephone from the Project Manager should be documented in an additional memorandum.

7.1 Field Corrective Action

If errors in field procedures are discovered during the observation or review of field activities by the Project QA Officer or his/her designee, corrective action will be initiated. Nonconformance to the QA/QC requirements of the field operating procedures will be identified by field audits or immediately by project staff who know or suspect that a procedure is not being performed in accordance with the requirements. The Project QA Officer or his designee will be informed immediately upon discovery of all deficiencies. Timely action will be taken if corrective action is necessary.

Corrective action in the field may be needed when the sample network is changed (i.e., more/less samples, sampling locations other than those specified in the Work Plan, etc.) or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. In general, the Project Manager and QA Officer may identify the need for corrective action. The Project Manager will approve the corrective measure that will be implemented by the field team. It will be the responsibility of the Project Manager to ensure that corrective action has been implemented.

If the corrective action will supplement the existing sampling using existing and approved procedures in the QAPP, corrective action approved by the Project Manager will be documented. If the corrective actions result in less samples (or analytical fractions), alternate locations, etc., which may result in non-achievement of project QA objectives, it will be necessary that all levels of project management, including the NYSDEC Project Coordinator, concur with the proposed action.

Corrective actions will be implemented and documented in the project field record book. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by the NYSDEC Project Coordinator.

If at any time a corrective action issue is identified which directly impacts project data quality objectives, the NYSDEC Project Coordinator will be notified immediately.

7.2 Laboratory Corrective Action

Corrective actions may be initiated if the quality assurance goals are not achieved. The initial step in a corrective action is to instruct the analytical laboratory to examine its procedures to assess whether analytical or computational errors caused the anomalous result. If no error in laboratory procedures or sample collection and handling procedures can be identified, then the Project Manager will assess whether reanalysis or resampling is required or whether any protocol should be modified for future sampling events.

7.3 Data Validation & Assessment Corrective Action

The need for corrective action may be identified during the data validation or assessment processes. Potential types of corrective action may include resampling by the field team, or reinjection/reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team, whether the data to be collected is necessary to meet the QA objectives (e.g., the holding time for samples is not exceeded, etc.). If the data validator identifies a corrective action situation, the Project Manager will be responsible for approving the corrective action implementation. All required corrective actions will be documented by the laboratory Quality Assurance Coordinator.

TABLE

TABLE 1

SAMPLE CONTAINER, VOLUME, PRESERVATION & HOLDING TIME REQUIREMENTS
OREGON ROAD SITE
BCP SITE NO. C905045
OLEAN, NEW YORK

Matrix	Parameter[1]	Method[1]	Container Type	Minimum Volume	Preservation (Cool to 2-4 °C for all samples)	Holding Time from Sample Date
Soil	TCL + CP-51 VOCs	8260B	EnCore/WMG	5 gm / 4 oz.	Cool to 2-4 °C, Zero Headspace	48 - hours / 14 days
	TCL SVOCs	8270C	WMG	16 oz.	Cool to 2-4 °C	14 days extrac./40 days
	TAL Metals[2]	6010	WMG	4 oz.	Cool to 2-4 °C	6 months/Hg 28 days
	Pesticides	8081	WMG	8oz	Cool to 2-4 °C	14 days extrac./40 days
	Herbicides	8151	WMG	8oz	Cool to 2-4 °C	14 days extrac./40 days
	PCBs	8082	WMG	4 oz.	Cool to 2-4 °C	14 days extrac./40 days
	PFAS	modified 537	HDPE/Polypropylene	4-8 oz.	Cool to 2-4 °C	14 days extrac./40 days
Groundwater	TCL + CP-51 VOCs	8260B	glass vial	3 - 4 oz.	HCl to pH<2, Zero Headspace, Cool to 2-4 °C	14 days
	TCL SVOCs	8270C	amber glass	1000 ml	Cool to 2-4 °C	7 days extrac/40 days
	TAL Metals[2]	6010	plastic	600 ml	HNO_3 to pH<2, Cool to 2-4 °C	6 months/Hg 28 days
	Pesticides	8081B	amber glass	1000 ml	Cool to 2-4 °C	14 days extrac./40 days
	Herbicides	8151A	amber glass	1000 ml	Cool to 2-4 °C	14 days extrac./40 days
	PCBs	8082	amber glass	1000 ml	Cool to 2-4 °C	7 days extrac/40 days
	PFAS	modified 537	HDPE/Polypropylene	2 - 500 mL	Trizma, Cool to 2-4 °C	14 days
	1,4-Dioxane	8270 SIM	amber glass	2 - 500 mL	Cool to 2-4 °C	7 days extrac/40 days
Air/Soil Vapor	TCL VOCs	TO-15	Summa Cannister	6 liters	None	Analyze within 14 days of sample date of collection

References:
1. Test Methods for Evaluating Solid Wastes, USEPA SW-846, Update III, 1991.

Notes:
1. EPA-approved methods published in Reference 1 above may be used.
2. Mercury sampling in soil/groundwater via EPA methods 7471/7470 respectively.

Acronyms:
VOCs = Volatile Organic Compounds
SVOCs = Semi-Volatile Organic Compounds
TCL = Target Compound List
TAL = Target Analyte List
PCBs = Polychlorinated Biphenyls

APPENDIX H

FIELD OPERATING PROCEDURES

FIELD OPERATING PROCEDURES

BENCHMARK ENVIRONMENTAL CIVIL/ENGINEERING & GEOLOGY, PLLC

FOP Number	Description
001.1	Abandonment of Borehole Procedures
002.0	Abandonment of Monitoring Wells Procedure
007.0	Calibration and Maintenance of Portable Dissolved Oxygen Meter
008.0	Calibration and Maintenance of Portable Field pH/Eh Meter
009.0	Calibration and Maintenance of Portable Field Turbidity Meter
011.1	Calibration and Maintenance of Portable Photoionization Detector
012.0	Calibration and Maintenance of Portable Specific Conductance Meter
015.0	Documentation Requirements for Drilling and Well Installation
017.0	Drill Site Selection Procedure
018.0	Drilling and Excavation Equipment Decontamination Procedures
022.0	Groundwater Level Measurement
023.1	Groundwater Purging Procedures Prior to Sample Collection
024.1	Groundwater Sample Collection Procedures
026.1	Hollow Stem Auger (HSA) Drilling Procedures
031.2	Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure
032.2	Management of Investigation-Derived Waste (IDW)
033.0	Monitoring Well Construction for Hollow Stem Auger Boreholes
036.0	Monitoring Well Development Procedures
040.1	Non-Disposable and Non-Dedicated Sampling Equipment Decontamination
046.0	Sample Labeling, Storage and Shipment Procedures
054.2	Soil Description Procedures Using The Visual-Manual Method
070.0	Well/Piezometer Construction Materials and Design
073.2	Real-Time Air Monitoring During Intrusive Activities

Notes:
1. FOPs are identified by the sequential FOP number and revision number.

BENCHMARK
ENVIRONMENTAL
ENGINEERING &
SCIENCE, PLLC

FIELD OPERATING PROCEDURES

Abandonment of Borehole Procedures

FOP 001.1

ABANDONMENT OF BOREHOLE PROCEDURE

PURPOSE

Soil borings that are not completed as monitoring wells will be plugged by filling the holes with a cement/bentonite grout. Field staff will calculate the borehole volume and compare it to the final installed volume of grout to evaluate whether bridging or loss to the formation has occurred. These calculations and the actual volume placed will be noted on the Boring Log.

PROCEDURE

1. Determine most suitable seal materials. Grout specifications generally have mixture ratios as follows:

   <u>Grout Slurry Composition (% Weight)</u>

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60 %	-	Cement (Portland Type I)
40 to 60 %	-	Potable Water

2. Calculate the volume of the borehole base on the bit or auger head diameter plus 10% and determine the volume of grout to be emplaced. Generally, the total mixed volume is the borehole volume plus 20%.

3. Identify the equipment to be used for the preparation and mixing of the grout. Ensure the volume of the tanks to be used for mixing has been measured adequately. Document these volumes on the Well Abandonment/Decommissioning Log (sample attached).

4. Identify the source of the water to be used for the grout and determine its suitability for use. In particular, water with high sulfate, or chloride levels or heated water should not be used. These types of waters can cause operational difficulties or modify the set-up for the grout.

5. Identify the equipment to be used for emplacing the grout. Ensure that the pump to be used has adequate pressure to enable complete return to surface.

6. Identify the volumes to be pumped at each stage or in total if only one stage is to be used.

7. Prepare the borehole abandonment plan and discuss the plan and activities with the drilling contractor prior to beginning any mixing activities.

8. Begin mixing the grout to be emplaced.

9. Record the type and amount of materials used during the mixing operation. Ensure the ratios are within specifications tolerance.

10. Begin pumping the grout through the return line bypass system to confirm all pump and surface fittings are secure.

11. Initiate downhole pumping from the bottom of the borehole. Record the times and volumes emplaced on the Well Abandonment/Decommissioning Log (sample attached).

12. Document the return circulation of grout. This may be facilitated by using a colored dye or other tagging method if a mudded borehole condition exists prior to grout injection.

13. Identify what procedures will be used for grouting in the upper 3 feet. When casing exists in the borehole, decisions are required as to the timing for removal and final disposition of the casing. Generally, it will not be removed prior to grouting because of the potential for difficult access and loss of circulation in the upper soil or rock layers. Accordingly, when cement return is achieved at surface, the casing is commonly removed and the borehole is topped off with grout or soils. If casing removal is not possible or not desired, the casing left in place should be cut off at a depth of 5 feet or greater below ground surface. If casing is not present during grouting, the grout level in the borehole is topped off after the rods or tremie pipe is removed.

14. Clear and clean the surface near the borehole.

15. The uppermost five feet of the borehole at the land surface should be filled with material physically similar to the natural soils. The surface of the borehole should be restored to the condition of the area surrounding the borehole. For example, concrete or asphalt will be patched with concrete or asphalt of the same type and thickness, grassed areas will be seeded, and topsoil will be used in other areas. All solid waste materials generated during the decommissioning process must be disposed of properly.

16. A follow-up check at each site should be made within one week to 10 days of completion. It should be noted that on occasion, the grout and/or surface material may settle over several days. If settling occurs, additional material physically similar to surrounding materials (i.e., asphalt, concrete, or soil) must be used to match the existing grade.

17. Document borehole and/or well/piezometer decommissioning activities on a Well Abandonment/Decommissioning Log (sample attached).

ATTACHMENTS

Well Abandonment/Decommissioning Log (sample)

REFERENCES

ASTM D 5299: *Guide for Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities.*

NYSDEC, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

NYSDEC, November 2009, *CP-43: Groundwater Monitoring Well Decommissioning Policy.*

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, 1089 p.

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

WELL ABANDONMENT/ DECOMMISSIONING LOG

PROJECT INFORMATION	WELL INFORMATION
Project Name:	WELL I.D.:
Client:	Stick-up (fags):
Project Job Number:	Total Depth (fbgs):
Date:	Screen Interval (fbgs):
Weather:	Well Material:
	Diameter (inches):
BM/TK Personnel:	
Drilling Company:	Drilling Company Personnel:
Drill Rig Type:	

DECOMMISSIONING PROCEDURES

Time	Description of Field Activities

PREPARED BY: DATE:

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FIELD OPERATING PROCEDURES

Abandonment of Monitoring Wells Procedure

FOP 002.0

ABANDONMENT OF MONITORING WELLS PROCEDURE

PURPOSE

This guideline presents a method for the abandonment and decommissioning of wells that are no longer reliable as competent monitors of formation groundwater. Well abandonment and decommissioning is required in order to remove a potential pathway for the vertical migration of impacted groundwater and/or surface water.

PROCEDURE

1. Examine the existing well to be abandoned/decommissioned and review well construction detail information (if applicable) to determine well depth,, screened interval, diameter, material of composition and other construction details. Establish appropriate equipment requirements for removal of the well.

2. Determine the most suitable seal materials as discussed in the next section.

3. Attempt to remove the well using a drilling rig, by using the following procedures:
    - Attaching the winch line to the well to see if it can be removed by pulling;
    - Using the rig's hydraulics to advance casing incrementally;
    - If a cable tool rig is available, bump back the casing using the cathead and drive block.

3. Upon removal of the well, ream the borehole by advancing the augers approximately one foot beyond the total depth of the well. Rotate the augers at a speed sufficient to remove the construction materials (i.e., filter pack, bentonite seal, etc.) from the borehole annulus (if possible). Backfill the resulting borehole with cement/bentonite grout, by tremie method, to approximately one foot below ground surface. Fill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary). Go to Step 10.

4. If the well cannot be removed from the borehole over-drill the borehole and well to approximately two (2) feet below the well depth. Upon reaching the desired depth, remove the well from within the augers and go back to Step 3.

5. If the borehole cannot be reamed out using conventional drilling techniques (i.e., over-drilled), remove or puncture the base plate of the well screen using the drill rig and associated equipment by pounding with the drill rods. Upon filling the well with grout by tremie method, slowly pull the well from the ground surface to allow the grout to evacuate through the bottom of the well to fill the void space created by removal of the well casing. Continue adding grout mix to the well casing, as necessary, to fill the void space to approximately one foot below ground surface. Fill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary). Go to Step 10.

   If the driller is unsuccessful at removing or puncturing the base plate of the well due, in part, to well construction materials (i.e., stainless steel or black iron), go to Step 6.

6. Insert a tremie pipe down the well to the bottom and pump a cement/bentonite grout mixture to a depth one to two feet above the top of the screen.

7. Perform a hydraulic pressure test on the portion of the well casing above the grouted screen section. Allow the grout to set up for a period not less than 72 hours before pressure testing of the grouted interval. Place a pneumatic packer a maximum of 4.5 feet above the top of the slotted screen section of the well. The infiltration pressure applied to the packer shall not exceed the pressure rating of the well casing material. If the interval between the top of the grout and the bottom of the packer is not saturated, potable water will be used to fill the interval. A gauge pressure of 5 psig at the well head shall be applied to the interval for a period of 5 minutes to allow for temperature stabilization. After 5 minutes, the pressure will be maintained at 5 psig for 30 minutes. The grout seal shall be considered acceptable if the total loss of water to the seal does not exceed 0.5 gallons over a 30-minute period.

8. If the grout seal is determined to be unacceptable, tremie grout an additional 5 feet of well riser above the failing interval and retest as specified above (see Step 7).

9. If the grout seal is determined to be acceptable, tremie grout the remainder of the well until grout displaces all formation water and a grout return is visible in the well at the surface. Cut off well casing at a depth of five feet or greater below ground surface and backfill the remaining borehole to match the existing grade elevation and material of construction (i.e., clean native soil, concrete or asphalt, as necessary).

10. Record all well construction details and abandonment procedures on the **Well Abandonment/Decommissioning Log** (sample attached).

CEMENT/BENTONITE GROUT MIXTURE

The cement/bentonite grout mixture identified below is generally considered the most suitable seal material for monitoring well advancement and abandonment. Grout specifications generally have mixture ratios as follows:

Grout Slurry Composition (% Weight)

1.5 to 3.0% - Bentonite (Quick Gel)
40 to 60% - Cement (Portland Type I)
40 to 60% - Potable Water

MISCELLANEOUS

All removed well materials (PVC, stainless steel, steel pipe) should be decontaminated (if necessary) as per the project specific **Drilling and Excavation Equipment Decontamination FOP** and removed from the site. The project manager will determine the destination of final disposal for all well materials. All drill cuttings (depending on site protocol) should be placed in DOT-approved 55-gallon drums, labeled and sampled in accordance with Benchmark's field operating procedure **Management of Investigation-Derived Waste** in order to determine proper removal and disposal procedures. The drilling subcontractor will provide any potable water utilized during this field activity from a known and reliable source (see Notes section).

ATTACHMENTS

Well Abandonment/Decommissioning Log (sample)

REFERENCES

New York State Department of Environmental Conservation, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, p. 1089.

Benchmark FOPs:
018 Drilling/Excavation Equipment Decontamination Protocols
032 Management of Investigation-Derived Waste

NOTES

Tap water may be used from any municipal water treatment system. The use of an untreated potable water supply is not an acceptable substitute.

WELL ABANDONMENT/ DECOMMISSIONING LOG

PROJECT INFORMATION	WELL INFORMATION
Project Name:	WELL I.D.:
Client:	Stick-up (fags):
Project Job Number:	Total Depth (fbgs):
Date:	Screen Interval (fbgs):
Weather:	Well Material:
	Diameter (inches):
BM/TK Personnel:	
Drilling Company:	Drilling Company Personnel:
Drill Rig Type:	

DECOMMISSIONING PROCEDURES

Time	Description of Field Activities

Benchmark
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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Dissolved Oxygen Meter

FOP 007.0

CALIBRATION AND MAINTENANCE OF PORTABLE DISSOLVED OXYGEN METER

PURPOSE

This guideline describes a method for calibration of a portable dissolved oxygen meter. This meter measures the concentration of dissolved oxygen within a water sample. This parameter is of interest both as a general indicator of water quality, and because of its pertinence to fate and transport of organics and inorganics. This guideline presents a method for calibration of this meter, which is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the dissolved oxygen meter will be within ± 1% of full-scale over the temperature range of 23° to 113° F (-5° to +45° C).

PROCEDURE

1. Calibrate the dissolved oxygen meter to ambient air based on probe temperature and true local atmospheric pressure conditions (or feet above sea level). Because procedures vary with different brands and models of meters, refer to the manufacturer's recommended calibration procedures.

2. In the event of a failure to adequately calibrate, follow the corrective action directed by the manufacturer.
3. If calibration cannot be achieved or maintained, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

4. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
    - Time, date, and initials of the field team member performing the calibration
    - The unique identifier for the meter, including manufacturer, model, and serial number
    - The brand and expiration dates of calibration solutions
    - The calibration readings
    - The instrument settings (if applicable)
    - The approximate response time
    - The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above
    - Corrective action taken (see Step 5 above) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use or between measurements, the dissolved oxygen probe will be kept immersed in or moist with deionized water.

- The meter batteries will be checked prior to each meter's use and will be replaced when the meter cannot be redline adjusted.

- The meter response time and stability will be tracked to determine the need for instrument maintenance. When response time becomes greater than two minutes, probe service is indicated.

ATTACHMENTS

Equipment Calibration Log (sample)

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ BM ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID	[illegible]		open air zero		MIBK re factor =
						_____ ppm Iso. Gas		
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/[illegible]					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field pH/Eh Meter

FOP 008.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD pH/Eh METER

PURPOSE

This guideline describes a method for calibration of a portable pH/Eh meter. The pH/Eh meter measures the hydrogen ion concentration or acidity of a water sample (pH function), and the oxidation/reduction potential of a water sample (Eh function). Calibration is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the pH/Eh meter will be:

pH	± 0.2 pH unit, over the temperature range of ± 0.2 C.
Eh	± 0.2 millivolts (mV) over the range of ± 399.9 mV, otherwise ± 2 mV.

PROCEDURE

Note: Meters produced by different manufacturers may have different calibration procedures. These instructions will take precedence over the procedure provided herein. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

1. Obtain and active the meter to be used. As stated above, initial calibrations will be performed at the beginning of each sampling day.

2. Immerse the sensing probe in a container of certified pH 7.0 buffer solution traceable to the National Bureau of Standards.

3. Measure the temperature of the buffer solution, and adjust the temperature setting accordingly.

4. Compare the meter reading to the known value of the buffer solution while stirring. If the reading obtained by the meter does not agree with the known value of the buffer solution, recalibrate the meter according to the manufacturer's instructions until the desired reading is obtained. This typically involves accessing and turning a dial or adjustment screw while measuring the pH of the buffer solution. The meter is adjusted until the output agrees with the known solution pH.

5. Repeat Steps 2 through 5 with a pH 4.0 and 10.0 buffer solution to provide a three-point calibration. Standards used to calibrate the pH meter will be of concentrations that bracket the expected values of the samples to be analyzed, especially for two-point calibrations (see note below).

Note: Some pH meters only allow two-point calibrations. Two-point calibrations should be within the suspected range of the groundwater to be analyzed. For example, if the groundwater pH is expected to be approximately 8, the two-point calibration should bracket that value. Buffer solutions of 7 and 10 should then be used for the two-point calibration.

6. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:

   - Time, date, and initials of the field team member performing the calibration
   - The unique identifier for the meter, including manufacturer, model, and serial number
   - The brand and expiration dates of buffer solutions
   - The instrument readings
   - The instrument settings (if applicable)

- Pass or fail designation in accordance with the accuracy specifications presented above
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate

MAINTENANCE

- When not in use, or between measurements, keep the pH/Eh probe immersed in or moist with buffer solutions.

- Check the meter batteries at the end of each day and recharge or replace as needed.

- Replace the pH/Eh probe any time that the meter response time becomes greater than two minutes or the meeting system consistently fails to retain its calibrated accuracy for a minimum of ten sample measurements.

- If a replacement of the pH/Eh probe fails to resolve instrument response time and stability problems, obtain a replacement instrument (rental instruments) and/or order necessary repairs/adjustment.

ATTACHMENTS

Equipment Calibration Log (sample)

Benchmark Environmental Engineering & Science, PLLC

EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ BM ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00 7.00 10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4 20 100 800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero _____ ppm Iso. Gas		MIBK re factor =
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/H					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Field Turbidity Meter

FOP 009.0

CALIBRATION AND MAINTENANCE OF PORTABLE FIELD TURBIDITY METER

PURPOSE

This guideline describes the method for calibration of the HACH 2100P portable field turbidity meter. Turbidity is one water quality parameter measured during purging and development of wells. Turbidity is measured as a function of the samples ability to transmit light, expressed as Nephelometric Turbidity Units (NTUs). The turbidity meter is factory calibrated and must be checked daily prior to using the meter in the field. Calibration is performed to verify instrument accuracy and function. This procedure also documents critical maintenance activities for this meter.

ACCURACY

Accuracy shall be ± 2% of reading below 499 NTU or ± 3% of reading above 500 NTU with resolution to 0.01 NTU in the lowest range. The range key provides for automatic or manual range selection for ranges of 0.00 to 9.99, 0.0 to 99.9 and 0 to 1000 NTU. Another key provides for selecting automatic signal averaging. Pressing the key shall toggle signal averaging on or off.

PROCEDURE

Calibration of the 2100P Turbidimeter is based on formazin, the primary standard for turbidity. The instrument's electronic and optical design provides long-term stability and minimizes the need for frequent calibration. The two-detector ratioing system compensates for most fluctuations in lamp output. **A formazin recalibration should be performed at least once every three months,** more often if experience indicates the need. During calibration, use a primary standard such as StablCal™ Stabilized Standards or formazin standards.

Note: Meters produced by different manufacturers may have different calibration check procedures. These manufacturers' instructions will take precedence over the procedure provided here. This procedure is intended to be used as a general guideline, or in the absence of available manufacturer's instructions.

Note: Because the turbidity meter measures light transmission, it is critical that the meter and standards be cared for as precision optical instruments. Scratches, dirt, dust, etc. can all temporarily or permanently affect the accuracy of meter readings.

Preparing StablCal Stabilized Standards in Sealed Vials

Sealed vials that have been sitting undisturbed for longer than a month must be shaken to break the condensed suspension into its original particle size. Start at *step 1* for these standards. If the standards are used on at least a weekly interval, start at *step 3*.

Note: These instructions do not apply to < 0.1 NTU StablCal Standards; < 0.1 NTU StablCal Standards should not be shaken or inverted.

1. Shake the standard vigorously for 2-3 minutes to re-suspend any particles.
2. Allow the standard to stand undisturbed for 5 minutes.
3. Gently invert the vial of StablCal 5 to 7 times.
4. Prepare the vial for measurement using traditional preparation techniques. This usually consists of oiling the vial (see *Section 2.3.2 on page 11 of the manual*)

and marking the vial to maintain the same orientation in the sample cell compartment (see *Section 2.3.3 on page 12 of the manual*). This step will eliminate any optical variations in the sample vial.

5. Let the vial stand for one minute. The standard is now ready for use in the calibration procedure.

Calibration Procedure

1. Turn the meter on.
2. Shake pre-mixed formazin primary standards in accordance with the above procedure.
3. Wipe the outside of the < 0.1 NTU standard and insert the sample cell in the cell compartment by aligning the orientation mark on the cell with the mark on the front of the cell compartment.
4. Close the lid and press **I/O**.
5. Press the **CAL** button. The **CAL** and **S0** icons will be displayed and the 0 will flash. The four-digit display will show the value of the **S0** standard for the previous calibration. If the blank value was forced to 0.0, the display will be blank. Press the right arrow key (→) to get a numerical display.
6. Press **READ**. The instrument will count from 60 to 0, read the blank and use it to calculate a correction factor for the 20 NTU standard measurement. If the dilution water is ≥ 0.5 NTU, E 1 will appear when the calibration is calculated (*see Section 3.6.2.3 on page 31 of the manual*). The display will automatically increment to the next standard. Remove the sample cell from the cell compartment

Note: The turbidity of the dilution water can be "forced" to zero by pressing → rather than reading the dilution water. The display will show "S0 NTU" and the ↑ key must be pressed to continue with the next standard.

7. Repeat steps 1 through 7 for the 20, 100 and 800 standards.

8. Following the 800 NTU standard calibration, the display will increment back to the **S0** display. Remove the sample cell from the cell compartment.

9. Press **CAL** to accept the calibration. The instrument will return to measurement mode automatically.

10. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample). Information will include, at a minimum:
    - Time, date, and initials of the field team member performing the calibration
    - The unique identifier for the meter, including manufacturer, model, and serial number
    - The brand of calibration standards
    - The instrument readings
    - The instrument settings (if applicable)
    - Pass or fail designation in accordance with the accuracy specifications presented above
    - Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

Note: Pressing CAL completes the calculation of the calibration coefficients. If calibration errors occurred during calibration, error messages will appear after CAL is pressed. If E 1 or E 2 appear, check the standard preparation and review the calibration; repeat the calibration if necessary. If "CAL?" appears, an error may have

occurred during calibration. If "CAL?" is flashing, the instrument is using the default calibration.

NOTES

- If the **I/O** key is pressed during calibration, the new calibration data is lost and the old calibration will be used for measurements. Once in calibration mode, only the **READ, I/O,** ↑ , and →keys function. Signal averaging and range mode must be selected before entering the calibration mode.

- If **E 1** or **E 2** are displayed, an error occurred during calibration. Check the standard preparation and review the calibration; repeat the calibration if necessary. Press **DIAG** to cancel the error message (**E 1** or **E 2)**. To continue without repeating the calibration, press **I/O** twice to restore the previous calibration. If "**CAL?"** is displayed, an error may have occurred during calibration. The previous calibration may not be restored. Either recalibrate or use the calibration as is.

- To review a calibration, press **CAL** and then ↑ to view the calibration standard values. As long as **READ** is never pressed and **CAL** is not flashing, the calibration will not be updated. Press **CAL** again to return to the measurement mode.

MAINTENANCE

- **Cleaning**: Keep the turbidimeter and accessories as clean as possible and store the instrument in the carrying case when not in use. Avoid prolonged exposure to sunlight and ultraviolet light. Wipe spills up promptly. Wash sample cells with non-abrasive laboratory detergent, rinse with distilled or demineralized water, and air dry. Avoid scratching the cells and wipe all moisture and fingerprints off the cells before inserting them into the instrument. Failure to do so can give inaccurate readings. See *Section 2.3.1 on page 11of the manual* for more information about sample cell care.

- **Battery Replacement**: AA alkaline cells typically last for about 300 tests with the signal-averaging mode off, about 180 tests if signal averaging is used. The "battery" icon flashes when battery replacement is needed. Refer to *Section 1.4.2 on page 5 of the manual* for battery installation instructions. If the batteries are changed within 30 seconds, the instrument retains the latest range and signal average selections. If it takes more than 30 seconds, the instrument uses the default settings. If, after changing batteries, the instrument will not turn off or on and the batteries are good, remove the batteries and reinstall them. If the instrument still won't function, contact Hach Service or the nearest authorized dealer.

- **Lamp Replacement**: The procedure in *Section 4.0 on page 49 of the manual* explains lamp installation and electrical connections. Use a small screwdriver to remove and install the lamp leads in the terminal block. The instrument requires calibration after lamp replacement.

ATTACHMENTS

Equipment Calibration Log (sample)

BENCHMARK
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EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ BM ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID			open air zero		MIBK re factor =
						_____ ppm Iso. Gas		
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

BENCHMARK
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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Photoionization Detector (PID)

FOP 011.1

CALIBRATION AND MAINTENANCE OF PORTABLE PHOTOIONIZATION DETECTOR

PURPOSE

This procedure describes a general method for the calibration and maintenance of a portable photoionization detector (PID). The PID detects and initially quantifies a reading of the volatile organic compound (VOC) concentration in air. The PID is used as a field-screening tool for initial evaluation of soil samples and for ambient air monitoring of compounds with ionization potentials (IP) less than the PID lamp electron voltage (eV) rating. The IP is the amount of energy required to move an electron to an infinite distance from the nucleus thus creating a positive ion plus an electron. It should be noted that all of the major components of air (i.e., carbon dioxide, methane, nitrogen, oxygen etc.) have IP's above 12 eV. As a result, they will not be ionized by the 9.8, 10.6, or 11.7 eV lamps typically utilized in field PIDs. The response of the PID will then be the sum of the organic and inorganic compounds in air that are ionized by the appropriate lamp (i.e., 9.8, 10.6 or 11.7 eV). Attached to this FOP is a table summarizing common organic compounds and their respective IPs.

Calibration is performed to verify instrument accuracy and function. All field instruments will be calibrated, verified and recalibrated at frequencies required by their respective operating manuals or manufacturer's specifications, but not less than once each day that the instrument is in use. Compound-specific calibration methods should be selected on a project-by-project basis to increase the accuracy of the instrument. The best way to calibrate a PID to different compounds is to use a standard of the gas of interest. However, correction factors have been determined that enable the user to quantify a large number of chemicals using only a single calibration gas, typically isobutylene. Field personnel should have access to all operating manuals for the instruments used for the field measurements. This procedure also documents critical maintenance activities for this meter.

Note: The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the MiniRAE 2000 Portable VOC Monitor equipped with a 10.6 eV lamp. The actual equipment to be used in the field will be equivalent or similar. The following information is provided for general reference; the equipment-specific manufacturer's manual should be followed with precedence over this FOP.

Note: The PID indicates <u>total</u> VOC concentration readings that are normalized to a calibration standard, so actual quantification of individual compounds is not provided. In addition, the PID response to compounds is highly variable, dependent on ionization potential of the compound, and the presence or absence of other compounds.

ACCURACY

The MiniRAE 2000 is accurate to ± 2 ppm or 10% of the reading for concentrations ranging from 0-2,000 ppm and ± 20% of the reading at concentrations greater than 2,000 ppm. Response time is less than two seconds to 90 percent of full-scale. The operating temperature range is 0 to 45° C and the operating humidity range is 0 to 95 % relative humidity (non-condensing).

CALIBRATION PROCEDURE

The calibration method and correction factor, if applicable, will be selected on a project-by-project basis and confirmed with the Project Manager prior to the start of field work.

1. Calibrate all field test equipment at the beginning of each sampling day. Check and recalibrate the PID according to the manufacture's specifications.

2. Calibrate the PID using a compressed gas cylinder or equivalent containing the calibration standard, a flow regulator, and a tubing assembly. In addition, a compressed gas cylinder containing zero air ("clean" air) may be required if ambient air conditions do not permit calibration to "clean air".

3. Fill two Tedlar® bags equipped with a one-way valve with zero-air (if applicable) and the calibration standard gas.

4. Assemble the calibration equipment and actuate the PID in its calibration mode.

5. Select the appropriate calibration method. Calibration may be completed with two methods: 1) where the calibration standard gas is the same as the measurement gas (no correction factor is applied) or 2) where the calibration standard gas is not the same as the measurement gas and a correction factor will be applied. An isobutylene standard gas must be used as the calibration standard gas for the use of correction factors with the MiniRAE 2000. See below for additional instructions for calibration specific to use with or without correction factors.

Calibrating Without a Correction Factor

Navigate within the menu to select the "cal memory" for the specific calibration standard gas prior to calibration. The default gas selections for the MiniRAE 2000 are as follows:

Cal Memory #0	Isobutylene
Cal Memory #1	Hexane
Cal Memory #2	Xylene
Cal Memory #3	Benzene
Cal Memory #4	Styrene
Cal Memory #5	Toluene
Cal Memory #6	Vinyl Chloride
Cal Memory #7	Custom

The calibration standard gas for Cal Memory #1-7 may be toggled for selection of any of the approximately 100 preprogrammed calibration standard gases for use without an applied correction factor (i.e., the calibration gas must be the same as the measurement gas).

Calibrating With a Correction Factor

Navigate within the menu to select the "Cal Memory".

Select "Cal Memory #0" and toggle for selection of any of the approximately 100 preprogrammed chemicals. During calibration, the unit requests isobutylene gas and displays the isobutylene concentration immediately following calibration, but when the unit is returned to the normal reading mode, it displays the selected chemical and applies the correction factor.

If the pre-programmed list does not include the desired chemical or a user-defined measurement gas and correction factor is desired, toggle Cal Memory #0 to "user defined custom gas". A list of approximately 300 correction factors is attached in Technical Note 106 generated by MiniRAE.

6. Once the PID settings have been verified, connect the PID probe to the zero air calibration bag (or calibrate to ambient air if conditions permit) and wait for a stable indication.

7. Connect the PID probe to the calibration standard bag. Measure an initial reading of the standard and wait for a stable indication.

8. Keep the PID probe connected to the calibration standard bag, calibrate to applicable concentration (typically 100 ppm with isobutylene) with the standard and wait for a stable indication.

9. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish

maintenance schedules and component replacement. Information will include, at a minimum:

- Time, date and initials of the field team member performing the calibration
- The unique identifier for the meter, including manufacturer, model, and serial number
- The calibration standard and concentration
- Correction factors used, if any
- The brand and expiration date of the calibration standard gas
- The instrument readings: before and after calibration
- The instrument settings (if applicable)
- Pass or fail designation in accordance with the accuracy specifications presented above
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

MAINTENANCE

- The probe and dust filter of the PID should be checked before and after every use for cleanliness. Should instrument response become unstable, recalibration should be performed. If this does not resolve the problem, access the photoionization bulb and clean with the manufacturer-supplied abrasive compound, then recalibrate.

- The PID battery must be recharged after each use. Store the PID in its carrying case when not in use. Additional maintenance details related to individual components of the PID are provided in the equipment manufacturer's instruction manual. If calibration or instrument performance is not in accordance with specifications, send the instrument to the equipment manufacturer for repair.

- Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

ATTACHMENTS

Table 1; Summary of Ionization Potentials
Equipment Calibration Log (sample)
Technical Note TN-106

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
A		
2-Amino pyridine	8	
Acetaldehyde	10.21	
Acetamide	9.77	
Acetic acid	10.69	X
Acetic anhydride	10	
Acetone	9.69	
Acetonitrile	12.2	X
Acetophenone	9.27	
Acetyl bromide	10.55	
Acetyl chloride	11.02	X
Acetylene	11.41	X
Acrolein	10.1	
Acrylamide	9.5	
Acrylonitrile	10.91	X
Allyl alcohol	9.67	
Allyl chloride	9.9	
Ammonia	10.2	
Aniline	7.7	
Anisidine	7.44	
Anisole	8.22	
Arsine	9.89	
B		
1,3-Butadiene (butadiene)	9.07	
1-Bromo-2-chloroethane	10.63	X
1-Bromo-2-methylpropane	10.09	
1-Bromo-4-fluorobenzene	8.99	
1-Bromobutane	10.13	
1-Bromopentane	10.1	
1-Bromopropane	10.18	
1-Bromopropene	9.3	
1-Butanethiol	9.14	
1-Butene	9.58	
1-Butyne	10.18	
2,3-Butadione	9.23	
2-Bromo-2-methylpropane	9.89	
2-Bromobutane	9.98	
2-Bromopropane	10.08	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
2-Bromothiophene	8.63	
2-Butanone (MEK)	9.54	
3-Bromopropene	9.7	
3-Butene nitrile	10.39	
Benzaldehyde	9.53	
Benzene	9.25	
Benzenethiol	8.33	
Benzonitrile	9.71	
Benzotrifluoride	9.68	
Biphenyl	8.27	
Boron oxide	13.5	X
Boron trifluoride	15.56	X
Bromine	10.54	
Bromobenzene	8.98	
Bromochloromethane	10.77	X
Bromoform	10.48	
Butane	10.63	X
Butyl mercaptan	9.15	
cis-2-Butene	9.13	
m-Bromotoluene	8.81	
n-Butyl acetate	10.01	
n-Butyl alcohol	10.04	
n-Butyl amine	8.71	
n-Butyl benzene	8.69	
n-Butyl formate	10.5	
n-Butyraldehyde	9.86	
n-Butyric acid	10.16	
n-Butyronitrile	11.67	X
o-Bromotoluene	8.79	
p-Bromotoluene	8.67	
p-tert-Butyltoluene	8.28	
s-Butyl amine	8.7	
s-Butyl benzene	8.68	
sec-Butyl acetate	9.91	
t-Butyl amine	8.64	
t-Butyl benzene	8.68	
trans-2-Butene	9.13	
C		

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	**Ionization Potential (eV)**	Cannot be Read by 10.6 eV PID
1-Chloro-2-methylpropane	10.66	X
1-Chloro-3-fluorobenzene	9.21	
1-Chlorobutane	10.67	X
1-Chloropropane	10.82	X
2-Chloro-2-methylpropane	10.61	X
2-Chlorobutane	10.65	X
2-Chloropropane	10.78	X
2-Chlorothiophene	8.68	
3-Chloropropene	10.04	
Camphor	8.76	
Carbon dioxide	13.79	X
Carbon disulfide	10.07	
Carbon monoxide	14.01	X
Carbon tetrachloride	11.47	X
Chlorine	11.48	X
Chlorine dioxide	10.36	
Chlorine trifluoride	12.65	X
Chloroacetaldehyde	10.61	X
α -Chloroacetophenone	9.44	
Chlorobenzene	9.07	
Chlorobromomethane	10.77	X
Chlorofluoromethane (Freon 22)	12.45	X
Chloroform	11.37	X
Chlorotrifluoromethane (Freon 13)	12.91	X
Chrysene	7.59	
Cresol	8.14	
Crotonaldehyde	9.73	
Cumene (isopropyl benzene)	8.75	
Cyanogen	13.8	X
Cyclohexane	9.8	
Cyclohexanol	9.75	
Cyclohexanone	9.14	
Cyclohexene	8.95	
Cyclo-octatetraene	7.99	
Cyclopentadiene	8.56	
Cyclopentane	10.53	
Cyclopentanone	9.26	
Cyclopentene	9.01	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Cyclopropane	10.06	
m-Chlorotoluene	8.83	
o-Chlorotoluene	8.83	
p-Chlorotoluene	8.7	
D		
1,1-Dibromoethane	10.19	
1,1-Dichloroethane	11.12	X
1,1-Dimethoxyethane	9.65	
1,1-Dimethylhydrazine	7.28	
1,2-Dibromoethene	9.45	
1,2-Dichloro-1,1,2,2-tetrafluoroethane (Freon 114)	12.2	X
1,2-Dichloroethane	11.12	X
1,2-Dichloropropane	10.87	X
1,3-Dibromopropane	10.07	
1,3-Dichloropropane	10.85	X
2,2-Dimethyl butane	10.06	
2,2-Dimethyl propane	10.35	
2,3-Dichloropropene	9.82	
2,3-Dimethyl butane	10.02	
3,3-Dimethyl butanone	9.17	
cis-Dichloroethene	9.65	
Decaborane	9.88	
Diazomethane	9	
Diborane	12	X
Dibromochloromethane	10.59	
Dibromodifluoromethane	11.07	X
Dibromomethane	10.49	
Dibutylamine	7.69	
Dichlorodifluoromethane (Freon 12)	12.31	X
Dichlorofluoromethane	12.39	X
Dichloromethane	11.35	X
Diethoxymethane	9.7	
Diethyl amine	8.01	
Diethyl ether	9.53	
Diethyl ketone	9.32	
Diethyl sulfide	8.43	
Diethyl sulfite	9.68	
Difluorodibromomethane	11.07	X

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	**Ionization Potential (eV)**	**Cannot be Read by 10.6 eV PID**
Dihydropyran	8.34	
Diiodomethane	9.34	
Diisopropylamine	7.73	
Dimethoxymethane (methylal)	10	
Dimethyl amine	8.24	
Dimethyl ether	10	
Dimethyl sulfide	8.69	
Dimethylaniline	7.13	
Dimethylformamide	9.18	
Dimethylphthalate	9.64	
Dinitrobenzene	10.71	X
Dioxane	9.19	
Diphenyl	7.95	
Dipropyl amine	7.84	
Dipropyl sulfide	8.3	
Durene	8.03	
m-Dichlorobenzene	9.12	
N,N-Diethyl acetamide	8.6	
N,N-Diethyl formamide	8.89	
N,N-Dimethyl acetamide	8.81	
N,N-Dimethyl formamide	9.12	
o-Dichlorobenzene	9.06	
p-Dichlorobenzene	8.95	
p-Dioxane	9.13	
trans-Dichloroethene	9.66	
E		
Epichlorohydrin	10.2	
Ethane	11.65	X
Ethanethiol (ethyl mercaptan)	9.29	
Ethanolamine	8.96	
Ethene	10.52	
Ethyl acetate	10.11	
Ethyl alcohol	10.48	
Ethyl amine	8.86	
Ethyl benzene	8.76	
Ethyl bromide	10.29	
Ethyl chloride (chloroethane)	10.98	X
Ethyl disulfide	8.27	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Ethyl ether	9.51	
Ethyl formate	10.61	X
Ethyl iodide	9.33	
Ethyl isothiocyanate	9.14	
Ethyl mercaptan	9.29	
Ethyl methyl sulfide	8.55	
Ethyl nitrate	11.22	X
Ethyl propionate	10	
Ethyl thiocyanate	9.89	
Ethylene chlorohydrin	10.52	
Ethylene diamine	8.6	
Ethylene dibromide	10.37	
Ethylene dichloride	11.05	X
Ethylene oxide	10.57	
Ethylenelmine	9.2	
Ethynylbenzene	8.82	
F		
2-Furaldehyde	9.21	
Fluorine	15.7	X
Fluorobenzene	9.2	
Formaldehyde	10.87	X
Formamide	10.25	
Formic acid	11.05	X
Freon 11 (trichlorofluoromethane)	11.77	X
Freon 112 (1,1,2,2-tetrachloro-1,2-difluoroethane)	11.3	X
Freon 113 (1,1,2-trichloro-1,2,2-trifluororethane)	11.78	X
Freon 114 (1,2-dichloro-1,1,2,2-tetrafluoroethane)	12.2	X
Freon 12 (dichlorodifluoromethane)	12.31	X
Freon 13 (chlorotrifluoromethane)	12.91	X
Freon 22 (chlorofluoromethane)	12.45	X
Furan	8.89	
Furfural	9.21	
m-Fluorotoluene	8.92	
o-Fluorophenol	8.66	
o-Fluorotoluene	8.92	
p-Fluorotoluene	8.79	
H		
1-Hexene	9.46	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
2-Heptanone	9.33	
2-Hexanone	9.35	
Heptane	10.08	
Hexachloroethane	11.1	X
Hexane	10.18	
Hydrazine	8.1	
Hydrogen	15.43	X
Hydrogen bromide	11.62	X
Hydrogen chloride	12.74	X
Hydrogen cyanide	13.91	X
Hydrogen fluoride	15.77	X
Hydrogen iodide	10.38	
Hydrogen selenide	9.88	
Hydrogen sulfide	10.46	
Hydrogen telluride	9.14	
Hydroquinone	7.95	
I		
1-Iodo-2-methylpropane	9.18	
1-Iodobutane	9.21	
1-Iodopentane	9.19	
1-Iodopropane	9.26	
2-Iodobutane	9.09	
2-Iodopropane	9.17	
Iodine	9.28	
Iodobenzene	8.73	
Isobutane	10.57	
Isobutyl acetate	9.97	
Isobutyl alcohol	10.12	
Isobutyl amine	8.7	
Isobutyl formate	10.46	
Isobutyraldehyde	9.74	
Isobutyric acid	10.02	
Isopentane	10.32	
Isophorone	9.07	
Isoprene	8.85	
Isopropyl acetate	9.99	
Isopropyl alcohol	10.16	
Isopropyl amine	8.72	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Isopropyl benzene	8.69	
Isopropyl ether	9.2	
Isovaleraldehyde	9.71	
m-Iodotoluene	8.61	
o-Iodotoluene	8.62	
p-Iodotoluene	8.5	
K		
Ketene	9.61	
L		
2,3-Lutidine	8.85	
2,4-Lutidine	8.85	
2,6-Lutidine	8.85	
M		
2-Methyl furan	8.39	
2-Methyl napthalene	7.96	
1-Methyl napthalene	7.96	
2-Methyl propene	9.23	
2-Methyl-1-butene	9.12	
2-Methylpentane	10.12	
3-Methyl-1-butene	9.51	
3-Methyl-2-butene	8.67	
3-Methylpentane	10.08	
4-Methylcyclohexene	8.91	
Maleic anhydride	10.8	X
Mesityl oxide	9.08	
Mesitylene	8.4	
Methane	12.98	X
Methanethiol (methyl mercaptan)	9.44	
Methyl acetate	10.27	
Methyl acetylene	10.37	
Methyl acrylate	9.9	
Methyl alcohol	10.85	X
Methyl amine	8.97	
Methyl bromide	10.54	
Methyl butyl ketone	9.34	
Methyl butyrate	10.07	
Methyl cellosolve	9.6	
Methyl chloride	11.28	X

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Methyl chloroform (1,1,1-trichloroethane)	11	X
Methyl disulfide	8.46	
Methyl ethyl ketone	9.53	
Methyl formate	10.82	X
Methyl iodide	9.54	
Methyl isobutyl ketone	9.3	
Methyl isobutyrate	9.98	
Methyl isocyanate	10.67	X
Methyl isopropyl ketone	9.32	
Methyl isothiocyanate	9.25	
Methyl mercaptan	9.44	
Methyl methacrylate	9.7	
Methyl propionate	10.15	
Methyl propyl ketone	9.39	
α -Methyl styrene	8.35	
Methyl thiocyanate	10.07	
Methylal (dimethoxymethane)	10	
Methylcyclohexane	9.85	
Methylene chloride	11.32	X
Methyl-n-amyl ketone	9.3	
Monomethyl aniline	7.32	
Monomethyl hydrazine	7.67	
Morpholine	8.2	
n-Methyl acetamide	8.9	
N		
1-Nitropropane	10.88	X
2-Nitropropane	10.71	X
Naphthalene	8.12	
Nickel carbonyl	8.27	
Nitric oxide, (NO)	9.25	
Nitrobenzene	9.92	
Nitroethane	10.88	X
Nitrogen	15.58	X
Nitrogen dioxide	9.78	
Nitrogen trifluoride	12.97	X
Nitromethane	11.08	X
Nitrotoluene	9.45	
p-Nitrochloro benzene	9.96	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
O		
Octane	9.82	
Oxygen	12.08	X
Ozone	12.08	X
P		
1-Pentene	9.5	
1-Propanethiol	9.2	
2,4-Pentanedione	8.87	
2-Pentanone	9.38	
2-Picoline	9.02	
3-Picoline	9.02	
4-Picoline	9.04	
n-Propyl nitrate	11.07	X
Pentaborane	10.4	
Pentane	10.35	
Perchloroethylene	9.32	
Pheneloic	8.18	
Phenol	8.5	
Phenyl ether (diphenyl oxide)	8.82	
Phenyl hydrazine	7.64	
Phenyl isocyanate	8.77	
Phenyl isothiocyanate	8.52	
Phenylene diamine	6.89	
Phosgene	11.77	X
Phosphine	9.87	
Phosphorus trichloride	9.91	
Phthalic anhydride	10	
Propane	11.07	X
Propargyl alcohol	10.51	
Propiolactone	9.7	
Propionaldehyde	9.98	
Propionic acid	10.24	
Propionitrile	11.84	X
Propyl acetate	10.04	
Propyl alcohol	10.2	
Propyl amine	8.78	
Propyl benzene	8.72	
Propyl ether	9.27	

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Propyl formate	10.54	
Propylene	9.73	
Propylene dichloride	10.87	X
Propylene imine	9	
Propylene oxide	10.22	
Propyne	10.36	
Pyridine	9.32	
Pyrrole	8.2	
Q		
Quinone	10.04	
S		
Stibine	9.51	
Styrene	8.47	
Sulfur dioxide	12.3	X
Sulfur hexafluoride	15.33	X
Sulfur monochloride	9.66	
Sulfuryl fluoride	13	X
T		
o-Terphenyls	7.78	
1,1,2,2-Tetrachloro-1,2-difluoroethane (Freon 112)	11.3	X
1,1,1-Trichloroethane	11	X
1,1,2-Trichloro-1,2,2-trifluoroethane (Freon 113)	11.78	X
2,2,4-Trimethyl pentane	9.86	
o-Toluidine	7.44	
Tetrachloroethane	11.62	X
Tetrachloroethene	9.32	
Tetrachloromethane	11.47	X
Tetrahydrofuran	9.54	
Tetrahydropyran	9.25	
Thiolacetic acid	10	
Thiophene	8.86	
Toluene	8.82	
Tribromoethene	9.27	
Tribromofluoromethane	10.67	X
Tribromomethane	10.51	
Trichloroethene	9.45	
Trichloroethylene	9.47	
Trichlorofluoromethane (Freon 11)	11.77	X

TABLE 1

SUMMARY OF IONIZATION POTENTIALS

Chemical Name	Ionization Potential (eV)	Cannot be Read by 10.6 eV PID
Trichloromethane	11.42	X
Triethylamine	7.5	
Trifluoromonobromo-methane	11.4	X
Trimethyl amine	7.82	
Tripropyl amine	7.23	
V		
o-Vinyl toluene	8.2	
Valeraldehyde	9.82	
Valeric acid	10.12	
Vinyl acetate	9.19	
Vinyl bromide	9.8	
Vinyl chloride	10	
Vinyl methyl ether	8.93	
W		
Water	12.59	X
X		
2,4-Xylidine	7.65	
m-Xylene	8.56	
o-Xylene	8.56	
p-Xylene	8.45	

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

EQUIPMENT CALIBRATION LOG

PROJECT INFORMATION:

Project Name: ____________________ Date: ____________________

Project No.: ____________________

Client: ____________________ Instrument Source: ☐ BM ☐ Rental

	METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	POST CAL. READING	SETTINGS
☐	pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00 7.00 10.01		
☐	Turbidity meter	NTU		Hach 2100P Turbidimeter	9706000145[illegible]		< 0.4 [illegible] [illegible]00 800		
☐	Sp. Cond. meter	uS mS		Myron L Company Ultra Meter 6P	[illegible]		______ mS @ 25 °C		
☐	PID	ppm		MinRAE 20[illegible]			open air zero _____ ppm Iso. Gas		MIBK response factor = 1.0
☐	Dissolved Oxygen	ppm		YSI Model 5[illegible]	[illegible]				
☐	Particulate meter	mg/m^3					zero air		
☐	Oxygen	%					open air		
☐	Hydrogen sulfide	ppm					open air		
☐	Carbon monoxide	ppm					open air		
☐	LEL	%					open air		
☐	Radiation Meter	uR/H					background area		
☐									

ADDITIONAL REMARKS: ____________________

PREPARED BY: ____________________ **DATE:** ____________________

Technical Note TN-106

Revised 08/2010

Correction Factors, Ionization Energies*, And Calibration Characteristics

Correction Factors and Ionization Energies

RAE Systems PIDs can be used for the detection of a wide variety of gases that exhibit different responses. In general, any compound with ionization energy (IE) lower than that of the lamp photons can be measured.* The best way to calibrate a PID to different compounds is to use a standard of the gas of interest. However, correction factors have been determined that enable the user to quantify a large number of chemicals using only a single calibration gas, typically isobutylene. In our PIDs, correction factors can be used in one of three ways:

1) Calibrate the monitor with isobutylene in the usual fashion to read in isobutylene equivalents. Manually multiply the reading by the correction factor (CF) to obtain the concentration of the gas being measured.

2) Calibrate the unit with isobutylene in the usual fashion to read in isobutylene equivalents. Call up the correction factor from the instrument memory or download it from a personal computer and then call it up. The monitor will then read directly in units of the gas of interest.

3) Calibrate the unit with isobutylene, but input an equivalent, "corrected" span gas concentration when prompted for this value. The unit will then read directly in units of the gas of interest.

Example 1:

With the unit calibrated to read isobutylene equivalents, the reading is 10 ppm with a 10.6 eV lamp. The gas being measured is butyl acetate, which has a correction factor of 2.6. Multiplying 10 by 2.6 gives an adjusted butyl acetate value of 26 ppm. Similarly, if the gas being measured were trichloroethylene (CF = 0.54), the adjusted value with a 10 ppm reading would be 5.4 ppm.

Example 2:

With the unit calibrated to read isobutylene equivalents, the reading is 100 ppm with a 10.6 eV lamp. The gas measured is m-xylene (CF = 0.43). After downloading this factor, the unit should read about 43 ppm when exposed to the same gas, and thus read directly in m-xylene values.

Example 3:

The desired gas to measure is ethylene dichloride (EDC). The CF is 0.6 with an 11.7 eV lamp. During calibration with 100 ppm isobutylene, insert 0.6 times 100, or 60 at the prompt for the calibration gas concentration. The unit then reads directly in EDC values.

Conversion to mg/m^3

To convert from ppm to mg/m^3, use the following formula:

$$\text{Conc. (mg/m}^3\text{)} = \frac{\text{[Conc.(ppmv) x mol. wt. (g/mole)]}}{\text{molar gas volume (L)}}$$

For air at 25 °C (77 °F), the molar gas volume is 24.4 L/mole and the formula reduces to:

$$\text{Conc.(mg/m}^3\text{)} = \text{Conc.(ppmv) x mol. wt. (g/mole) x 0.041}$$

For example, if the instrument is calibrated with a gas standard in ppmv, such as 100 ppm isobutylene, and the user wants the display to read in mg/m^3 of hexane, whose m.w. is 86 and CF is 4.3, the overall correction factor would be 4.3 x 86 x 0.041 equals 15.2.

Correction Factors for Mixtures

The correction factor for a mixture is calculated from the sum of the mole fractions Xi of each component divided by their respective correction factors CFi:

$$\text{CFmix} = 1 / (X_1/CF_1 + X_2/CF_2 + X_3/CF_3 + \ldots Xi/CFi)$$

Thus, for example, a vapor phase mixture of 5% benzene and 95% n-hexane would have a CFmix of CFmix = 1 / (0.05/0.53 + 0.95/4.3) = 3.2. A reading of 100 would then correspond to 320 ppm of the total mixture, comprised of 16 ppm benzene and 304 ppm hexane.

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* *The term "ionization energy" is more scientifically correct and replaces the old term "ionization potential." High-boiling ("heavy") compounds may not vaporize enough to give a response even when their ionization energies are below the lamp photon energy. Some inorganic compounds like* H_2O_2 *and* NO_2 *give weak response even when their ionization energies are well below the lamp photon energy.*

For a spreadsheet to compute the correction factor and TLV of a mixture see the appendix at the end of the CF table.

TLVs and Alarm Limits for Mixtures

The correction factor for mixtures can be used to set alarm limits for mixtures. To do this one first needs to calculate the exposure limit for the mixture. The Threshold Limit Value (TLV) often defines exposure limits. The TLV for the mixture is calculated in a manner similar to the CF calculation:

$$\text{TLV mix} = 1 / (X_1/\text{TLV}_1 + X_2/\text{TLV}_2 + X_3/\text{TLV}_3 + ... \text{Xi}/\text{TLVi})$$

In the above example, the 8-h TLV for benzene is 0.5 ppm and for n-hexane 50 ppm. Therefore the TLV of the mixture is TLVmix = 1 / (0.05/0.5 + 0.95/50) = 8.4 ppm, corresponding to 8.0 ppm hexane and 0.4 ppm benzene. For an instrument calibrated on isobutylene, the reading corrsponding to the TLV is:

$$\text{Alarm Reading} = \text{TLVmix} / \text{CFmix} = 8.4 / 3.2 = 2.6 \text{ ppm}$$

A common practice is to set the lower alarm limit to half the TLV, and the higher limit to the TLV. Thus, one would set the alarms to 1.3 and 2.6 ppm, respectively.

Calibration Characteristics

a) Flow Configuration. PID response is essentially independent of gas flow rate as long as it is sufficient to satisfy the pump demand. Four main flow configurations are used for calibrating a PID:

1) **Pressurized gas cylinder (Fixed-flow regulator):** The flow rate of the regulator should match the flow demand of the instrument pump or be slightly higher.
2) **Pressurized gas cylinder (Demand-flow regulator):** A demand-flow regulator better matches pump speed differences, but results in a slight vacuum during calibration and thus slightly high readings.
3) **Collapsible gas bag:** The instrument will draw the calibration gas from the bag at its normal flow rate, as long as the bag valve is large enough. The bag should be filled with enough gas to allow at least one minute of flow (~ 0.6 L for a MiniRAE, ~0.3 L for MultiRAE).
4) **T (or open tube) method:** The T method uses a T-junction with gas flow higher than the pump draw. The gas supply is connected to one end of the T, the instrument inlet is connected to a second end of the T, and excess gas flow escapes through the third, open end of the T. To prevent ambient air mixing, a long tube should be connected to the open end, or a high excess rate should be used. Alternatively, the instrument probe can be inserted into an open tube slightly wider than the probe. Excess gas flows out around the probe.

The first two cylinder methods are the most efficient in terms of gas usage, while the bag and T methods give slightly more accurate results because they match the pump flow better.

b) Pressure. Pressures deviating from atmospheric pressure affect the readings by altering gas concentration and pump characteristics. It is best to calibrate with the instrument and calibration gas at the same pressure as each other and the sample gas. (Note that the cylinder pressure is not relevant because the regulator reduces the pressure to ambient.) If the instrument is calibrated at atmospheric pressure in one of the flow configurations described above, then 1) pressures slightly above ambient are acceptable but high pressures can damage the pump and 2) samples under vacuum may give low readings if air leaks into the sample train.

c) Temperature. Because temperature effects gas density and concentration, the temperature of the calibration gas and instrument should be as close as possible to the ambient temperature where the unit will be used. We recommend that the temperature of the calibration gas be within the instrument's temperature specification (typically 14° to 113° F or -10° to 45° C). Also, during actual measurements, the instrument should be kept at the same or higher temperature than the sample temperature to avoid condensation in the unit.

d) Matrix. The matrix gas of the calibration compound and VOC sample is significant. Some common matrix components, such as methane and water vapor can affect the VOC signal. PIDs are most commonly used for monitoring VOCs in air, in which case the preferred calibration gas matrix is air. For a MiniRAE, methane, methanol, and water vapor reduce the response by about 20% when their concentration is 15,000 ppm and by about 40% at 30,000 ppm. Despite earlier reports of oxygen effects, RAE PID responses with 10.6 eV lamps are independent of oxygen concentration, and calibration gases in a pure nitrogen matrix can be used. H_2 and CO_2 up to 5 volume % also have no effect.

e) Concentration. Although RAE Systems PIDs have electronically linearized output, it is best to calibrate in a concentration range close to the actual measurement range. For example, 100 ppm standard gas for anticipated vapors of 0 to 250 ppm, and 500 ppm standard for expected concentrations of 250 to 1000 ppm. The correction factors in this table were typically measured at 50 to 100 ppm and apply from the ppb range up to about 1000 ppm. Above 1000 ppm the CF may vary and it is best to calibrate with the gas of interest near the concentration of interest.

f) Filters. Filters affect flow and pressure conditions and therefore all filters to be used during sampling should also be in place during calibration. Using a water trap (hydrophobic filter) greatly reduces the chances of drawing water aerosols or dirt particles into the instrument. Regular filter replacements are recommended because dirty filters can adsorb VOCs and cause slower response time and shifts in calibration.

g) Instrument Design. High-boiling (“heavy”) or very reactive compounds can be lost by reaction or adsorption onto materials in the gas sample train, such as filters, pumps and other sensors. Multi-gas meters, including EntryRAE, MultiRAE and AreaRAE have the pump and other sensors upstream of the PID and are prone to these losses. Compounds possibly affected by such losses are shown in green in the table, and may give slow response, or in extreme cases, no response at all. In many cases the multi-gas meters can still give a rough indication of the relative concentration, without giving an accurate, quantitative reading. The ppbRAE and MiniRAE series instruments have inert sample trains and therefore do not exhibit significant loss; nevertheless, response may be slow for the very heavy compounds and additional sampling time up to a minute or more should be allowed to get a stable reading.

Table Abbreviations:

CF = Correction Factor (multiply by reading to get corrected value for the compound when calibrated to isobutylene)
NR= No Response
IE = Ionization Energy (values in parentheses are not well established)
C = Confirmed Value indicated by “+” in this column; all others are preliminary or estimated values and are subject to change
ne = Not Established ACGIH 8-hr. TWA
C## = Ceiling value, given where 8-hr.TWA is not available

Disclaimer:

Actual readings may vary with age and cleanliness of lamp, relative humidity, and other factors. For accurate work, the instrument should be calibrated regularly under the operating conditions used. The factors in this table were measured in dry air at room temperature, typically at 50-100 ppm. CF values may vary above about 1000 ppm.

Updates:

The values in this table are subject to change as more or better data become available. Watch for updates of this table on the Internet at **http://www.raesystems.com**

IE data are taken from the CRC Handbook of Chemistry and Physics, 73rd Edition, D.R. Lide (Ed.), CRC Press (1993) and NIST Standard Ref. Database 19A, NIST Positive Ion Energetics, Vers. 2.0, Lias, et.al., U.S. Dept. Commerce (1993). Exposure limits (8-h TWA and Ceiling Values) are from the 2005 ACGIH Guide to Occupational Exposure Values, ACGIH, Cincinnati, OH 2005. Equations for exposure limits for mixtures of chemicals were taken from the 1997 TLVs and BEIs handbook published by the ACGIH (1997).

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Acetaldehyde		75-07-0	C_2H_4O	NR	+	6	+	3.3	+	10.23	C25
Acetic acid	Ethanoic Acid	64-19-7	$C_2H_4O_2$	NR	+	22	+	2.6	+	10.66	10
Acetic anhydride	Ethanoic Acid Anhydride	108-24-7	$C_4H_6O_3$	NR	+	6.1	+	2.0	+	10.14	5
Acetone	2-Propanone	67-64-1	C_3H_6O	1.2	+	1.1	+	1.4	+	9.71	500
Acetone cyanohydrin	2-Hydroxyisobutyronitrile	75-86-5	C_4H_7NO					4	+	11.1	C5
Acetonitrile	Methyl cyanide, Cyanomethane	75-05-8	C_2H_3N					100		12.19	40
Acetylene	Ethyne	74-86-2	C_2H_2					2.1	+	11.40	ne
Acrolein	Propenal	107-02-8	C_3H_4O	42	+	3.9	+	1.4	+	10.10	0.1
Acrylic acid	Propenoic Acid	79-10-7	$C_3H_4O_2$			12	+	2.0	+	10.60	2
Acrylonitrile	Propenenitrile	107-13-1	C_3H_3N			NR	+	1.2	+	10.91	2
Allyl alcohol		107-18-6	C_3H_6O	4.5	+	2.4	+	1.6	+	9.67	2
Allyl chloride	3-Chloropropene	107-05-1	C_3H_5Cl			4.3		0.7		9.9	1
Ammonia		7664-41-7	H_3N	NR	+	9.7	+	5.7	+	10.16	25
Amyl acetate	mix of n-Pentyl acetate & 2-Methylbutyl acetate	628-63-7	$C_7H_{14}O_2$	11	+	2.3	+	0.95	+	<9.9	100
Amyl alcohol	1-Pentanol	75-85-4	$C_5H_{12}O$			5		1.6		10.00	ne
Aniline	Aminobenzene	62-53-3	C_7H_7N	0.50	+	0.48	+	0.47	+	7.72	2
Anisole	Methoxybenzene	100-66-3	C_7H_8O	0.89	+	0.58	+	0.56	+	8.21	ne
Arsine	Arsenic trihydride	7784-42-1	AsH_3			1.9	+			9.89	0.05
Benzaldehyde		100-52-7	C_7H_6O					1		9.49	ne
Benzenamine, N-methyl-	N-Methylphenylamine	100-61-8	C_7H_9N			0.7				7.53	
Benzene		71-43-2	C_6H_6	0.55	+	0.53	+	0.6	+	9.25	0.5
Benzonitrile	Cyanobenzene	100-47-0	C_7H_5N			1.6				9.62	ne
Benzyl alcohol	α-Hydroxytoluene, Hydroxymethylbenzene, Benzenemethanol	100-51-6	C_7H_8O	1.4	+	1.1	+	0.9	+	8.26	ne
Benzyl chloride	α-Chlorotoluene, Chloromethylbenzene	100-44-7	C_7H_7Cl	0.7	+	0.6	+	0.5	+	9.14	1
Benzyl formate	Formic acid benzyl ester	104-57-4	$C_8H_8O_2$	0.9	+	0.73	+	0.66	+		ne
Boron trifluoride		7637-07-2	BF_3	NR		NR		NR		15.5	C1
Bromine		7726-95-6	Br_2	NR	+	1.30	+	0.74	+	10.51	0.1
Bromobenzene		108-86-1	C_6H_5Br			0.6		0.5		8.98	ne
2-Bromoethyl methyl ether		6482-24-2	C_3H_7OBr			0.84	+			~10	ne
Bromoform	Tribromomethane	75-25-2	$CHBr_3$	NR	+	2.5	+	0.5	+	10.48	0.5
Bromopropane,1-	n-Propyl bromide	106-94-5	C_3H_7Br	150	+	1.5	+	0.6	+	10.18	ne
Butadiene	1,3-Butadiene, Vinyl ethylene	106-99-0	C_4H_6	0.8		0.85	+	1.1		9.07	2
Butadiene diepoxide, 1,3-	1,2,3,4-Diepoxybutane	298-18-0	$C_4H_6O_2$	25	+	3.5	+	1.2		~10	ne
Butanal	1-Butanal	123-72-8	C_4H_8O			1.8				9.84	
Butane		106-97-8	C_4H_{10}			67	+	1.2		10.53	800
Butanol, 1-	Butyl alcohol, n-Butanol	71-36-3	$C_4H_{10}O$	70	+	4.7	+	1.4	+	9.99	20
Butanol, t-	tert-Butanol, t-Butyl alcohol	75-65-0	$C_4H_{10}O$	6.9	+	2.9	+			9.90	100
Butene, 1-	1-Butylene	106-98-9	C_4H_8			0.9				9.58	ne
Butoxyethanol, 2-	Butyl Cellosolve, Ethylene glycol monobutyl ether	111-76-2	$C_6H_{14}O_2$	1.8	+	1.2	+	0.6	+	<10	25
Butoxyethanol acetate	Ethanol, 2-(2-butoxyethoxy)-, acetate	124-17-4	$C_{10}H_{20}O_4$			5.6				≤10.6	
Butoxyethoxyethanol	2-(2-Butoxyethoxy)ethanol	112-34-5	$C_8H_{18}O_3$			4.6				≤10.6	
Butyl acetate, n-		123-86-4	$C_6H_{12}O_2$			2.6	+			10	150
Butyl acrylate, n-	Butyl 2-propenoate, Acrylic acid butyl ester	141-32-2	$C_7H_{12}O_2$			1.6	+	0.6	+		10
Butylamine, n-		109-73-9	$C_4H_{11}N$	1.1	+	1.1	+	0.7	+	8.71	C5
Butyl cellosolve	see 2-Butoxyethanol	111-76-2									
Butyl hydroperoxide, t-		75-91-2	$C_4H_{10}O_2$	2.0	+	1.6	+			<10	1
Butyl mercaptan	1-Butanethiol	109-79-5	$C_4H_{10}S$	0.55	+	0.52	+			9.14	0.5
Carbon disulfide		75-15-0	CS_2	4	+	1.2	+	0.44		10.07	10
Carbon tetrachloride	Tetrachloromethane	56-23-5	CCl_4	NR	+	NR	+	1.7	+	11.47	5
Carbonyl sulfide	Carbon oxysulfide	463-58-1	COS							11.18	
Cellosolve see 2-Ethoxyethanol											
CFC-14 see Tetrafluoromethane											
CFC-113 see 1,1,2-Trichloro-1,2,2-trifluoroethane											

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Chlorine		7782-50-5	Cl_2					1.0	+	11.48	0.5
Chlorine dioxide		10049-04-4	ClO_2	NR	+	NR	+	NR	+	10.57	0.1
Chlorobenzene	Monochlorobenzene	108-90-7	C_6H_5Cl	0.44	+	0.40	+	0.39	+	9.06	10
Chlorobenzotrifluoride, 4-	PCBTF, OXSOL 100 p-Chlorobenzotrifluoride	98-56-6	$C_7H_4ClF_3$	0.74	+	0.63	+	0.55	+	<9.6	25
Chloro-1,3-butadiene, 2-	Chloroprene	126-99-8	C_4H_5Cl			3					10
Chloro-1,1-difluoroethane, 1-	HCFC-142B, R-142B	75-68-3	$C_2H_3ClF_2$	NR		NR		NR		12.0	ne
Chlorodifluoromethane	HCFC-22, R-22	75-45-6	$CHClF_2$	NR		NR		NR		12.2	1000
Chloroethane	Ethyl chloride	75-00-3	C_2H_5Cl	NR	+	NR	+	1.1	+	10.97	100
Chloroethanol	Ethylene chlrohydrin	107-07-3	C_2H_5ClO					2.9		10.52	C1
Chloroethyl ether, 2-	bis(2-chloroethyl) ether	111-44-4	$C_4H_8Cl_2O$	8.6	+	3.0	+				5
Chloroethyl methyl ether, 2-	Methyl 2-chloroethyl ether	627-42-9	C_3H_7ClO			3					ne
Chloroform	Trichloromethane	67-66-3	$CHCl_3$	NR	+	NR	+	3.5	+	11.37	10
Chloro-2-methylpropene, 3-	Methallyl chloride, Isobutenyl chloride	563-47-3	C_4H_7Cl	1.4	+	1.2	+	0.63	+	9.76	ne
Chloropicrin		76-06-2	CCl_3NO_2	NR	+	~400	+	7	+	?	0.1
Chlorotoluene, o-	o-Chloromethylbenzene	95-49-8	C_7H_7Cl			0.5		0.6		8.83	50
Chlorotoluene, p-	p-Chloromethylbenzene	106-43-4	C_7H_7Cl					0.6		8.69	ne
Chlorotrifluoroethene	CTFE, Chlorotrifluoroethylene Genetron 1113	79-38-9	C_2ClF_3	6.7	+	3.9	+	1.2	+	9.76	5
Chlorotrimethylsilane		75-77-4	C_3H_9ClSi	NR		NR		0.82	+	10.83	ne
Cresol, m-	m-Hydroxytoluene	108-39-4	C_7H_8O	0.57	+	0.50	+	0.57	+	8.29	5
Cresol, o-	o-Hydroxytoluene	95-48-7	C_7H_8O			1.0				8.50	
Cresol, p-	p-Hydroxytoluene	106-44-5	C_7H_8O			1.4				8.35	
Crotonaldehyde	*trans*-2-Butenal	123-73-9 4170-30-3	C_4H_6O	1.5	+	1.1	+	1.0	+	9.73	2
Cumene	Isopropylbenzene	98-82-8	C_9H_{12}	0.58	+	0.54	+	0.4	+	8.73	50
Cyanogen bromide		506-68-3	CNBr	NR		NR		NR		11.84	ne
Cyanogen chloride		506-77-4	CNCl	NR		NR		NR		12.34	C0.3
Cyclohexane		110-82-7	C_6H_{12}	3.3	+	1.4	+	0.64	+	9.86	300
Cyclohexanol	Cyclohexyl alcohol	108-93-0	$C_6H_{12}O$	1.5	+	0.9	+	1.1	+	9.75	50
Cyclohexanone		108-94-1	$C_6H_{10}O$	1.0	+	0.9	+	0.7	+	9.14	25
Cyclohexene		110-83-8	C_6H_{10}			0.8	+			8.95	300
Cyclohexylamine		108-91-8	$C_6H_{13}N$			1.2				8.62	10
Cyclopentane 85% 2,2-dimethylbutane 15%		287-92-3	C_5H_{10}	NR	+	15	+	1.1		10.33	600
Cyclopropylamine	Aminocyclpropane	765-30-0	C_3H_7N	1.1	+	0.9	+	0.9	+		ne
Decamethylcyclopentasiloxane		541-02-6	$C_{10}H_{30}O_5Si_5$	0.16	+	0.13	+	0.12	+		ne
Decamethyltetrasiloxane		141-62-8	$C_{10}H_{30}O_3Si_4$	0.17	+	0.13	+	0.12	+	<10.2	ne
Decane		124-18-5	$C_{10}H_{22}$	4.0	+	1.4	+	0.35	+	9.65	ne
Diacetone alcohol	4-Methyl-4-hydroxy-2-pentanone	123-42-2	$C_6H_{12}O_2$			0.7					50
Dibromochloromethane	Chlorodibromomethane	124-48-1	$CHBr_2Cl$	NR	+	5.3	+	0.7	+	10.59	ne
Dibromo-3-chloropropane, 1,2-	DBCP	96-12-8	$C_3H_5Br_2Cl$	NR	+	1.7	+	0.43	+		0.001
Dibromoethane, 1,2-	EDB, Ethylene dibromide, Ethylene bromide	106-93-4	$C_2H_4Br_2$	NR	+	1.7	+	0.6	+	10.37	ne
Dichlorobenzene, o-	1,2-Dichlorobenzene	95-50-1	$C_6H_4Cl_2$	0.54	+	0.47	+	0.38	+	9.08	25
Dichlorodifluoromethane	CFC-12	75-71-8	CCl_2F_2			NR	+	NR	+	11.75	1000
Dichlorodimethylsilane		75-78-5	$C_2H_6Cl_2Si$	NR		NR		1.1	+	>10.7	ne
Dichloroethane, 1,2-	EDC, 1,2-DCA, Ethylene dichloride	107-06-2	$C_2H_4Cl_2$			NR	+	0.6	+	11.04	10
Dichloroethene, 1,1-	1,1-DCE, Vinylidene chloride	75-35-4	$C_2H_2Cl_2$			0.82	+	0.8	+	9.79	5
Dichloroethene, c-1,2-	*c*-1,2-DCE, *cis*-Dichloroethylene	156-59-2	$C_2H_2Cl_2$			0.8				9.66	200
Dichloroethene, t-1,2-	*t*-1,2-DCE, *trans*-Dichloroethylene	156-60-5	$C_2H_2Cl_2$			0.45	+	0.34	+	9.65	200
Dichloro-1-fluoroethane, 1,1-	R-141B	1717-00-6	$C_2H_3Cl_2F$	NR	+	NR	+	2.0	+		ne
Dichloromethane	see Methylene chloride										

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Dichloropentafluoropropane	AK-225, mix of ~45% 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca) & ~55% 1,3-Dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)	442-56-0 507-55-1	$C_3HCl_2F_5$	NR	+	NR	+	25	+		ne
Dichloropropane, 1,2-		78-87-5	$C_3H_6Cl_2$					0.7		10.87	75
Dichloro-1-propene, 1,3-		542-75-6	$C_3H_4C_{12}$	1.3	+	0.96	+			<10	1
Dichloro-1-propene, 2,3-		78-88-6	$C_3H_4Cl_2$	1.9	+	1.3	+	0.7	+	<10	ne
Dichloro-1,1,1-trifluoroethane, 2,2-	R-123	306-83-2	$C_2HCl_2F_3$	NR	+	NR	+	10.1	+	11.5	ne
Dichloro-2,4,6-trifluoropyridine, 3,5-	DCTFP	1737-93-5	$C_5Cl_2F_3N$	1.1	+	0.9	+	0.8	+		ne
Dichlorvos *	Vapona; O,O-dimethyl O-dichlorovinyl phosphate	62-73-7	$C_4H_7Cl_2O_4P$			0.9	+			<9.4	0.1
Dicyclopentadiene	DCPD, Cyclopentadiene dimer	77-73-6	$C_{10}H_{12}$	0.57	+	0.48	+	0.43	+	8.8	5
Diesel Fuel		68334-30-5	m.w. 226			0.9	+				11
Diesel Fuel #2 (Automotive)		68334-30-5	m.w. 216	1.3		0.7	+	0.4	+		11
Diethylamine		109-89-7	$C_4H_{11}N$			1	+			8.01	5
Diethylaminopropylamine, 3-		104-78-9	$C_7H_{18}N_2$			1.3					ne
Diethylbenzene	See Dowtherm J										
Diethylmaleate		141-05-9	$C_8H_{12}O_4$			4					ne
Diethyl sulfide	see Ethyl sulfide										
Diglyme	See Methoxyethyl ether	111-96-6	$C_6H_{14}O_3$								
Diisobutyl ketone	DIBK, 2,2-dimethyl-4-heptanone	108-83-8	$C_9H_{18}O$	0.71	+	0.61	+	0.35	+	9.04	25
Diisopropylamine		108-18-9	$C_6H_{15}N$	0.84	+	0.74	+	0.5	+	7.73	5
Diketene	Ketene dimer	674-82-8	$C_4H_4O_2$	2.6	+	2.0	+	1.4	+	9.6	0.5
Dimethylacetamide, N,N-	DMA	127-19-5	C_4H_9NO	0.87	+	0.8	+	0.8	+	8.81	10
Dimethylamine		124-40-3	C_2H_7N			1.5				8.23	5
Dimethyl carbonate	Carbonic acid dimethyl ester	616-38-6	$C_3H_6O_3$	NR	+	~70	+	1.7	+	~10.5	ne
Dimethyl disulfide	DMDS	624-92-0	$C_2H_6S_2$	0.2	+	0.20	+	0.21	+	7.4	ne
Dimethyl ether	see Methyl ether										
Dimethylethylamine	DMEA	598-56-1	$C_4H_{11}N$	1.1	+	1.0	+	0.9	+	7.74	~3
Dimethylformamide, N,N-	DMF	68-12-2	C_3H_7NO	0.7	+	0.7	+	0.8	+	9.13	10
Dimethylhydrazine, 1,1-	UDMH	57-14-7	$C_2H_8N_2$			0.8	+	0.8	+	7.28	0.01
Dimethyl methylphosphonate	DMMP, methyl phosphonic acid dimethyl ester	756-79-6	$C_3H_9O_3P$	NR	+	4.3	+	0.74	+	10.0	ne
Dimethyl sulfate		77-78-1	$C_2H_6O_4S$	~23		~20	+	2.3	+		0.1
Dimethyl sulfide	see Methyl sulfide										
Dimethyl sulfoxide	DMSO, Methyl sulfoxide	67-68-5	C_2H_6OS			1.4	+			9.10	ne
Dioxane, 1,4-		123-91-1	$C_4H_8O_2$			1.3				9.19	25
Dioxolane, 1,3-	Ethylene glycol formal	646-06-0	$C_3H_6O_2$	4.0	+	2.3	+	1.6	+	9.9	20
Dowtherm A see Therminol® *											
Dowtherm J (97% Diethylbenzene) *		25340-17-4	$C_{10}H_{14}$			0.5					
DS-108F Wipe Solvent	Ethyl lactate/Isopar H/ Propoxypropanol ~7:2:1	97-64-3 64742-48-9 1569-01-3	m.w. 118	3.3	+	1.6	+	0.7	+		ne
Epichlorohydrin	ECH Chloromethyloxirane, 1-chloro2,3-epoxypropane	106-89-8	C_2H_5ClO	~200	+	8.5	+	1.4	+	10.2	0.5
Ethane		74-84-0	C_2H_6			NR	+	15	+	11.52	ne
Ethanol	Ethyl alcohol	64-17-5	C_2H_6O			10	+	3.1	+	10.47	1000
Ethanolamine *	MEA, Monoethanolamine	141-43-5	C_2H_7NO	5.6	+	1.6	+			8.96	3
Ethene	Ethylene	74-85-1	C_2H_4			9	+	4.5	+	10.51	ne
Ethoxyethanol, 2-	Ethyl cellosolve	110-80-5	$C_4H_{10}O_2$			1.3				9.6	5
Ethyl acetate		141-78-6	$C_4H_8O_2$			4.6	+	3.5		10.01	400
Ethyl acetoacetate		141-97-9	$C_6H_{10}O_3$	1.4	+	1.2	+	1.0	+	<10	ne
Ethyl acrylate		140-88-5	$C_5H_8O_2$			2.4	+	1.0	+	<10.3	5
Ethylamine		75-04-7	C_2H_7N			0.8				8.86	5

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (Ev)	TWA
Ethylbenzene		100-41-4	C_8H_{10}	0.52	+	0.52	+	0.51	+	8.77	100
Ethyl caprylate	Ethyl octanoate	106-32-1	$C_{10}H_{20}O_2$		+	0.52	+	0.51	+		
Ethylenediamine	1,2-Ethanediamine; 1,2-Diaminoethane	107-15-3	$C_2H_8N_2$	0.9	+	0.8	+	1.0	+	8.6	10
Ethylene glycol *	1,2-Ethanediol	107-21-1	$C_2H_6O_2$			16	+	6	+	10.16	C100
Ethylene glycol, Acrylate	2-hydroxyethyl Acrylate	818-61-1	$C_5H_8O_3$			8.2				≤10.6	
Ethylene glycol dimethyl ether	1,2-Dimethoxyethane, Monoglyme	110-71-4	$C_4H_{10}O_2$	1.1		0.86		0.7		9.2	ne
Ethylene glycol monobutyl ether acetate	2-Butoxyethyl acetate	112-07-2	$C_8H_{16}O_3$			1.3				≤10.6	
Ethylene glycol, monothio	mercapto-2-ethanol	60-24-2	C_2H_6OS			1.5				9.65	
Ethylene oxide	Oxirane, Epoxyethane	75-21-8	C_2H_4O			13	+	3.5	+	10.57	1
Ethyl ether	Diethyl ether	60-29-7	$C_4H_{10}O$			1.1	+	1.7		9.51	400
Ethyl 3-ethoxypropionate	EEP	763-69-9	$C_7H_{14}O_3$	1.2	+	0.75	+				ne
Ethyl formate		109-94-4	$C_3H_6O_2$					1.9		10.61	100
Ethylhexyl □acrylate, 2-	Acrylic acid 2-ethylhexyl ester	103-11-7	$C_{11}H_{20}O_2$			1.1	+	0.5	+		ne
Ethylhexanol	2-Ethyl-1-hexanol	104-76-7	$C8H_{18}O$			1.9				≤10.6	
Ethylidenenorbornene	5-Ethylidene bicyclo(2,2,1)hept-2-ene	16219-75-3	C_9H_{12}	0.4	+	0.39	+	0.34	+	≤8.8	ne
Ethyl (S)-(-)-lactate see also DS-108F	Ethyl lactate, Ethyl (S)-(-)-hydroxypropionate	687-47-8 97-64-3	$C_5H_{10}O_3$	13	+	3.2	+	1.6	+	~10	ne
Ethyl mercaptan	Ethanethiol	75-08-1	C_2H_6S	0.60	+	0.56	+			9.29	0.5
Ethyl sulfide	Diethyl sulfide	352-93-2	$C_4H_{10}S$			0.5	+			8.43	ne
Formaldehyde	Formalin	50-00-0	CH_2O	NR	+	NR	+	1.6	+	10.87	C0.3
Formamide		75-12-7	CH_3NO			6.9	+	4		10.16	10
Formic acid		64-18-6	CH_2O_2	NR	+	NR	+	9	+	11.33	5
Furfural	2-Furaldehyde	98-01-1	$C_5H_4O_2$			0.92	+	0.8	+	9.21	2
Furfuryl alcohol		98-00-0	$C_5H_6O_2$			0.80	+			<9.5	10
Gasoline #1		8006-61-9	m.w. 72			0.9	+				300
Gasoline #2, 92 octane		8006-61-9	m.w. 93	1.3	+	1.0	+	0.5	+		300
Glutaraldehyde	1,5-Pentanedial, Glutaric dialdehyde	111-30-8	$C_5H_8O_2$	1.1	+	0.8	+	0.6	+		C0.05
Glycidyl methacrylate	2,3-Epoxypropyl methacrylate	106-91-2	$C_7H_{10}O_3$	2.6	+	1.2	+	0.9	+		0.5
Halothane	2-Bromo-2-chloro-1,1,1-trifluoroethane	151-67-7	$C_2HBrClF_3$					0.6		11.0	50
HCFC-22 see Chlorodifluoromethane											
HCFC-123 see 2,2-Dichloro-1,1,1-trifluoroethane											
HCFC-141B see 1,1-Dichloro-1-fluoroethane											
HCFC-142B see 1-Chloro-1,1-difluoroethane											
HCFC-134A see 1,1,1,2-Tetrafluoroethane											
HCFC-225 see Dichloropentafluoropropane											
Heptane, n-		142-82-5	C_7H_{16}	45	+	2.8	+	0.60	+	9.92	400
Heptanol, 4-	Dipropylcarbinol	589-55-9	$C_7H_{16}O$	1.8	+	1.3	+	0.5	+	9.61	ne
Hexamethyldisilazane, 1,1,1,3,3,3- *	HMDS	999-97-3	$C_6H_{19}NSi_2$			0.2	+	0.2	+	~8.6	ne
Hexamethyldisiloxane	HMDSx	107-46-0	$C_6H_{18}OSi_2$	0.33	+	0.27	+	0.25	+	9.64	ne
Hexane, n-		110-54-3	C_6H_{14}	350	+	4.3	+	0.54	+	10.13	50
Hexanol, 1-	Hexyl alcohol	111-27-3	$C_6H_{14}O$	9	+	2.5	+	0.55	+	9.89	ne
Hexene, 1-		592-41-6	C_6H_{12}			0.8				9.44	30
HFE-7100 see Methyl nonafluorobutyl ether											
Histoclear (Histo-Clear)	Limonene/corn oil reagent		m.w. ~136	0.5	+	0.4	+	0.3	+		ne
Hydrazine *		302-01-2	H_4N_2	>8	+	2.6	+	2.1	+	8.1	0.01
Hydrazoic acid	Hydrogen azide		HN_3							10.7	
Hydrogen	Synthesis gas	1333-74-0	H_2	NR	+	NR	+	NR	+	15.43	ne
Hydrogen cyanide	Hydrocyanic acid	74-90-8	HCN	NR	+	NR	+	NR	+	13.6	C4.7
Hydrogen iodide *	Hydriodic acid	10034-85-2	HI			~0.6*				10.39	
Hydrogen peroxide		7722-84-1	H_2O_2	NR	+	NR	+	NR	+	10.54	1
Hydrogen sulfide		7783-06-4	H_2S	NR	+	3.3	+	1.5	+	10.45	10
Hydroxypropyl methacrylate		27813-02-1 923-26-2	$C_7H_{12}O_3$	9.9	+	2.3	+	1.1	+		ne
Iodine *		7553-56-2	I_2	0.1	+	0.1	+	0.1	+	9.40	C0.1

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Iodomethane	Methyl iodide	74-88-4	CH_3I	0.21	+	0.22	+	0.26	+	9.54	2
Isoamyl acetate	Isopentyl acetate	123-92-2	$C_7H_{14}O_2$	10.1		2.1		1.0		<10	100
Isobutane	2-Methylpropane	75-28-5	C_4H_{10}			100	+	1.2	+	10.57	ne
Isobutanol	2-Methyl-1-propanol	78-83-1	$C_4H_{10}O$	19	+	3.8	+	1.5		10.02	50
Isobutene	Isobutylene, Methyl butene	115-11-7	C_4H_8	1.00	+	1.00	+	1.00	+	9.24	Ne
Isobutyl acrylate	Isobutyl 2-propenoate	106-63-8	$C_7H_{12}O_2$			1.5	+	0.60	+		Ne
Isoflurane	1-Chloro-2,2,2-trifluoroethyl difluoromethyl ether, forane	26675-46-7	$C_3H_2ClF_5O$	NR	+	NR	+	48	+	~11.7	Ne
Isooctane	2,2,4-Trimethylpentane	540-84-1	C8H18			1.2				9.86	ne
Isopar E Solvent	Isoparaffinic hydrocarbons	64741-66-8	m.w. 121	1.7	+	0.8	+				Ne
Isopar G Solvent	Photocopier diluent	64742-48-9	m.w. 148			0.8	+				Ne
Isopar K Solvent	Isoparaffinic hydrocarbons	64742-48-9	m.w. 156	0.9	+	0.5	+	0.27	+		Ne
Isopar L Solvent	Isoparaffinic hydrocarbons	64742-48-9	m.w. 163	0.9	+	0.5	+	0.28	+		Ne
Isopar M Solvent	Isoparaffinic hydrocarbons	64742-47-8	m.w. 191			0.7	+	0.4	+		Ne
Isopentane	2-Methylbutane	78-78-4	C_5H_{12}			8.2					Ne
Isophorone		78-59-1	$C_9H_{14}O$					3		9.07	C5
Isoprene	2-Methyl-1,3-butadiene	78-79-5	C_5H_8	0.69	+	0.63	+	0.60	+	8.85	Ne
Isopropanol	Isopropyl alcohol, 2-propanol, IPA	67-63-0	C_3H_8O	500	+	6.0	+	2.7		10.12	200
Isopropyl acetate		108-21-4	$C_5H_{10}O_2$			2.6				9.99	100
Isopropyl ether	Diisopropyl ether	108-20-3	$C_6H_{14}O$			0.8				9.20	250
Jet fuel JP-4	Jet B, Turbo B, F-40 Wide cut type aviation fuel	8008-20-6 + 64741-42-0	m.w. 115			1.0	+	0.4	+		Ne
Jet fuel JP-5	Jet 5, F-44, Kerosene type aviation fuel	8008-20-6 + 64747-77-1	m.w. 167			0.6	+	0.5	+		29
Jet fuel JP-8	Jet A-1, F-34, Kerosene type aviation fuel	8008-20-6 + 64741-77-1	m.w. 165			0.6	+	0.3	+		30
Jet fuel A-1 (JP-8)	F-34, Kerosene type aviation fuel	8008-20-6 + 64741-77-1	m.w. 145			0.67					34
Jet Fuel TS	Thermally Stable Jet Fuel, Hydrotreated kerosene fuel	8008-20-6 + 64742-47-8	m.w. 165	0.9	+	0.6	+	0.3	+		30
Limonene, D-	(R)-(+)-Limonene	5989-27-5	$C_{10}H_{16}$			0.33	+			~8.2	Ne
Kerosene C10-C16 petro.distillate – see Jet Fuels		8008-20-6									
MDI – see 4,4'-Methylenebis(phenylisocyanate)											
Maleic anhydride	2,5-Furandione	108-31-6	$C_4H_2O_3$							~10.8	0.1
Mesitylene	1,3,5-Trimethylbenzene	108-67-8	C_9H_{12}	0.36	+	0.35	+	0.3	+	8.41	25
Methallyl chloride – see 3-Chloro-2-methylpropene											
Methane	Natural gas	74-82-8	CH_4	NR	+	NR	+	NR	+	12.61	Ne
Methanol	Methyl alcohol, carbinol	67-56-1	CH_4O	NR	+	NR	+	2.5	+	10.85	200
Methoxyethanol, 2-	Methyl cellosolve, Ethylene glycol monomethyl ether	109-86-4	$C_3H_8O_2$	4.8	+	2.4	+	1.4	+	10.1	5
Methoxyethoxyethanol, 2-	2-(2-Methoxyethoxy)ethanol Diethylene glycol monomethyl ether	111-77-3	$C_7H_{16}O$	2.3	+	1.2	+	0.9	+	<10	Ne
Methoxyethyl ether, 2-	bis(2-Methoxyethyl) ether, Diethylene glycol dimethyl ether, Diglyme	111-96-6	$C_6H_{14}O_3$	0.64	+	0.54	+	0.44	+	<9.8	Ne
Methyl acetate		79-20-9	$C_3H_6O_2$	NR	+	6.6	+	1.4	+	10.27	200
Methyl acrylate	Methyl 2-propenoate, Acrylic acid methyl ester	96-33-3	$C_4H_6O_2$			3.7	+	1.2	+	(9.9)	2
Methylamine	Aminomethane	74-89-5	CH_5N			1.2				8.97	5
Methyl amyl ketone	MAK, 2-Heptanone, Methyl pentyl ketone	110-43-0	$C_7H_{14}O$	0.9	+	0.85	+	0.5	+	9.30	50
Methyl bromide	Bromomethane	74-83-9	CH_3Br	110	+	1.7	+	1.3	+	10.54	1
Methyl t-butyl ether	MTBE, *tert*-Butyl methyl ether	1634-04-4	$C_5H_{12}O$			0.9	+			9.24	40
Methyl cellosolve	see 2-Methoxyethanol										
Methyl chloride	Chloromethane	74-87-3	CH_3Cl	NR	+	NR	+	0.74	+	11.22	50
Methylcyclohexane		107-87-2	C_7H_{14}	1.6	+	0.97	+	0.53	+	9.64	400
Methylene bis(phenyl-isocyanate), 4,4'- *	MDI, Mondur M		$C_{15}H_{10}N_2O_2$	Very slow ppb level response							0.005

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Methylene chloride	Dichloromethane	75-09-2	CH_2Cl_2	NR	+	NR	+	0.89	+	11.32	25
Methyl ether	Dimethyl ether	115-10-6	C_2H_6O	4.8	+	3.1	+	2.5	+	10.03	Ne
Methyl ethyl ketone	MEK, 2-Butanone	78-93-3	C_4H_8O	0.86	+	0.9	+	1.1	+	9.51	200
Methylhydrazine	Monomethylhydrazine, Hydrazomethane	60-34-4	$C_2H_6N_2$	1.4	+	1.2	+	1.3	+	7.7	0.01
Methyl isoamyl ketone	MIAK, 5-Methyl-2-hexanone	110-12-3	$C_7H_{14}O$	0.8	+	0.76	+	0.5	+	9.28	50
Methyl isobutyl ketone	MIBK, 4-Methyl-2-pentanone	108-10-1	$C_6H_{12}O$	0.9	+	0.8	+	0.6	+	9.30	50
Methyl isocyanate	CH3NCO	624-83-9	C_2H_3NO	NR	+	4.6	+	1.5		10.67	0.02
Methyl isothiocyanate	CH3NCS	551-61-6	C_2H_3NS	0.5	+	0.45	+	0.4	+	9.25	ne
Methyl mercaptan	Methanethiol	74-93-1	CH_4S	0.65		0.54		0.66		9.44	0.5
Methyl methacrylate		80-62-6	$C_5H_8O_2$	2.7	+	1.5	+	1.2	+	9.7	100
Methyl nonafluorobutyl ether	HFE-7100DL	163702-08-7, 163702-07-6	$C_5H_3F_9O$			NR	+	~35	+		ne
Methyl-1,5-pentanediamine, 2- (coats lamp) *	Dytek-A amine, 2-Methyl pentamethylenediamine	15520-10-2	C6H16N2			~0.6	+			<9.0	ne
Methyl propyl ketone	MPK, 2-Pentanone	107-87-9	$C_5H_{12}O$			0.93	+	0.79	+	9.38	200
Methyl-2-pyrrolidinone, N-	NMP, N-Methylpyrrolidone, 1-Methyl-2-pyrrolidinone, 1-Methyl-2-pyrrolidone	872-50-4	C_5H_9NO	1.0	+	0.8	+	0.9	+	*9.17*	ne
Methyl salicylate	Methyl 2-hydroxybenzoate	119-36-8	C_8H_8O3	1.3	+	0.9	+	0.9	+	~9	ne
Methylstyrene, α-	2-Propenylbenzene	98-83-9	C_9H_{10}			0.5				8.18	50
Methyl sulfide	DMS, Dimethyl sulfide	75-18-3	C_2H_6S	0.49	+	0.44	+	0.46	+	8.69	ne
Mineral spirits	Stoddard Solvent, Varsol 1, White Spirits	8020-83-5 8052-41-3 68551-17-7	m.w. 144	1.0		0.69	+	0.38	+		100
Mineral Spirits - Viscor 120B Calibration Fluid, b.p. 156-207°C		8052-41-3	m.w. 142	1.0	+	0.7	+	0.3	+		100
Monoethanolamine - see Ethanolamine											
Mustard *	HD, Bis(2-chloroethyl) sulfide	505-60-2 39472-40-7 68157-62-0	$C_4H_8Cl_2S$			0.6					0.0005
Naphtha - see VM & P Naptha											
Naphthalene	Mothballs	91-20-3	$C_{10}H_8$	0.45	+	0.42	+	0.40	+	8.13	10
Nickel carbonyl (in CO)	Nickel tetracarbonyl	13463-39-3	C_4NiO_4			0.18				<8.8	0.001
Nicotine		54-11-5	$C_{10}H_{14}N_2$			2.0				≤10.6	
Nitric oxide		10102-43-9	NO	~6		5.2	+	2.8	+	9.26	25
Nitrobenzene		98-95-3	$C_6H_5NO_2$	2.6	+	1.9	+	1.6	+	9.81	1
Nitroethane		79-24-3	$C_2H_5NO_2$					3		10.88	100
Nitrogen dioxide		10102-44-0	NO_2	23	+	16	+	6	+	9.75	3
Nitrogen trifluoride		7783-54-2	NF_3	NR		NR		NR		13.0	10
Nitromethane		75-52-5	CH_3NO_2					4		11.02	20
Nitropropane, 2-		79-46-9	$C_3H_7NO_2$					2.6		10.71	10
Nonane		111-84-2	C_9H_{20}			1.4				9.72	200
Norpar 12	n-Paraffins, mostly C_{10}-C_{13}	64771-72-8	m.w. 161	3.2	+	1.1	+	0.28	+		ne
Norpar 13	n-Paraffins, mostly C_{13}-C_{14}	64771-72-8	m.w. 189	2.7	+	1.0	+	0.3	+		ne
Octamethylcyclotetrasiloxane		556-67-2	$C_8H_{24}O_4Si_4$	0.21	+	0.17	+	0.14	+		ne
Octamethyltrisiloxane		107-51-7	$C_8H_{24}O_2Si_3$	0.23	+	0.18	+	0.17	+	<10.0	ne
Octane, n-		111-65-9	C_8H_{18}	13	+	1.8	+			9.82	300
Octene, 1-		111-66-0	C_8H_{16}	0.9	+	0.75	+	0.4	+	9.43	75
Pentane		109-66-0	C_5H_{12}	80	+	8.4	+	0.7	+	10.35	600
Peracetic acid *	Peroxyacetic acid, Acetyl hydroperoxide	79-21-0	$C_2H_4O_3$	NR	+	NR	+	2.3	+		ne
Peracetic/Acetic acid mix *	Peroxyacetic acid, Acetyl hydroperoxide	79-21-0	$C_2H_4O_3$			50	+	2.5	+		ne
Perchloroethene	PCE, Perchloroethylene, Tetrachloroethylene	127-18-4	C_2Cl_4	0.69	+	0.57	+	0.31	+	9.32	25
PGME	Propylene glycol methyl ether, 1-Methoxy-2-propanol	107-98-2	$C_6H_{12}O_3$	2.4	+	1.5	+	1.1	+		100

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
PGMEA	Propylene glycol methyl ether acetate, 1-Methoxy-2-acetoxypropane, 1-Methoxy-2-propanol acetate	108-65-6	$C_6H_{12}O_3$	1.65	+	1.0	+	0.8	+		ne
Phenol	Hydroxybenzene	108-95-2	C_6H_6O	1.0	+	1.0	+	0.9	+	8.51	5
Phosgene	Dichlorocarbonyl	75-44-5	CCl_2O	NR	+	NR	+	8.5	+	11.2	0.1
Phosgene in Nitrogen	Dichlorocarbonyl	75-44-5	CCl_2O	NR	+	NR	+	6.8	+	11.2	0.1
Phosphine (coats lamp)		7803-51-2	PH_3	28		3.9	+	1.1	+	9.87	0.3
Photocopier Toner	Isoparaffin mix					0.5	+	0.3	+		ne
Picoline, 3-	3-Methylpyridine	108-99-6	C_6H_7N			0.9				9.04	ne
Pinene, α-		2437-95-8	$C_{10}H_{16}$			0.31	+	0.47		8.07	ne
Pinene, β-		18172-67-3	$C_{10}H_{16}$	0.38	+	0.37	+	0.37	+	~8	100
Piperylene, isomer mix	1,3-Pentadiene	504-60-9	C_5H_8	0.76	+	0.69	+	0.64	+	8.6	100
Propane		74-98-6	C_3H_8			NR	+	1.8	+	10.95	2500
Propanol, n-	Propyl alcohol	71-23-8	C_3H_8O			5		1.7		10.22	200
Propene	Propylene	115-07-1	C_3H_6	1.5	+	1.4	+	1.6	+	9.73	ne
Propionaldehyde	Propanal	123-38-6	C_3H_6O			1.9				9.95	ne
Propyl acetate, n-		109-60-4	$C_5H_{10}O_2$			3.5		2.3		10.04	200
Propylamine, n-	1-Propylamine, 1-Aminopropane	107-10-8	C_3H_9N	1.1	+	1.1	+	0.9	+	8.78	ne
Propylene carbonate *		108-32-7	$C_4H_6O_3$			62	+	1	+	10.5	ne
Propylene glycol	1,2-Propanediol	57-55-6	$C_3H_8O_2$	18		5.5	+	1.6	+	<10.2	ne
Propylene glycol propyl ether	1-Propoxy-2-propanol	1569-01-3	$C_6H_{14}O_2$	1.3	+	1.0	+	1.6	+		ne
Propylene oxide	Methyloxirane	75-56-9 16088-62-3 15448-47-2	C_3H_6O	~240		6.6	+	2.9	+	10.22	20
Propyleneimine	2-Methylaziridine	75-55-8	C_3H_7N	1.5	+	1.3	+	1.0	+	9.0	2
Propyl mercaptan, 2-	2-Propanethiol, Isopropyl mercaptan	75-33-2	C_3H_8S	0.64	+	0.66	+			9.15	ne
Pyridine		110-86-1	C_5H_5N	0.78	+	0.7	+	0.7	+	9.25	5
Pyrrolidine (coats lamp)	Azacyclohexane	123-75-1	C_4H_9N	2.1	+	1.3	+	1.6	+	~8.0	ne
RR7300 (PGME/PGMEA)	70:30 PGME:PGMEA (1-Methoxy-2-propanol:1-Methoxy-2-acetoxypropane)	107-98-2	$C_4H_{10}O_2$ / $C_6H_{12}O_3$			1.4	+	1.0	+		ne
Sarin	GB, Isopropyl methylphosphonofluoridate	107-44-8 50642-23-4	$C_4H_{10}FO_2P$			~3					
Stoddard Solvent - see Mineral Spirits		8020-83-5									
Styrene		100-42-5	C_8H_8	0.45	+	0.40	+	0.4	+	8.43	20
Sulfur dioxide		7446-09-5	SO_2	NR		NR	+	NR	+	12.32	2
Sulfur hexafluoride		2551-62-4	SF_6	NR		NR		NR		15.3	1000
Sulfuryl fluoride	Vikane	2699-79-8	SO_2F_2	NR		NR		NR		13.0	5
Tabun *	Ethyl N, N-dimethylphosphoramidocyanidate	77-81-6	$C_5H_{11}N_2O_2P$			0.8					15ppt
Tetrachloroethane, 1,1,1,2-		630-20-6	$C_2H_2Cl_4$					1.3		~11.1	ne
Tetrachloroethane, 1,1,2,2-		79-34-5	$C_2H_2Cl_4$	NR	+	NR	+	0.60	+	~11.1	1
Tetrachlorosilane		10023-04-7	$SiCl_4$	NR		NR		15	+	11.79	ne
Tetraethyl lead	TEL	78-00-2	$C_8H_{20}Pb$	0.4		0.3		0.2		~11.1	0.008
Tetraethyl orthosilicate	Ethyl silicate, TEOS	78-10-4	$C_8H_{20}O_4Si$			0.7	+	0.2	+	~9.8	10
Tetrafluoroethane, 1,1,1,2-	HFC-134A	811-97-2	$C_2H_2F_4$			NR		NR			ne
Tetrafluoroethene	TFE, Tetrafluoroethylene, Perfluoroethylene	116-14-3	C_2F_4			~15				10.12	ne
Tetrafluoromethane	CFC-14, Carbon tetrafluoride	75-73-0	CF_4			NR	+	NR	+	>15.3	ne
Tetrahydrofuran	THF	109-99-9	C_4H_8O	1.9	+	1.7	+	1.0	+	9.41	200
Tetramethyl orthosilicate	Methyl silicate, TMOS	681-84-5	$C_4H_{12}O_4Si$	10	+	1.9	+			~10	1
Therminol® D-12 *	Hydrotreated heavy naphtha	64742-48-9	m.w. 160	0.8	+	0.51	+	0.33	+		ne
Therminol® VP-1 *	Dowtherm A, 3:1 Diphenyl oxide: Biphenyl	101-84-8 92-52-4	$C_{12}H_{10}O$ $C_{12}H_{10}$			0.4	+				1
Toluene	Methylbenzene	108-88-3	C_7H_8	0.54	+	0.50	+	0.51	+	8.82	50

Compound Name	Synonym/Abbreviation	CAS No.	Formula	9.8	C	10.6	C	11.7	C	IE (eV)	TWA
Tolylene-2,4-diisocyanate	TDI, 4-Methyl-1,3-phenylene-2,4-diisocyanate	584-84-9	$C_9H_6N_2O_2$	1.4	+	1.4	+	2.0	+		0.002
Trichlorobenzene, 1,2,4-	1,2,4-TCB	120-82-1	$C_6H_3Cl_3$	0.7	+	0.46	+			9.04	C5
Trichloroethane, 1,1,1-	1,1,1-TCA, Methyl chloroform	71-55-6	$C_2H_3Cl_3$			NR	+	1	+	11	350
Trichloroethane, 1,1,2-	1,1,2-TCA	79-00-5	$C_2H_3Cl_3$	NR	+	NR	+	0.9	+	11.0	10
Trichloroethene	TCE, Trichoroethylene	79-01-6	C_2HCl_3	0.62	+	0.54	+	0.43	+	9.47	50
Trichloromethylsilane	Methyltrichlorosilane	75-79-6	CH_3Cl_3Si	NR		NR		1.8	+	11.36	ne
Trichlorotrifluoroethane, 1,1,2-	CFC-113	76-13-1	$C_2Cl_3F_3$			NR		NR		11.99	1000
Triethylamine	TEA	121-44-8	$C_6H_{15}N$	0.95	+	0.9	+	0.65	+	7.3	1
Triethyl borate	TEB; Boric acid triethyl ester	150-46-9	$C_6H_{15}O_3B$			2.2	+	1.1	+	~10	ne
Triethyl phosphate	Ethyl phosphate	78-40-0	$C_6H_{15}O_4P$	~50	+	3.1	+	0.60	+	9.79	ne
Trifluoroethane, 1,1,2-		430-66-0	$C_2H_3F_3$					34		*12.9*	ne
Trimethylamine		75-50-3	C_3H_9N			0.9				7.82	5
Trimethylbenzene, 1,3,5- - see Mesitylene		108-67-8									25
Trimethyl borate	TMB; Boric acid trimethyl ester, Boron methoxide	121-43-7	$C_3H_9O_3B$			5.1	+	1.2	+	10.1	ne
Trimethyl phosphate	Methyl phosphate	512-56-1	$C_3H_9O_4P$			8.0	+	1.3	+	9.99	ne
Trimethyl phosphite	Methyl phosphite	121-45-9	$C_3H_9O_3P$			1.1	+		+	*8.5*	2
Turpentine	Pinenes (85%) + other diisoprenes	8006-64-2	$C_{10}H_{16}$	0.37	+	0.30	+	0.29	+	~8	20
Undecane		1120-21-4	$C_{11}H_{24}$			2				9.56	ne
Varsol – see Mineral Spirits											
Vinyl actetate		108-05-4	$C_4H_6O_2$	1.5	+	1.2	+	1.0	+	9.19	10
Vinyl bromide	Bromoethylene	593-60-2	C_2H_3Br			0.4				9.80	5
Vinyl chloride	Chloroethylene, VCM	75-01-4	C_2H_3Cl			2.0	+	0.6	+	9.99	5
Vinyl-1-cyclohexene, 4-	Butadiene dimer, 4-Ethenylcyclohexene	100-40-3	C_8H_{12}	0.6	+	0.56	+			9.83	0.1
Vinylidene chloride - see 1,1-Dichloroethene											
Vinyl-2-pyrrolidinone, 1-	NVP, N-vinylpyrrolidone, 1-ethenyl-2-pyrrolidinone	88-12-0	C_6H_9NO	1.0	+	0.8	+	0.9	+		ne
Viscor 120B - see Mineral Spirits - Viscor 120B Calibration Fluid											
V. M. & P. Naphtha	Ligroin; Solvent naphtha; Varnish maker's & painter's naptha	64742-89-8	m.w. 111 (C_8-C_9)	1.7	+	0.97	+				300
Xylene, m-	1,3-Dimethylbenzene	108-38-3	C_8H_{10}	0.50	+	0.44	+	0.40	+	8.56	100
Xylene, o-	1,2-Dimethylbenzene	95-47-6	C_8H_{10}	0.56	+	0.46	+	0.43		8.56	100
Xylene, p-	1,4-Dimethylbenzene	106-42-3	C_8H_{10}	0.48	+	0.39	+	0.38	+	8.44	100
None				1		1		1			
Undetectable				1E+6		1E+6		1E+6			

* Compounds indicated in green can be detected using a MiniRAE 2000 or ppbRAE/+ with slow response, but may be lost by adsorption on a MultiRAE or EntryRAE. Response on multi-gas meters can give an indication of relative concentrations, but may not be quantitative and for some chemicals no response is observed.

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Appendix I:
Example of Automatic Calculation of Correction Factors, TLVs and Alarm Limits for Mixtures
(Calculations performed using Excel version of this database, available on request)

Compound	CF 9.8 eV	CF 10.6 eV	CF 11.7eV	Mol. Frac	Conc ppm	TLV ppm	STEL Ppm
Benzene	0.55	0.53	0.6	0.01	1	0.5	2.5
Toluene	0.54	0.5	0.51	0.06	10	50	150
Hexane, n-	300	4.3	0.54	0.06	10	50	150
Heptane, n-	45	2.8	0.6	0.28	50	400	500
Styrene	0.45	0.4	0.42	0.06	10	20	40
Acetone	1.2	1.1	1.4	0.28	50	750	1000
Isopropanol	500	6	2.7	0.28	50	400	500
None	1	1	1	0.00	0	1	
Mixture Value:	2.1	1.5	0.89	1.00	181	56	172
TLV Alarm Setpoint when					ppm	ppm	ppm
Calibrated to Isobutylene:	26	37	62				
	ppm	ppm	ppm				
STEL Alarm Setpoint, same Calibration	86	115	193				
	ppm	ppm	ppm				

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FIELD OPERATING PROCEDURES

Calibration and Maintenance of Portable Specific Conductance Meter

FOP 012.0

CALIBRATION AND MAINTENANCE OF PORTABLE SPECIFIC CONDUCTANCE METER

PURPOSE

This guideline describes a method for calibration of a portable specific conductance meter. This meter measures the ability of a water sample to conduct electricity, which is largely a function of the dissolved solids within the water. The instrument has been calibrated by the manufacturer according to factory specifications. This guideline presents a method for checking the factory calibration of a portable specific conductance meter. A calibration check is performed to verify instrument accuracy and function. All field test equipment will be checked at the beginning of each sampling day. This procedure also documents critical maintenance activities for this meter.

ACCURACY

The calibrated accuracy of the specific conductance meter will be within ± 1 percent of full-scale, with repeatability of ± 1 percent. The built-in cell will be automatically temperature compensated from at least 32° to 160° F (0° to 71°C).

PROCEDURE

Note: The information included below is equipment manufacturer- and model-specific, however, accuracy, calibration, and maintenance procedures for this type of portable equipment are typically similar. The information below pertains to the Myron L Company Ultrameter Model 6P. The actual equipment to be used in the field will be equivalent or similar.

1. Calibrate all field test equipment at the beginning of each sampling day. Check and recalibrate the specific conductance meter according to the manufacture's specifications.

2. Use a calibration solution of known specific conductivity and salinity. For maximum accuracy, use a Standard Solution Value closest to the samples to be tested.

3. Rinse conductivity cell three times with proper standard.

4. Re-fill conductivity cell with same standard.

5. Press **COND** or **TDS**, then press **CAL/MCLR**. The "CAL" icon will appear on the display.

6. Press the **↑/MS** or **MR/↓** key to step the displayed value toward the standard's value or hold a key down to cause rapid scrolling of the reading.

7. Press CAL/MCLR once to confirm new value and end the calibration sequence for this particular solution type.

8. Repeat steps 1 through 7 with additional new solutions, as necessary.

9. Document the calibration results and related information in the Project Field Book and on an **Equipment Calibration Log** (see attached sample), indicating the meter readings before and after the instrument has been adjusted. This is important, not only for data validation, but also to establish maintenance schedules and component replacement. Information will include, at a minimum:
    - Time, date and initials of the field team member performing the calibration
    - The unique identifier for the meter, including manufacturer, model, and serial number
    - The brand and expiration date of the calibration standards
    - The instrument readings: before and after calibration

- The instrument settings (if applicable)
- The overall adequacy of calibration including the Pass or fail designation in accordance with the accuracy specifications presented above.
- Corrective action taken (see Maintenance below) in the event of failure to adequately calibrate.

MAINTENANCE

NOTE: Ultrameters should be rinsed with clean water after use. Solvents should be avoided. Shock damage from a fall may cause instrument failure.

Temperature Extremes

Solutions in excess of 160°F/71°C should not be placed in the cell cup area; this may cause damage. Care should be exercised not to exceed rated operating temperature. Leaving the Ultrameter in a vehicle or storage shed on a hot day can easily subject the instrument to over 150°F voiding the warranty.

Battery Replacement

Dry Instrument THOROUGHLY. Remove the four bottom screws. Open instrument carefully; it may be necessary to rock the bottom slightly side to side to release it from the RS-232 connector. Carefully detach battery from circuit board. Replace with 9-volt alkaline battery. Replace bottom, ensuring the sealing gasket is installed in the groove of the top half of case. Re-install screws, tighten evenly and securely.

NOTE: Because of nonvolatile EEPROM circuitry, all data stored in memory and all calibration settings are protected even during power loss or battery replacement.

Cleaning Sensors

The conductivity cell cup should be kept as clean as possible. Flushing with clean water following use will prevent buildup on electrodes. However, if very dirty samples — particularly scaling types — are allowed to dry in the cell cup, a film will form. This film reduces accuracy. When there are visible films of oil, dirt, or scale in the cell cup or on the electrodes, use a foaming non-abrasive household cleaner. Rinse out the cleaner and your Ultrameter is ready for accurate measurements.

NOTE: Maintain a log for each monitoring instrument. Record all maintenance performed on the instrument on this log with date and name of the organization performing the maintenance.

ATTACHMENTS

Equipment Calibration Log (sample)

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EQUIPMENT CALIBRATION

PROJECT INFORMATION:

Project Name: Date:

Project No.:

Client: Instrument Source: ☐ BM ☐ Rental

METER TYPE	UNITS	TIME	MAKE/MODEL	SERIAL NUMBER	CAL. BY	STANDARD	READING	SETTI
☐ pH meter	units		Myron L Company Ultra Meter 6P	606987		4.00		
						7.00		
						10.01		
☐ Turbidity meter	NTU		Hach 2100P Turbidimeter	970600014560		< 0.4		
						20		
						100		
						800		
☐ Sp. conductance meter	uS/mS		Myron L Company Ultra Meter 6P	606987		µS @ 25 °C		
☐ PID	ppm		Photovac 2020 PID	[illegible]		open air zero		MIBK re factor =
						_____ ppm Iso. Gas		
☐ Particulate meter	mg/m^3					zero air		
☐ Oxygen	%					open air		
☐ Hydrogen sulfide	ppm					open air		
☐ Carbon monoxide	ppm					open air		
☐ LEL	%					open air		
☐ Radiation Meter	uR/H					background area		
☐								

ADDITIONAL REMARKS:

PREPARED BY: **DATE:**

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FIELD OPERATING PROCEDURES

Documentation Requirements for Drilling and Well Installation

FOP 015.0

DOCUMENTATION REQUIREMENTS FOR DRILLING AND WELL INSTALLATION

PURPOSE

The purpose of these documentation requirements is to document the procedures used for drilling and installing wells in order to ensure the quality of the data obtained from these operations. Benchmark field technical personnel will be responsible for developing and maintaining documentation for quality control of field operations. At least one field professional will monitor each major operation (e.g. one person per drilling rig) to document and record field procedures for quality control. These procedures provide a description of the format and information for this documentation.

PROCEDURE

Project Field Book

Personnel assigned by the Benchmark Field Team Leader or Project Manager will maintain a Project Field Book for all site activities. These Field Books will be started upon initiation of any site activities to document the field investigation process. The Field Books will meet the following criteria:

- Permanently bound, with nominal 8.5-inch by 11-inch gridded pages.
- Water resistant paper.
- Pages must be pre-numbered or numbered in the field, front and back.

Notations in the field book will be in black or blue ink that will not smudge when wet. Information that may be recorded in the Field Book includes:

- Time and date of all entries.

- Name and location of project site and project job number.
- Listing of key project, client and agency personnel and telephone numbers.
- Date and time of daily arrivals and departures, name of person keeping the log, names and affiliation of persons on site, purpose of visit (if applicable), weather conditions, outline of project activities to be completed.
- Details of any variations to the procedures/protocols (i.e., as presented in the Work Plan or Field Operating Procedures) and the basis for the change.
- Field-generated data relating to implementation of the field program, including sample locations, sample descriptions, field measurements, instrument calibration, etc.
- Record of all photographs taken in the field, including date, time, photographer, site location and orientation, sequential number of photograph, and roll number.

Upon completion of the site activities, all Field Books will be photocopied and both the original and photocopied versions placed in the project files. In addition, all field notes except those presented on specific field forms will be neatly transcribed into Field Activity Daily Log (FADL) forms (sample attached).

Field Borehole/Monitoring Well Installation Log Form

Examples of the Field Borehole Log and Field Borehole/Monitoring Well Installation Log forms are attached to this Field Operating Procedure. One form will be completed for every boring by the Benchmark field person overseeing the drilling. At a minimum, these forms will include:

- Project name, location, and number.
- Boring number.

- Rig type and drilling method.
- Drilling dates.
- Sampling method.
- Sample descriptions, to meet the requirements of the Unified Soil Classification System (USCS) for soils and the Unified Rock Classification System (URCS) for rock.
- Results of photoionization evaluations (scan and/or headspace determinations).
- Blow counts for sampler penetration (Standard Penetration Test, N-Value).
- Drilling rate, rig chatter, and other drilling-related information, as necessary.

All depths recorded on Boring/Monitoring Well Installation Log forms will be expressed in increments tenths of feet, and not in inches.

Well Completion Detail Form

An example of this form is attached to this Field Operating Procedure. One form will be completed for every boring by the Benchmark field person overseeing the well installation. At a minimum, these forms will include:

- Project name, location, and number.
- Well number.
- Installation dates.
- Dimensions and depths of the various well components illustrated in the Well Completion Detail (attached). These include the screened interval, bottom caps or plugs, centralizers, and the tops and bottoms of the various annular materials.

- Drilling rate, rig chatter, and other drilling related information.

All depths recorded on Field Borehole/Monitoring Well Installation Logs will be expressed in tenths of feet, and not in inches.

Daily Drilling Report Form

An example of this form is attached to this Field Operating Procedure. This form should be used to summarize all drilling activities. One form should be completed for each rig for each day. These forms will include summaries of:

- Footage drilled, broken down by diameter (e.g. 200 feet of 6-inch diameter hole, 50 feet of 10-inch diameter hole).
- Footage of well and screen installed, broken down by diameter.
- Quantities of materials used, including sand, cement, bentonite, centralizers, protective casings, traffic covers, etc. recorded by well or boring location.
- Active time (hours), and activity (drilling, decontamination, development, well installation, surface completions, etc.)
- Down-time (hours) and reason.
- Mobilizations and other events.
- Other quantities that will be the basis for drilling invoices.

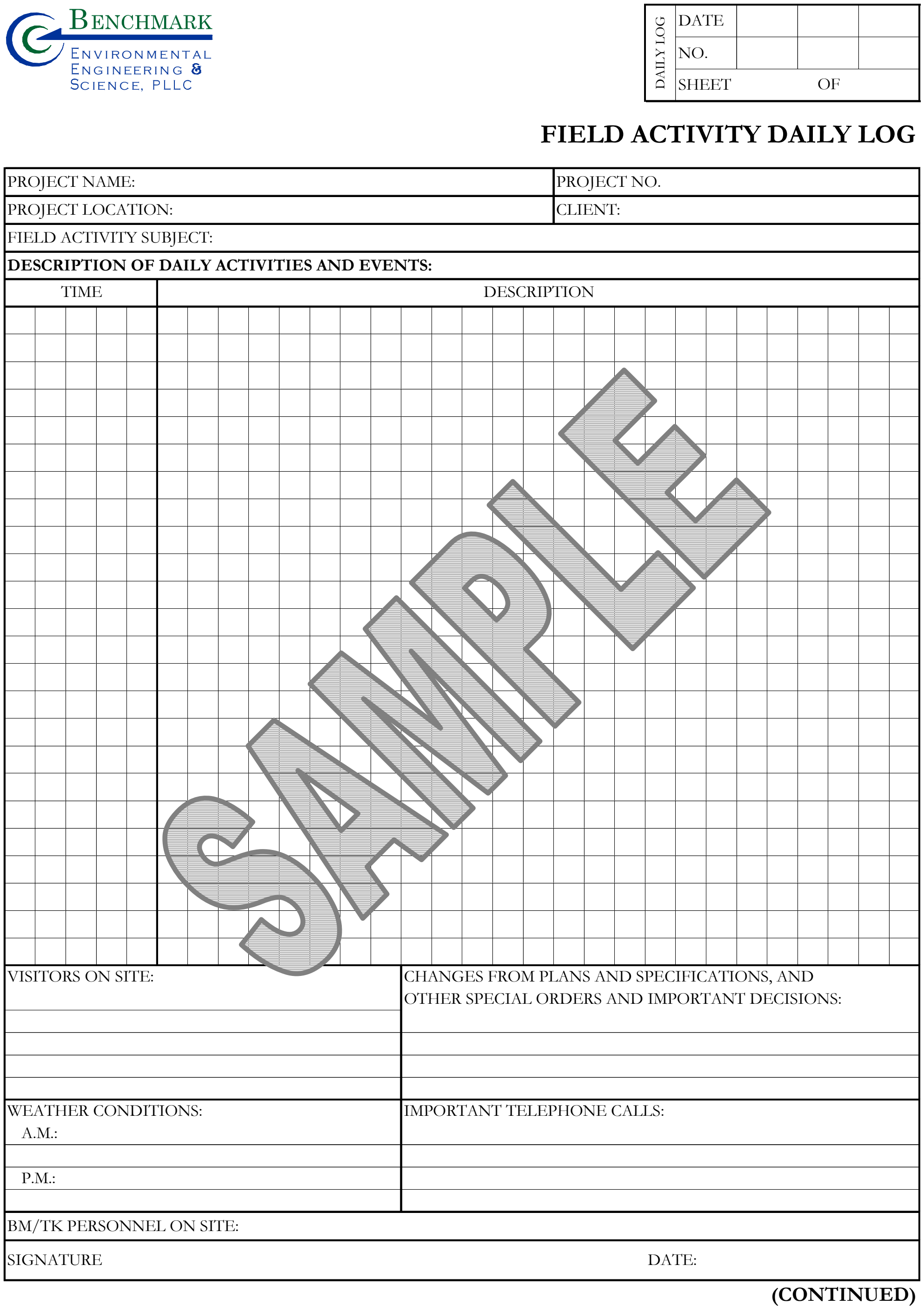
The form should be signed daily by both the Benchmark field supervisor and the driller's representative, and provided to the Benchmark Field Team Leader.

Other Project Field Forms

Well purging/well development forms, test pit logs, environmental sampling field data sheets, water level monitoring forms, and well testing (slug test or pumping test) forms. Refer to specific guidelines for form descriptions.

ATTACHMENTS

Field Activity Daily Log (FADL) (sample)
Field Borehole Log (sample)
Field Borehole/Monitoring Well Installation Log (sample)
Stick-up Well/Piezometer Completion Detail (sample)
Flush-mount Well/Piezometer Completion Detail (sample)
Daily Drilling Report (sample)

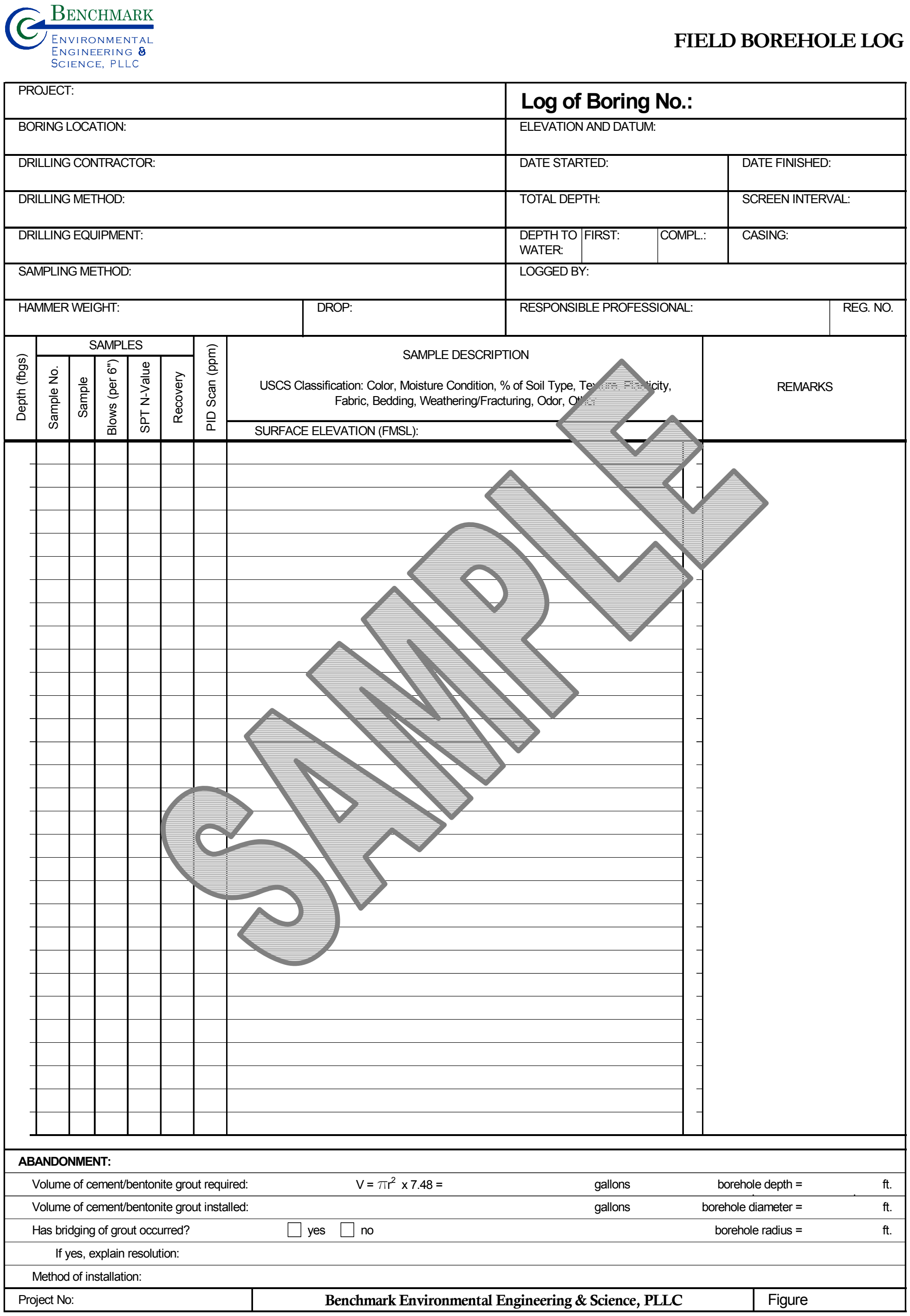


DAILY LOG	DATE		
	NO.		
	SHEET	OF	

FIELD ACTIVITY DAILY LOG

PROJECT NAME:	PROJECT NO.
PROJECT LOCATION:	CLIENT:
FIELD ACTIVITY SUBJECT:	
DESCRIPTION OF DAILY ACTIVITIES AND EVENTS:	
TIME	DESCRIPTION
VISITORS ON SITE:	CHANGES FROM PLANS AND SPECIFICATIONS, AND OTHER SPECIAL ORDERS AND IMPORTANT DECISIONS:
WEATHER CONDITIONS: A.M.: P.M.:	IMPORTANT TELEPHONE CALLS:
BM/TK PERSONNEL ON SITE:	
SIGNATURE	DATE:

(CONTINUED)



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FIELD BOREHOLE LOG

PROJECT:

Log of Boring No.:

BORING LOCATION:

ELEVATION AND DATUM:

DRILLING CONTRACTOR:

DATE STARTED:

DATE FINISHED:

DRILLING METHOD:

TOTAL DEPTH:

SCREEN INTERVAL:

DRILLING EQUIPMENT:

DEPTH TO WATER: FIRST: COMPL.:

CASING:

SAMPLING METHOD:

LOGGED BY:

HAMMER WEIGHT:

DROP:

RESPONSIBLE PROFESSIONAL:

REG. NO.

Depth (fbgs)	SAMPLES					PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	REMARKS
	Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery			

ABANDONMENT:

Volume of cement/bentonite grout required: V = πr^2 x 7.48 = gallons borehole depth = ft.

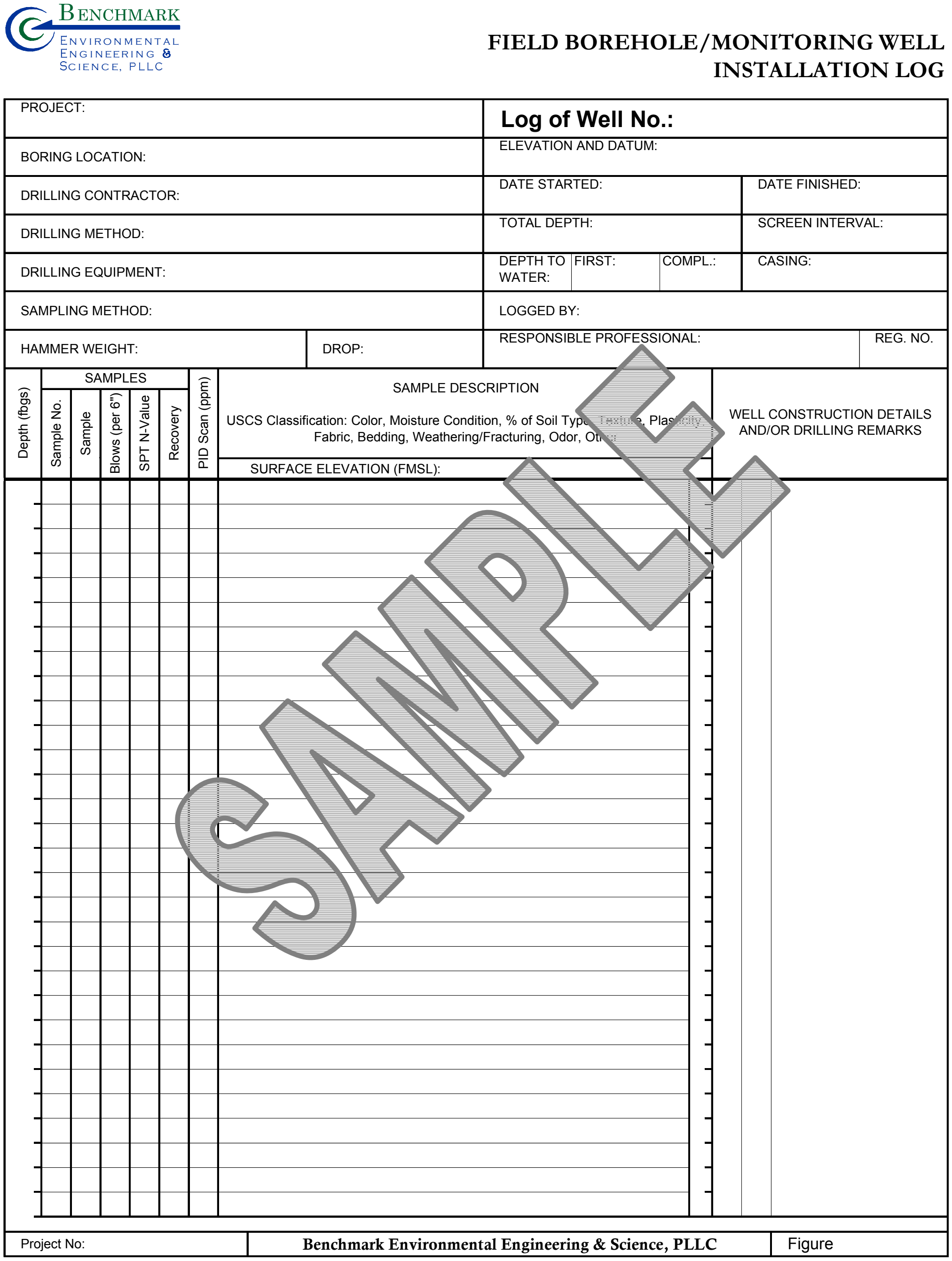
Volume of cement/bentonite grout installed: gallons borehole diameter = ft.

Has bridging of grout occurred? ☐ yes ☐ no borehole radius = ft.

If yes, explain resolution:

Method of installation:

Project No: **Benchmark Environmental Engineering & Science, PLLC** Figure



FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:		**Log of Well No.:**		
BORING LOCATION:		ELEVATION AND DATUM:		
DRILLING CONTRACTOR:		DATE STARTED:		DATE FINISHED:
DRILLING METHOD:		TOTAL DEPTH:		SCREEN INTERVAL:
DRILLING EQUIPMENT:		DEPTH TO WATER:	FIRST: COMPL.:	CASING:
SAMPLING METHOD:		LOGGED BY:		
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:		REG. NO.

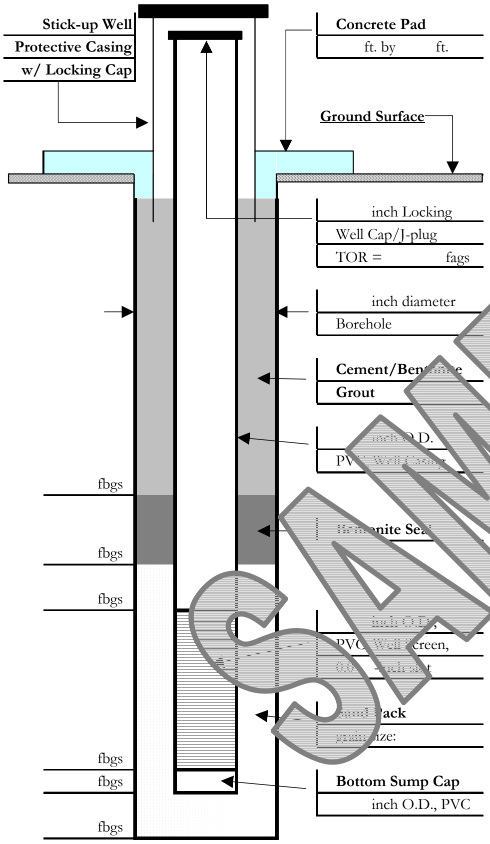
Depth (fbgs)	SAMPLES					PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS
	Sample No.	Sample	Blows (per 6")	SPT N-Value	Recovery			

Project No:	**Benchmark Environmental Engineering & Science, PLLC**	Figure

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

STICK-UP WELL/PIEZOMETER COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information

Company:

Driller:

Helper:

Permit Number:

Drill Rig Type:

Well Information

Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction

Casing:

Screen:

Sump:

Sand Pack:

Annular Seal:

Well Development

Well Purpose:	
Techneque(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	fbTOR
Pump Depth:	
Purge Duration:	minutes
Yeild:	gpm
Specific Capacity:	gpm/ft

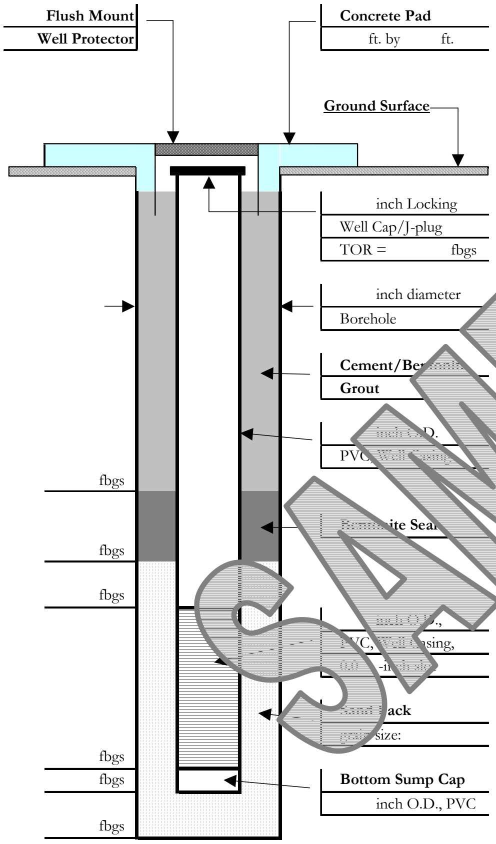
Comments:

PREPARED BY: DATE:

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

FLUSHMOUNT WELL/PIEZOMETER COMPLETION DETAIL

Project Name:	WELL NUMBER:
Client:	Date Installed:
Boring Location:	Project Number:



Driller Information

Company:
Driller:
Helper:
Permit Number:
Drill Rig Type:

Well Information

Land Surface Elevation:	fmsl (approximate)
Drilling Method:	
Soil Sample Collection Method:	
Drilling Fluid:	
Fluid Loss During Drilling:	gallons (approximate)

Material of Well Construction

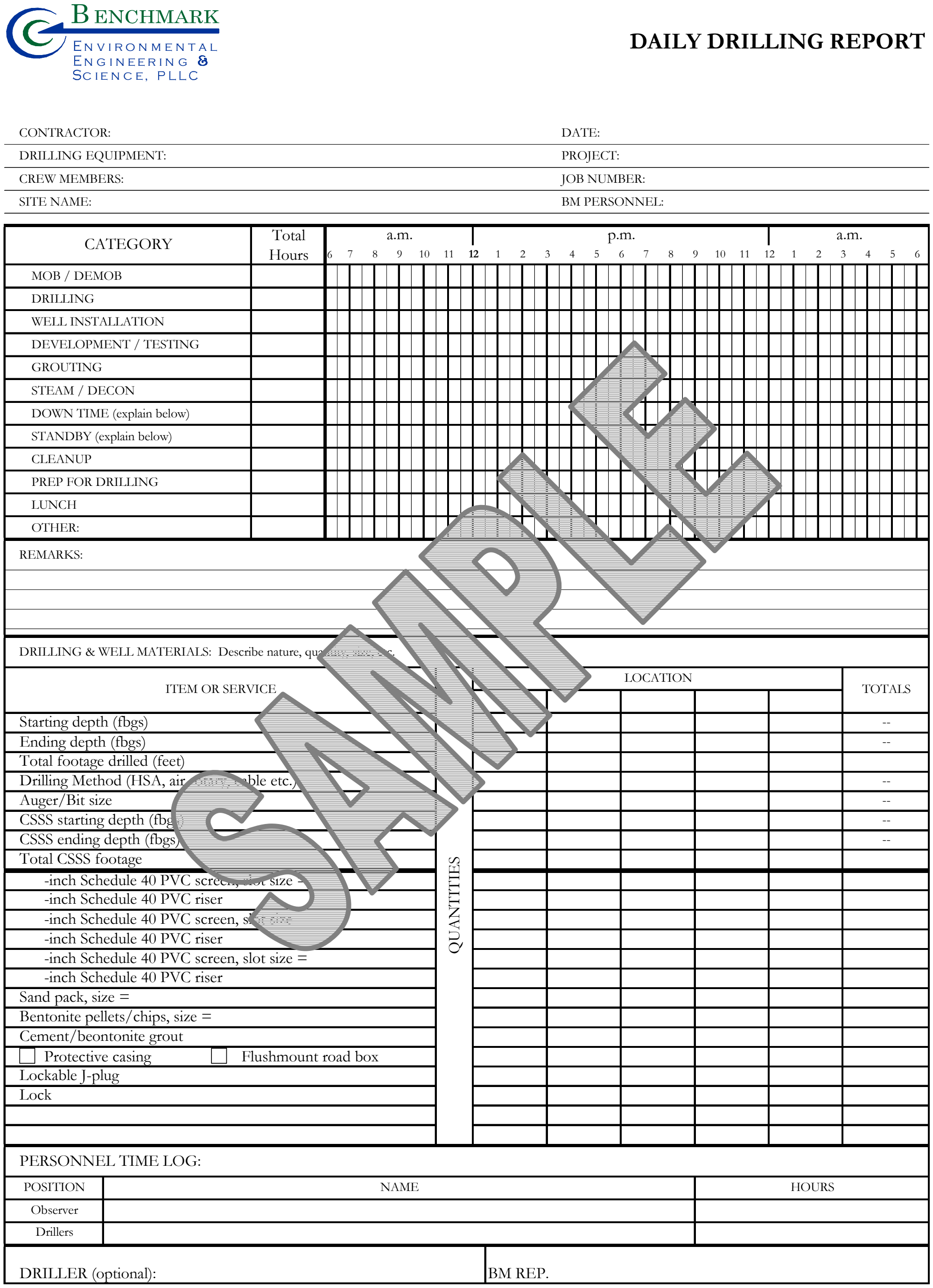
Casing:
Screen:
Sump:
Sand Pack:
Annular Seal:

Well Development

Well Purpose:	
Techneque(s):	
Date Completed:	
BM/TK Personnel:	
Total Volume Purge:	gallons
Static Water Level:	fbTOR
Pump Depth:	
Purge Duration:	minutes
Yeild:	gpm
Specific Capacity:	gpm/ft

Comments:

PREAPRED BY: DATE:



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DAILY DRILLING REPORT

CONTRACTOR:
DATE:
DRILLING EQUIPMENT:
PROJECT:
CREW MEMBERS:
JOB NUMBER:
SITE NAME:
BM PERSONNEL:

CATEGORY	Total Hours	a.m.						p.m.												a.m.						
		6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6
MOB / DEMOB																										
DRILLING																										
WELL INSTALLATION																										
DEVELOPMENT / TESTING																										
GROUTING																										
STEAM / DECON																										
DOWN TIME (explain below)																										
STANDBY (explain below)																										
CLEANUP																										
PREP FOR DRILLING																										
LUNCH																										
OTHER:																										

REMARKS:

DRILLING & WELL MATERIALS: Describe nature, quantity, size, etc.

ITEM OR SERVICE		LOCATION					TOTALS
Starting depth (fbgs)	QUANTITIES						--
Ending depth (fbgs)							--
Total footage drilled (feet)							
Drilling Method (HSA, air rotary, cable etc.)							--
Auger/Bit size							--
CSSS starting depth (fbgs)							--
CSSS ending depth (fbgs)							--
Total CSSS footage							
-inch Schedule 40 PVC screen, slot size =							
-inch Schedule 40 PVC riser							
-inch Schedule 40 PVC screen, slot size =							
-inch Schedule 40 PVC riser							
-inch Schedule 40 PVC screen, slot size =							
-inch Schedule 40 PVC riser							
Sand pack, size =							
Bentonite pellets/chips, size =							
Cement/beontonite grout							
☐ Protective casing ☐ Flushmount road box							
Lockable J-plug							
Lock							

PERSONNEL TIME LOG:

POSITION	NAME	HOURS
Observer		
Drillers		

DRILLER (optional):
BM REP.

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FIELD OPERATING PROCEDURES

Drill Site Selection Procedure

FOP 017.0

DRILL SITE SELECTION PROCEDURE

PURPOSE

This procedure presents a method for selecting a site location for drilling. Drill site selection should be based on the project objectives, ease of site access, freedom from obstructions and buried metallic objects (drums) and site safety (appropriate set backs from overhead and buried services).

PROCEDURE

The following procedure outlines procedures prior to drilling activities:

1. Review project objectives and tentatively select drilling locations that provide necessary information for achieving objectives (i.e., Work Plan).

2. Clear locations with property owner/operator to ensure that drilling activities will not interfere with site operations and select appropriate access routes.

3. Stake locations in the field, measure distance from locations to recognizable landmarks, such as building or fence lines and plot locations on site plan. Ensure location is relatively flat, free of overhead wires and readily accessible. Survey location if property ownership is in doubt.

4. Obtain clearances from appropriate utilities and if buried waste/metallic objects are suspected, screen location with appropriate geophysical method.

5. Establish a secure central staging area for storage of drilling supplies and for equipment decontamination. Locate a secure storage area for drilling samples, as necessary.

ATTACHMENTS

none

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FIELD OPERATING PROCEDURES

Drilling and Excavation Equipment Decontamination Procedures

FOP 018.0

DRILLING AND EXCAVATION EQUIPMENT DECONTAMINATION PROCEDURES

PURPOSE

This procedure is to be used for the decontamination of drilling and excavation equipment (i.e., drill rigs, backhoes, augers, drill bits, drill rods, buckets, and associated equipment) used during a subsurface investigation. The purpose of this procedure is to remove chemical constituents associated with a particular drilling or excavation location from this equipment. This prevents these constituents from being transferred between drilling or excavation locations, or being transported out of controlled areas.

PROCEDURE

The following procedure will be utilized prior to the use of drilling or excavation equipment at each location, and prior to the demobilization of such equipment from the site:

1. Remove all loose soil and other particulate materials from the equipment at the survey site.

2. Wrap augers, tools, plywood, and other reusable items with a plastic cover prior to transport from the site of use to the decontamination facility.

3. Transport equipment to the decontamination facility. All equipment must be decontaminated at an established decontamination facility. This facility will be placed within a controlled area, and will be equipped with necessary features to contain and collect wash water and entrained materials.

4. Wash equipment thoroughly with pressurized low-volume water or steam, supplied by a pressure washer or steam cleaner.

5. If necessary, use a brush or scraper to remove visible soils adhering to the equipment, and a non-phosphate detergent to remove any oils, grease, and/or hydraulic fluids adhering to the equipment. Continue pressure washing until all visible contaminants are removed.

6. Allow equipment to air dry.

7. Store equipment in a clean area or wrap the equipment in new plastic sheeting as necessary to ensure cleanliness until ready for use.

8. Manage all wash waters and entrained solids as described in the Benchmark Field Operating Procedure for Management of Investigation-Derived Waste.

ATTACHMENTS

none

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FIELD OPERATING PROCEDURES

Groundwater Level Measurement

FOP 022.0

GROUNDWATER LEVEL MEASUREMENT

PURPOSE

This procedure describes the methods used to obtain accurate and consistent water level measurements in monitoring wells, piezometers and well points. Water levels will be measured at monitoring wells and, if practicable, in supply wells to estimate purge volumes associated with sampling, and to develop a potentiometric surface of the groundwater in order to estimate the direction and velocity of flow in the aquifer. Water levels in monitoring wells will be measured using an electronic water level indicator (e-line) that has been checked for operation prior to mobilization.

PROCEDURE

1. Decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Benchmark Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

2. Unlock and remove the well protective cap or cover and place on clean plastic.

3. Lower the probe slowly into the monitoring well until the audible alarm sounds. This indicates the depth to water has been reached.

4. Move the cable up and down slowly to identify the depth at which the alarm just begins to sound. Measure this depth against the mark on the lip of the well riser used as a surveyed reference point (typically the north side of the riser).

5. Read depth from the graduated cable to the nearest 0.01 foot. Do not use inches. If the e-line is not graduated, use a rule or tape measure graduated in 0.01-foot increments to measure from the nearest reference mark on the e-line cable.

6. Record the water level on a Water Level Monitoring Record (sample attached).

7. Remove the probe from the well slowly, drying the cable and probe with a clean paper wipe. Be sure to repeat decontamination before use in another well.

8. Replace well plug and protective cap or cover. Lock in place as appropriate.

ATTACHMENTS

Water Level Monitoring Record (sample)

REFERENCES

<u>Benchmark FOPs:</u>
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

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WATER LEVEL MONITORING RECORD

Project Name:	Client:
Project No.:	Location:
Field Personnel:	Date:
Weather:	

Well No.	Time	Top of Riser Elevation (fmsl)	Static Depth to Water (fbTOR)	Groundwater Elevation (fmsl)	Total Depth (fbTOR)	Last Total Depth Measurement (fbTOR)

Comments/Remarks:

PREAPRED BY: DATE:

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FIELD OPERATING PROCEDURES

Groundwater Purging Procedures Prior to Sample Collection

FOP 023.1

GROUNDWATER PURGING PROCEDURES PRIOR TO SAMPLE COLLECTION

PURPOSE

This procedure describes the methods for monitoring well/piezometer purging prior to groundwater sample collection in order to collect representative groundwater samples. The goal of purging is to remove stagnant, non-representative groundwater from the well and/or prevent stagnant water from entering collected samples. Purging involves the removal of at least three to five volumes of water in wells with moderate yields and at least one well volume from wells with low yields (slow water level recovery).

Purge and sample wells in order of least-to-most contaminated (this is not necessary if dedicated or disposable equipment is used). If you do not know this order, sample the upgradient wells first, then the furthest down-gradient or side-gradient wells, and finally the wells closest to, but down-gradient of the most contaminated area. Sampling should commence immediately following purging or as soon as the well has adequately recharged and not more than 24-hours following end time of evacuation.

PROCEDURE

1. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Benchmark Field Operating Procedure for Groundwater Level Measurement and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Benchmark Field Operating Procedure for Non-disposable and Non-dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

2. Inspect the interior and exterior of the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form and/or Groundwater Well Inspection Form (samples attached). Specifically, inspect

the integrity of the following: concrete surface seal, lock, protective casing and well cover, well riser and J-plug/cap. Report any irregular findings to the Project Manager.

3. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

4. Calibrate the photoionization detector (PID) in accordance with the Benchmark Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.

5. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.

6. Lower the e-line probe slowly into the monitoring well and record the initial water level in accordance with the procedures referenced in the Benchmark Field Operating Procedure for Groundwater Level Measurement.

7. Following static water level determinations, slowly lower the e-line to the bottom of the well/piezometer. Record the total depth to the nearest 0.01-foot and compare to the previous total depth measurement. If a significant discrepancy exists, re-measure the total depth. Continue with purging activities observing purge water to determine whether the well/piezometer had become silted due to inactivity or damaged (i.e., well sand within purge water). Upon confirmation of the new total depth and determination of the cause (i.e., siltation or damage), notify the Project Manager following field activities.

8. Calculate the volume of water in the well based on the water level below the top of riser and the total depth of the well using the following equation:

$$V = 0.0408[(B)^2 \text{ x } \{(A) - (C)\}]$$

Where,

A = Total Depth of Well (feet below measuring point)
B = Casing diameter (inches)
C = Static Water Level (feet below measuring point)

9. **For wells where the water level is 20 feet or less below the top of riser**, a peristaltic pump may be used to purge the well. Measure the purged volume using a calibrated container (i.e., graduated 5-gallon bucket) and record measurements on the attached Groundwater Well Development and Purge Log. Use new and dedicated tubing for each well. During the evacuation of shallow wells, the intake opening of the pump tubing should be positioned just below the surface of the water. As the water level drops, lower the tubing as needed to maintain flow. For higher yielding wells, the intake level should not be lowered past the top of the screen. Pumping from the top of the water column will ensure proper flushing of the well. Continue pumping until the required volumes are removed (typically three well volumes). For higher yielding wells, adjust the purging rate to maintain the water level above the screen. For lower yielding wells or wells where the screen straddles the water table, maintain purging at a rate that matches the rate of recovery of the well (well yield). If the well purges to dryness and is slow to recharge (greater than 15 minutes), terminate evacuation. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.**

10. **For wells where the water level is initially below 20 feet,** or drawn down to this level because of slow recharge rate, conduct purging using one of three devices listed below:

   - <u>Bailer</u> – A bottom filling dedicated polyethylene bailer attached to a length of dedicated hollow-braid polypropylene rope. Purging a well utilizing a bailer should be conducted smoothly and slowly as not to agitate the groundwater or damage the well.

   - <u>Well Wizard Purge Pump (or similar)</u> – This pneumatic bladder pump uses compressed air to push water to the surface. Groundwater is not in contact with the drive air during the pumping process, therefore the pump may be used for sample collection.

- Submersible Pump (12 or 24 volt, or similar) – These submersible pumps are constructed of PVC or stainless steel and are capable of pumping up to 70 feet from ground surface using a 12 volt battery (standard pump) and standard low flow controller. For depths up to 200 feet from ground surface, a high performance power booster controller is used with a 12 volt battery. Unless these pumps are dedicated to the monitoring well location, decontamination between locations is necessary and an equipment blank may be required.

- Waterra™ Pump – This manually operated pump uses dedicated polyethylene tubing and a check valve that can be used as an optional method for purging deeper wells. The pump utilizes positive pressure to evacuate the well, therefore the pump may be used for sample collection, and however over-agitation groundwater should be avoided.

Prior to use in a well, non-dedicated bailers, exterior pump bodies and pump tubing should be cleaned in accordance with the Benchmark Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination. Dedicated and/or disposable equipment should be contained within the sealed original manufacturers packaging and certified pre-cleaned by the manufacturer with a non-phosphate laboratory detergent and rinsed using de-ionized water.

8. Purging will continue until a predetermined volume of water has been removed (typically three well volumes) or to dryness. Measurements for pH, temperature, specific conductance, dissolved oxygen (optional), Eh (optional), and turbidity will be recorded following removal of each well volume. Purge the well to dryness or until the readings for indicator parameters listed above (or well-specific indicator parameters) stabilize within the following limits for each parameter measured:

Field Parameter	Stabilization Criteria
Dissolved Oxygen	± 0.3 mg/L
Turbidity	± 10 %
Specific Conductance	± 3 %
Eh	± 10 mV
PH	± 0.1 unit

Stabilization criteria presented within the project Work Plan will take precedence.

DOCUMENTATION AND SAMPLE COLLECTION

This section pertains to the documentation of collected field data during and following purging activities and sample collection.

1. Record all data including the final three stable readings for each indicator parameter on the attached Groundwater Well Purge & Sample Log.
2. Record, at a minimum, the "volume purged," "purging stop-time," "purged dry (Y/N)," "purged below sand pack (Y/N)," and any problems purging on the attached Groundwater Well Purge & Sample Log.
3. Collect groundwater samples in accordance with the Benchmark Field Operating Procedure for Groundwater Sample Collection. Record "sample flow rate" as an average, "time sample collected," and any other pertinent information related to the sampling event on the attached Groundwater Well Purge & Sample Log.
4. Restore the well to its capped/covered and locked condition.

ALTERNATIVE METHODS

Alternative purging and sampling methods and equipment, other than those described herein are acceptable if they provide representative groundwater samples. The purging and sampling method and equipment must not adversely affect sample integrity, chemistry, temperature, and turbidity. In addition, alternative equipment must have minimal or no effect on groundwater geochemistry, aquifer permeability and well materials. Equipment materials must also minimize sorption and leaching. The field team is responsible for documenting and describing any alternative equipment and procedures used to purge a well and collect samples.

ATTACHMENTS

Groundwater Field Form
Groundwater Well Inspection Form

REFERENCES

Benchmark FOPs:
011 Calibration and Maintenance of Portable Photoionization Detector
022 Groundwater Level Measurement
024 Groundwater Sample Collection Procedures
040 Non-disposable and Non-dedicated Sampling Equipment Decontamination

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GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.	Diameter (inches):	Sample Time:
Product Depth (fbTOR):	Water Column (ft):	DTW when sampled:
DTW (static) (fbTOR):	Casing Volume:	Purpose: ☐ Development ☐ Sample
Total Depth (fbTOR):	Purge Volume (gal):	Purge Method:

Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.	Diameter (inches):	Sample Time:
Product Depth (fbTOR):	Water Column (ft):	DTW when sampled:
DTW (static) (fbTOR):	Casing Volume:	Purpose: ☐ Development ☐ Sample
Total Depth (fbTOR):	Purge Volume (gal):	Purge Method:

Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

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GROUNDWATER WELL INSPECTION FORM

Project:

Client:

Job No.:

Date:

Time:

WELL I.D.:

EXTERIOR INSPECTION

Protective Casing:

Lock:

Hinge/Lid:

Concrete Surface Seal:

Bollards:

Label/I.D.:

Other:

INTERIOR INSPECTION

Well Riser:

Annular Space:

Well Cap:

Water Level (fbTOR):

Total Depth (fbTOR):

Other:

Comments/Corrective Actions:

PREPARED BY: DATE:

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FIELD OPERATING PROCEDURES

Groundwater Sample Collection Procedures

FOP 024.1

GROUNDWATER SAMPLE COLLECTION PROCEDURES

PURPOSE

This procedure describes the methods for collecting groundwater samples from monitoring wells and domestic supply wells following purging and sufficient recovery. This procedure also includes the preferred collection order in which water samples are collected based on the volatilization sensitivity or suite of analytical parameters required.

PROCEDURE

Allow approximately 3 to 10 days following well development before performing purge and sample activities at any well location. Conversely, perform sampling as soon as practical after sample purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. If the well takes longer than 24 hours to recharge, the Project Manager should be consulted. The following two procedures outline sample collection activities for monitoring and domestic type wells.

Monitoring Wells

1. Purge the monitoring well in accordance with the Benchmark FOPs for Groundwater Purging Procedures Prior to Sample Collection or Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedures. Perform sampling as soon as practical after purging at any time after the well has recovered sufficiently to sample, or within 24 hours after evacuation, if the well recharges slowly. If the well does not yield sufficient volume for all required laboratory analytical testing (including quality control), a decision should be made to prioritize analyses based on contaminants of concern at the site. Analyses will be prioritized in the order of the parameters volatilization sensitivity. After volatile organics have been collected, field parameters

must be measured from the next sample collected. If a well takes longer than 24 hours to recharge, the Project Manager should be consulted.

2. Sampling equipment that is not disposable or dedicated to the well will be decontaminated in accordance with the Benchmark Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

3. Calibrate all field meters (i.e., pH/Eh, turbidity, specific conductance, dissolved oxygen, PID etc.) in accordance with the Benchmark Field Operating Procedure for Calibration and Maintenance of the specific field meter.

4. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Benchmark Field Operating Procedure for Groundwater Level Measurement and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Benchmark Field Operating Procedure for Non-disposable and Non-dedicated Sampling Equipment Decontamination. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

5. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.

6. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

7. Calibrate the photoionization detector (PID) in accordance with the Benchmark Field Operating Procedure for Calibration and Maintenance of Portable Photoionization Detector.

8. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging. Record PID measurements on a well-specific Groundwater Field Form (sample attached).

9. Lower the e-line probe slowly into the monitoring well and record the measurement on a well-specific Groundwater Field Form (sample attached).

10. Groundwater samples will be collected directly from the sampling valve on the flow through cell (low-flow), discharge port of a standard pump assembly (peristaltic, pneumatic, submersible, or Waterra™ pump) or bailer (stainless steel, PVC or polyethylene) into appropriate laboratory provided containers. In low-yielding wells at which the flow through cell is not used, the samples may be collected using a disposable bailer. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.**

11. If disposable polyethylene bailers are used, the bailer should be lowered *slowly* below the surface of the water to minimize agitation and volatilization. For wells that are known to produce turbid samples (values greater than 50 NTU), the bailer should be lowered and retrieved at a rate that limits surging of the well.

12. Sampling data will be recorded on a Groundwater Field Form (sample attached).

13. Pre-label all sample bottles in the field using a waterproof permanent marker in accordance with the Benchmark Sample Labeling, Storage, and Shipment FOP. The following information, at a minimum, should be included on the label:

    - Project Number;
    - Sample identification code (as per project specifications);
    - Date of sample collection (mm, dd, yy);
    - Time of sample collection (military time only) (hh:mm);
    - Specify "grab" or "composite" sample type;
    - Sampler initials;
    - Preservative(s) (if applicable); and
    - Analytes for analysis (if practicable).

14. Collect a separate sample of approximately 200 ml into an appropriate container prior to collecting the first and following the last groundwater sample collected to measure the following field parameters:

Parameter	Units
Dissolved Oxygen	parts per million (ppm)
Specific Conductance	μmhos/cm or μS or mS
pH	pH units
Temperature	°C or °F
Turbidity	NTU
Eh (*optional*)	mV
PID VOCs (*optional*)	ppm

Record all field measurements on a Groundwater Field Form (sample attached).

15. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added based on the volatilization sensitivity or suite of analytical parameters required, as designated in the **Sample Collection Order** section below.

16. Lower the e-line probe slowly into the monitoring well and record the measurement on a well-specific Groundwater Field Form (sample attached).

17. The samples will be labeled, stored, and shipped in accordance with the Benchmark Field Operating Procedure for Sample Labeling, Storage, and Shipment Procedures.

Domestic Supply Wells

1. Calculate or estimate the volume of water in the well. It is desirable to purge at least one casing volume before sampling. This is controlled, to some extent, by the depth of the well, well yield and the rate of the existing pump. If the volume of water in the well cannot be calculated, the well should be purged continuously for no less than 15 minutes.

2. Connect a sampling tap to an accessible fitting between the well and the pressure tank where practicable. A hose will be connected to the device and the hose discharge located 25 to 50 feet away. The well will be allowed to pump until the lines and one

well volume is removed. Flow rate will be measured with a container of known volume and a stopwatch.

3. Place a clean piece of polyethylene or Teflon™ tubing on the sampling port and collect the samples in the order designated below and in the sample containers supplied by the laboratory for the specified analytes. ***DO NOT*** use standard garden hose to collect samples.

4. Sampling results and measurements will be recorded on a Groundwater Field Form (sample attached) as described in the previous section.

5. Collect samples into pre-cleaned bottles provided by the analytical laboratory with the appropriate preservative(s) added based on the volatilization sensitivity or suite of analytical parameters required, as designated in the **Sample Collection Order** section below.

6. The samples will be labeled, stored, and shipped in accordance with the Benchmark Field Operating Procedure for Sample Labeling, Storage, and Shipment Procedures.

SAMPLE COLLECTION ORDER

All groundwater samples, from monitoring wells and domestic supply wells, will be collected in accordance with the following.

1. Samples will be collected preferentially in recognition of volatilization sensitivity. The preferred order of sampling if no free product is present is:

    - Field parameters
    - Volatile Organic Compounds (VOCs)
    - Purgeable organic carbons (POC)
    - Purgeable organic halogens (POH)
    - Total Organic Halogens (TOX)
    - Total Organic Carbon (TOC)
    - Extractable Organic Compounds (i.e., BNAs, SVOCs, etc.)
    - Total petroleum hydrocarbons (TPH) and oil and grease

- PCBs and pesticides
- Total metals (Dissolved Metals)
- Total Phenolic Compounds
- Cyanide
- Sulfate and Chloride
- Turbidity
- Nitrate (as Nitrogen) and Ammonia
- Preserved inorganics
- Radionuclides
- Unpreserved inorganics
- Bacteria
- Field parameters

2. Document the sampling procedures and related information in the Project Field Book and on a Groundwater Field Form (sample attached).
3. 1,4-dioxane will be analyzed via the 8270 SIM method.

DOCUMENTATION

The three words used to ensure adequate documentation for groundwater sampling are accountability, controllability, and traceability. Accountability is undertaken in the sampling plan and answers the questions who, what, where, when, and why to assure that the sampling effort meets its goals. Controllability refers to checks (including QA/QC) used to ensure that the procedures used are those specified in the sampling plan. Traceability is documentation of what was done, when it was done, how it was done, and by whom it was done, and is found in the field forms, Project Field Book, and chain-of-custody forms. At a minimum, adequate documentation of the sampling conducted in the field consists of an entry in the Project Field Book (with sewn binding), field data sheets for each well, and a chain-of-custody form.

As a general rule, if one is not sure whether the information is necessary, it should nevertheless be recorded, as it is impossible to over-document one's fieldwork. Years may go by before the documentation comes under close scrutiny, so the documentation must be capable of defending the sampling effort without the assistance or translation of the sampling crew.

The minimum information to be recorded daily with an indelible pen in the Project Field Book and/or field data sheets includes date and time(s), name of the facility, name(s) of the sampling crew, site conditions, the wells sampled, a description of how the sample shipment was handled, and a QA/QC summary. After the last entry for the day in the Project Field Book, the Field Team Leader should sign the bottom of the page under the last entry and then draw a line across the page directly under the signature.

PRECAUTIONS/RECOMMENDATIONS

The following precautions should be adhered to prior to and during sample collection activities:

- Field vehicles should be parked downwind (to avoid potential sample contamination concerns) at a minimum of 15 feet from the well and the engine turned off prior to PID vapor analysis and VOC sample collection.

- Ambient odors, vehicle exhaust, precipitation, or windy/dusty conditions can potentially interfere with obtaining representative samples. These conditions should be minimized and should be recorded in the field notes. Shield sample bottles from strong winds, rain, and dust when being filled.

- The outlet from the sampling device should discharge below the top of the sample's air/water interface, when possible. The sampling plan should specify how the samples will be transferred from the sample collection device to the sample container to minimize sample alterations.

- The order of sampling should be from the least contaminated to the most contaminated well to reduce the potential for cross contamination of sampling equipment (see the Sampling Plan or Work Plan).
- Samples should not be transferred from one sampling container to another.
- Sampling equipment must not be placed on the ground, because the ground may be contaminated and soil contains trace metals. Equipment and supplies should be removed from the field vehicle only when needed.
- Smoking and eating should not be allowed until the well is sampled and hands are washed with soap and water, due to safety and possibly sample contamination concerns. These activities should be conducted beyond a 15-foot radius of the well.
- No heat-producing or electrical instruments should be within 15 feet of the well, unless they are intrinsically safe, prior to PID vapor analysis.
- Minimize the amount of time that the sample containers remain open.
- Do not touch the inside of sample bottles or the groundwater sample as it enters the bottle. Disposable gloves may be a source of phthalates, which could be introduced into groundwater samples if the gloves contact the sample.
- Sampling personnel should use a new pair of disposable gloves for each well sampled to reduce the potential for exposure of the sampling personnel to contaminants and to reduce sample cross contamination. In addition, sampling personnel should change disposable gloves between purging and sampling operations at the same well.
- Sampling personnel should not use perfume, insect repellent, hand lotion, etc., when taking groundwater samples. If insect repellent must be used, then sampling personnel should not allow samples or sampling equipment to contact the

repellent, and it should be noted in the documentation that insect repellent was used.

- Complete the documentation of the well. A completed assemblage of paperwork for a sampling event includes the completed field forms, entries in the Project Field Book (with a sewn binding), transportation documentation (if required), and possibly chain-of-custody forms.

ATTACHMENTS

Groundwater Field Form (sample)

REFERENCES

1. Wilson, Neal. *Soil Water and Ground Water Sampling*, 1995

<u>Benchmark FOPs:</u>

007 Calibration and Maintenance of Portable Dissolved Oxygen Meter
008 Calibration and Maintenance of Portable Field pH/Eh Meter
009 Calibration and Maintenance of Portable Field Turbidity Meter
011 Calibration and Maintenance of Portable Photoionization Detector
012 Calibration and Maintenance of Portable Specific Conductance Meter
022 Groundwater Level Measurement
023 Groundwater Purging Procedures Prior to Sample Collection (optional)
031 Low Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedures (optional)
040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination
046 Sample Labeling, Storage and Shipment Procedures

Benchmark Environmental Engineering & Science, PLLC

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose:	☐ Development	☐ Sample	
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose:	☐ Development	☐ Sample	
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

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FIELD OPERATING PROCEDURES

Hollow Stem Auger Drilling Procedures

FOP 026.1

HOLLOW STEM AUGER (HSA) DRILLING PROCEDURES

PURPOSE

This guideline presents a method for drilling a borehole through unconsolidated materials, including soils or overburden, and consolidated materials, including bedrock.

PROCEDURE

The following procedure will be used to drill a borehole for sampling and/or well installation, using hollow-stem auger methods and equipment.

1. Follow Benchmark's Field Operating Procedure for Drill Site Selection Procedure prior to implementing any drilling activity.

2. Perform drill rig safety checks with the driller by completing the Drilling Safety Checklist form (sample attached).

3. Conduct tailgate health and safety meeting with project team and drillers by completing the Tailgate Safety Meeting Form.

4. Calibrate air-monitoring equipment in accordance with the appropriate Benchmark's Field Operating Procedures (i.e., PID, FID, combustible gas meter) or manufacturer's recommendations for calibration of field meters (i.e., DataRAM 4 Particulate Meter).

5. Ensure all drilling equipment (i.e., augers, rods, split-spoons) appear clean and free of soil prior to initiating any subsurface intrusion. Decontamination of drilling equipment should be in accordance with Benchmark's FOP: Drilling and Excavation Equipment Decontamination Procedures.

6. Mobilize the auger rig to the site and position over the borehole.

7. Level and stabilize the rig using the rig jacks, and recheck the rig location against the planned drilling location. If necessary, raise the jacks and adjust the rig position.

8. Place a metal or plywood auger pan over the borehole location to collect the auger cuttings. This auger pan will be equipped with a 12-inch nominal diameter hole for auger passage. As an alternative, a piece of polyethylene tarp may be used as a substitute.

9. Advance augers into the subsurface. For sampling or pilot-hole drilling, nominal 8-inch outside diameter (OD) augers should be used. The boring diameter will be approved by the Benchmark field supervisor.

10. Collect soil samples via split spoon sampler in accordance with Benchmark's Field Operating Procedure for Split Spoon Sampling.

11. Check augers periodically during drilling to ensure the boring is plumb. Adjust rig position as necessary to maintain plumb.

12. Continue drilling until reaching the assigned total depth, or until auger refusal occurs. Auger refusal is when the drilling penetration drops below 0.1 feet per 10 minutes, with the full weight of the rig on the auger bit, and a center <u>bit</u> (not center plug) in place.

13. Plug and abandon boreholes not used for well installation in accordance with Benchmark's Field Operating Procedure for Abandonment of Borehole.

OTHER PROCEDURAL ISSUES

- Slip rings may be used for lifting a sampling or bit string. The string will not be permitted to extend more than 15 feet above the mast crown.

- Borings will not be over drilled (rat holed) without the express permission of the Benchmark field supervisor. All depth measurements should be accurate to the nearest 0.1 foot, to the extent practicable.

- Potable water may be placed in the auger stem if critically necessary for borehole control or to accomplish sampling objectives and must be approved by the Benchmark Project Manager and/or NYSDEC Project Manager. Upon approval, the potable water source and quantity used will be documented in the Project Field Book and subsequent report submittal.

ATTACHMENTS

Drilling Safety Checklist (sample)
Tailgate Safety Meeting Form (sample)

REFERENCES

<u>Benchmark FOPs:</u>

001	*Abandonment of Borehole Procedures*
010	*Calibration and Maintenance of Portable Flame Ionization Detector*
011	*Calibration and Maintenance of Portable Photoionization Detector*
017	*Drill Site Selection Procedure*
018	*Drilling and Excavation Equipment Decontamination Procedures*
058	*Split Spoon Sampling Procedures*

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DRILLING SAFETY CHECKLIST

Project: **Supplemental Phase II RFI/ICMs**	Date:
Project No.: **0041-009-500**	Drilling Company:
Client: **RealCo., Inc.**	Drill Rig Type:

ITEMS TO CHECK	OK	ACTION NEEDED
"Kill switches" installed by the manufacturer are in operable condition and all workers at the drill site are familiar with their location and how to activate them?		
"Kill switches" are accessible to workers on both sides of the rotating stem? NOTE: Optional based on location and number of switches provided by the manufacturer.		
Cables on drill rig are free of kinks, frayed wires, "bird cages" and worn or missing sections?		
Cables are terminated at the working end with a proper eye splice, either swaged Coupling or using cable clamps?		
Cable clamps are installed with the saddle on the live or load side? Clamps should not be alternated and should be of the correct size and number for the cable size to which it is installed. Clamps are complete with no missing parts?		
Hooks installed on hoist cables are the safety type with a functional latch to prevent accidental separation?		
Safety latches are functional and completely span the entire throat of the hook and have positive action to close the throat except when manually displaced for connecting or disconnecting a load?		
Drive shafts, belts, chain drives and universal joints shall be guarded to prevent accidental insertion of hands and fingers or tools.		
Outriggers shall be extended prior to and whenever the boom is raised off its cradle. Hydraulic outriggers must maintain pressure to continuously support and stabilize the drill rig even while unattended.		
Outriggers shall be properly supported on the ground surface to prevent settling into the soil.		
Controls are properly labeled and have freedom of movement. Controls should not be blocked or locked in an action position.		
Safeties on any device shall not be bypassed or neutralized.		
Controls shall be operated smoothly and cables and lifting devices shall not be jerked or operated erratically to overcome resistance.		
Slings, chokers and lifting devices are inspected before using and are in proper working order? Damaged units are removed from service and are properly tagged?		
Shackles and clevises are in proper working order and pins and screws are fully inserted before placing under a load?		
High-pressure hoses have a safety (chain, cable or strap) at each end of the hose section to prevent whipping in the event of a failure?		
Rotating parts of the drill string shall be free of sharp projections or hooks, which could entrap clothing or foreign objects?		
Wire ropes should not be allowed to bend around sharp edges without cushion material.		
The exclusion zone is centered over the borehole and the radius is equal or greater than the boom height?		

ITEMS TO CHECK	OK	ACTION NEEDED

BENCHMARK ENVIRONMENTAL ENGINEERING & SCIENCE, PLLC

DRILLING SAFETY CHECKLIST

Project: **Supplemental Phase II RFI/ICMs** Date:

Project No.: **0041-009-500** Drilling Company:

Client: **RealCo., Inc.** Drill Rig Type:

ITEMS TO CHECK	OK	ACTION NEEDED
The work area around the borehole shall be kept clear of trip hazards and walking surfaces should be free of slippery material.		
Workers shall not proceed higher than the drilling deck without a fall restraining device and must attach the device in a manner to restrict fall to less than 6 feet.		
A fire extinguisher of appropriate size shall be immediately available to the drill crew. The drill crew shall have received annual training on proper use of the fire extinguisher.		
29 CFR 1910.333 © (3) Except where electrical distribution and transmission lines have been de-energized and visibly grounded, drill rigs will be operated proximate to, under, by, or near power lines only in accordance with the following: .333 © (3) (ii) 50 kV or less -minimum clearance is 10 ft. For 50 kV or over - 10ft. Plus ½ in. For each additional kV **Benchmark Policy: Maintain 20 feet clearance**		
29 CFR 1910.333 © (3) (iii) While the rig is in transit with the boom in the down position, clearance from energized power lines will be maintained as follows: Less than 50 kV - 4 feet 50 to 365 kV - 10 feet 365 to 720 kV - 16 feet		

Name: (printed)

Signed: Date:

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TAILGATE SAFETY MEETING FORM

Project Name: Date: Time:
Project Number: Client:
Work Activities:

HOSPITAL INFORMATION:

Name:
Address: *City:* *State:* *Zip:*
Phone No.: *Ambulance Phone No.*

SAFETY TOPICS PRESENTED:

Chemical Hazards:

Physical Hazards: Slips, Trips, Falls

PERSONAL PROTECTIVE EQUIPMENT:

Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D
Activity:	*PPE Level:*	A	B	C	D

New Equipment:

Other Safety Topic (s): Environmental Hazards (aggressive fauna)
Eating, drinking, use of tobacco products is prohibited in the Exclusion Zone (EZ)

ATTENDEES

Name Printed	**Signatures**

Meeting conducted by:

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FIELD OPERATING PROCEDURES

Low-Flow (Minimal Drawdown) Groundwater Purging & Sampling Procedure

FOP 031.2

LOW FLOW (MINIMAL DRAWDOWN) GROUNDWATER PURGING & SAMPLING PROCEDURES

PURPOSE

This procedure describes the methods used for performing low flow (minimal drawdown) purging, also referred to as micro-purging, at a well prior to groundwater sampling to obtain a representative sample from the water-bearing zone. This method of purging is used to minimize the turbidity of the produced water. This may increase the representativeness of the groundwater samples by avoiding the necessity of filtering suspended solids in the field prior to preservation of the sample.

Well purging is typically performed immediately preceding groundwater sampling. The sample should be collected as soon as the parameters measured in the field (i.e., pH, specific conductance, dissolved oxygen, Eh, temperature, and turbidity) have stabilized.

PROCEDURE

Allow approximately 3 to 10 days following well development for groundwater to return to static conditions before performing low-flow purge and sample activities at any well location. Conversely, perform low-flow sampling as soon as purged groundwater has stabilized. If the well does not yield sufficient volume (i.e., cannot maintain a constant water level during purging) for low-flow purge and sampling, then an alternative method must be performed in accordance with Benchmark's Groundwater Purging Procedures Prior to Sample Collection FOP.

1. Water samples should not be taken immediately following well development. Sufficient time should be allowed to stabilize the groundwater flow regime in

the vicinity of the monitoring well. This lag time will depend on site conditions and methods of installation but may exceed one week.

2. Prepare the electronic water level indicator (e-line) in accordance with the procedures referenced in the Benchmark's Groundwater Level Measurement FOP and decontaminate the e-line probe and a lower portion of cable following the procedures referenced in the Benchmark's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP. Store the e-line in a protected area until use. This may include wrapping the e-line in clean plastic until the time of use.

3. Calibrate all sampling devices and monitoring equipment in accordance with manufacturer's recommendations, the site Quality Assurance Project Plan (QAPP) and/or Field Sampling Plan (FSP). Calibration of field instrumentation should be followed as specified in Benchmark's Calibration and Maintenance FOP for each individual meter.

4. Inspect the well/piezometer for signs of vandalism or damage and record condition on the Groundwater Field Form (sample attached). Specifically, inspect the integrity of the following: concrete surface seal, lock, protective casing and well cover, well casing and J-plug/cap. Report any irregular findings to the Project Manager.

5. Unlock and remove the well protective cap or cover and place on clean plastic to avoid introducing foreign material into the well.

6. Monitor the well for organic vapors using a PID, as per the Work Plan. If a reading of greater than 5 ppm is recorded, the well should be allowed to vent until levels drop below 5 ppm before proceeding with purging.

7. Lower the e-line probe slowly into the monitoring well and record the initial water level in accordance with the procedures referenced in Benchmark's Groundwater Level Measurement FOP. Refer to the construction diagram for the well to identify the screened depth.

8. Decontaminate all non-dedicated pump and tubing equipment following the procedures referenced in the Benchmark's Non-disposable and Non-dedicated Sampling Equipment Decontamination FOP.

9. Lower the purge pump or tubing (i.e., low-flow electrical submersible, peristaltic, etc.) slowly into the well until the pump/tubing intake is approximately in the middle of the screened interval. Rapid insertion of the pump will increase the turbidity of well water, and can increase the required purge time. This step can be eliminated if dedicated tubing is already within the well.

   Placement of the pump close to the bottom of the well will cause increased entrainment of solids, which may have settled in the well over time. Low-flow purging has the advantage of minimizing mixing between the overlying stagnant casing water and water within the screened interval. The objective of low-flow purging is to maintain a purging rate, which minimizes stress (drawdown) of the water level in the well. Low-flow refers to the velocity with which water enters the pump intake and that is imparted to the formation pore water in the immediate vicinity of the well screen.

10. Lower the e-line back down the well as water levels will be frequently monitored during purge and sample activities.

11. Begin pumping to purge the well. The pumping rate should be between 100 and 500 milliliters (ml) per minute (0.03 to 0.13 gallons per minute) depending on site hydrogeology. Periodically check the well water level with the e-line adjusting the flow rate as necessary to stabilize drawdown within the well. If possible, a steady flow rate should be maintained that results in a stabilized water level (drawdown of 0.3 feet or less). If the water level exceeds 2 feet below static and declining, slow the purge rate until the water level generally stabilizes. Record each pumping rate and water level during the event. If the water level continues to drop and will not stabilize, the monitoring location is not conducive to low-flow sampling and conventional purge and sample methods should be performed.

The low flow rate determined during purging will be maintained during the collection of analytical samples. At some sites where geologic heterogeneities are sufficiently different within the screened interval, high conductivity zones may be preferentially sampled.

12. Measure and record field parameters (pH, specific conductance, Eh, dissolved oxygen (DO), temperature, and turbidity) during purging activities. In lieu of measuring all of the parameters, a minimum subset could be limited to pH, specific conductance, and turbidity or DO. A reduction in the field parameter list must be approved by the Project Manager and/or the NYSDEC Project Manager.

    Water quality indicator parameters should be used to determine purging needs prior to sample collection in each well. Stabilization of indicator parameters should be used to determine when formation water is first encountered during purging. In general, the order of stabilization is pH, temperature, and specific conductance, followed by Eh, DO and turbidity. Performance criteria for determination of stabilization should be based on water-level drawdown, pumping rate and equipment specifications for measuring indicator parameters. An in-line flow through cell to continuously measure the above parameters may be used. The in-line device should be disconnected or bypassed during sample collection.

13. Purging will continue until parameters of water quality have stabilized or at least a minimum of three (3) well volumes have been removed. Record measurements for field indicator parameters (including water levels) at regular intervals during purging. The stability of these parameters with time can be used to guide the decision to discontinue purging. Proper adjustments must be made to stabilize the flow rate as soon as possible.

14. Record well purging and sampling data in the Project Field Book or on the Groundwater Field Form (sample attached). Measurements should be taken approximately every three to five minutes, or as merited given the rapidity of change.

15. Purging is complete when field indicator parameters stabilize. Stabilization is achieved after all field parameters have stabilized for three successive readings. Three successive readings should be within ± 0.1 units for pH, ± 3% for specific conductance, ± 10 mV for Eh, and ± 10% for turbidity and dissolved oxygen. These stabilization guidelines are provided for rough estimates only, actual site-specific knowledge may be used to adjust these requirements higher or lower.

    An in-line water quality measurement device (e.g., flow-through cell) should be used to establish the stabilization time for several field parameters on a well-specific basis. Data on pumping rate, drawdown, and volume required for parameter stabilization can be used as a guide for conducting subsequent sampling activities.

16. Collect all project-required samples from the discharge tubing at the flow rate established during purging in accordance with Benchmark's Groundwater Sample Collection Procedures FOP. **A peristaltic pump and dedicated tubing cannot be used to collect VOC or SVOC project-required samples; only non-organic compounds may be collected using this type of pump.** Continue to maintain a constant flow rate such that the water level is not drawn down as described above. Fill sample containers with minimal turbulence by allowing the ground water to flow from the tubing along the inside walls of the container.

17. If field filtration is recommended as a result of increased turbidity greater than 50 NTU, an in-line filter equipped with a 0.45-micron filter should be utilized. Collection of a filtered sample must be accompanied by an unfiltered sample.

18. Replace the dedicated tubing down the well taking care to avoid contact with the ground surface.

19. Restore the well to its capped/covered and locked condition.

20. Upon purge and sample collection completion, slowly lower the e-line to the bottom of the well/piezometer. Record the total depth to the nearest 0.01-

foot and compare to the previous total depth measurement. If a significant discrepancy exists, re-measure the total depth. Record observations of purge water to determine whether the well/piezometer had become silted due to inactivity or damaged (i.e., well sand within purge water). Upon confirmation of the new total depth and determination of the cause (i.e., siltation or damage), notify the Project Manager following project field activities.

ATTACHMENTS

Groundwater Field Form (sample)

REFERENCES

United States Environmental Protection Agency, 540/S-95/504, 1995. *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures.*

Benchmark FOPs:

007	*Calibration and Maintenance of Portable Dissolved Oxygen Meter*
008	*Calibration and Maintenance of Portable Field pH/Eh Meter*
009	*Calibration and Maintenance of Portable Field Turbidity Meter*
011	*Calibration and Maintenance of Portable Photoionization Detector*
012	*Calibration and Maintenance of Portable Specific Conductance Meter*
022	*Groundwater Level Measurement*
024	*Groundwater Sample Collection Procedures*
040	*Non-Disposable and Non-Dedicated Sampling Equipment Decontamination*
046	*Sample Labeling, Storage and Shipment Procedures*

GROUNDWATER FIELD FORM

Project Name: Date:
Location: Project No.: Field Team:

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose:	☐ Development		☐ Sample
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

Well No.			Diameter (inches):			Sample Time:			
Product Depth (fbTOR):			Water Column (ft):			DTW when sampled:			
DTW (static) (fbTOR):			Casing Volume:			Purpose:	☐ Development		☐ Sample
Total Depth (fbTOR):			Purge Volume (gal):			Purge Method:			
Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:			Date: (if different from above)						
	S1								
	S2								

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

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FIELD OPERATING PROCEDURES

Management of Investigative-Derived Waste (IDW)

FOP 032.2

MANAGEMENT OF INVESTIGATION-DERIVED WASTE (IDW)

PURPOSE

The purpose of these guidelines is to ensure the proper holding, storage, transportation, and disposal of materials generated from field investigation activities that may contain hazardous wastes. Investigation-derived waste (IDW) includes the following:

- Drill cuttings, discarded soil samples, drilling mud solids, and used sample containers.
- Well development and purge waters and discarded groundwater samples.
- Decontamination waters and associated solids.
- Soiled disposable personal protective equipment (PPE).
- Used disposable sampling equipment.
- Used plastic sheeting and aluminum foil.
- Other equipment or materials that either contain or have been in contact with potentially impacted environmental media.

Because these materials may contain regulated chemical constituents, they must be managed as a solid waste. This management may be terminated if characterization analytical results indicate the absence of these constituents.

PROCEDURE

1. Contain all investigation-derived wastes in Department of Transportation (DOT)-approved 55-gallon drums, roll-off boxes, or other containers suitable for the wastes.

2. Contain wastes from separate borings or wells in separate containers (i.e. do not combine wastes from several borings/wells in a single container, unless it is a container used specifically for transfer purposes, or unless specific permission to do so has been provided by the Benchmark Field Team Leader. Unused samples from surface sample locations within a given area may be combined.

3. To the extent practicable, separate solids from drilling muds, decontamination waters, and similar liquids. Place solids within separate containers.

4. Transfer all waste containers to a staging area. Access to this area will be controlled. Waste containers must be transferred to the staging area as soon as practicable after the generating activity is complete.

5. Pending transfer, all containers will be covered and secured when not immediately attended.

6. Label all containers with regard to contents, origin, date of generation, using Benchmark's IDW container label (sample attached). Use indelible ink for all labeling.

7. Complete the Investigative Derived Waste Container Log (sample attached) as waste containers are labeled in order to track and inventory project waste. Leave a copy of the log with the site manager or fax copy to the owner/operator as necessary.

8. Collect samples for waste characterization purposes, or use boring/well sample analytical data for characterization.

9. For wastes determined to be hazardous in character, **be aware of accumulation time limitations**. Coordinate the disposal of these wastes with the plant manager/owner/operator, if applicable.

10. Upon NYSDEC Project Manager approval, dispose of investigation-derived wastes as follows:

- Soil, water, and other environmental media for which analysis does not detect organic constituents, and for which inorganic constituents are at levels that meet the Site's cleanup objectives, may be spread on the Property or otherwise treated as a non-waste material. Disposal quantity and on-site location will be documented on Project Field Books and in the project report submittal.

- Soil, water, and other environmental media in which organic compounds are detected or metals are present above the Site's cleanup objectives will be disposed off-site in accordance with applicable state and federal regulations. Disposal quantity and off-site location will be documented on Project Field Books and in the project report submittal.

- Personal protective equipment, disposable bailers, and similar equipment may be disposed as municipal waste, unless waste characterization results mandate otherwise.

WASTE STORAGE MANAGEMENT

Hazardous materials generated on site should be temporarily stored in a secure location that is under the control of the owner/operator or does not allow for vandalism (i.e., within a locked building structure or within a locked fenced in area). A waste-staging area should be designated on-site by the Project Manager in conjunction with the owner/operator.

ATTACHMENTS

Investigation Derived Waste Container Log (sample)
Investigation Derived Waste Container Label (sample)

REFERENCES

None

INVESTIGATION DERIVED WASTE CO

Project Name: Location:

Project Number: Personnel:

Container		Contents	Date		Staging Location	Date Sampled	Co
Number	Description		Started	Ended			

Prepared By:

Signed:

IDW Container Label (sample):

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Project Name:
Project Number:

Container I.D.:
Contents/Matrix:
Estimated Quantity:
Date of Generation:
Date of Sample Collection:

Contact Name:
Contact Phone Number:

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FIELD OPERATING PROCEDURES

Monitoring Well Construction for Hollow Stem Auger Boreholes

FOP 033.0

MONITORING WELL CONSTRUCTION FOR HOLLOW STEM AUGER BOREHOLES

PURPOSE

Wells will be installed within selected boreholes for the purpose of evaluating groundwater characteristics. Well installation procedures depend upon the drilling method. This procedure describes well construction and installation for boreholes drilled using the hollow stem auger method. Refer to the Benchmark's Hollow Stem Auger Drilling Procedures FOP. Nominal dimensions and materials for the well are shown in the attached well construction diagram.

PROCEDURE

1. Advance borehole in accordance with the Benchmark's Hollow Stem Auger Drilling Procedure FOP to the required depth. The nominal inside diameter (ID) of the auger stem used should be at least 2 inches larger than the outside diameter (OD) of the riser and screen selected for the well installation. Record the monitoring well construction on the Field Borehole/Monitoring Well Installation Log (sample attached) (see Documentation Requirements for Drilling and Well Installation FOP).

2. Remove the drill rods and center bit/plug from the auger stem and verify borehole depth using weighted measuring tape.

3. In the event of an over drill (i.e. borehole depth is more than one foot greater than desired base of screen depth), use bentonite chips poured through the auger stem to seal the over drilled portion of the borehole. Be sure to note bentonite chip thickness on Field Borehole/Monitoring Well Installation Log.

4. Add a maximum of 6 inches of filter pack material through the auger stem to the base of the borehole. (Note: This step may be avoided if dense non-aqueous phase liquids are suspected to be present and it is desirable to have the screen and/or sump at the base of the borehole.)

5. Measure the length of the well string (i.e. riser and screen), and lower the well string into the well assembly to the desired depth. All measurements during the well installation process will be accurate to 0.1 foot.

6. Surface pour filter pack material into the annulus between the well and the auger stem as the augers are gradually withdrawn from the borehole. Use a weighted tape to confirm that the level of sand is maintained within the augers at all times. Record material volumes used.

7. After filter pack materials are brought to the required level, surface pour bentonite chips or pellets into the annulus between the well and the auger stem to form the filter pack seal. If necessary to avoid bridging, delayed hydration (coated) pellets may be used. Record the volume of material used.

8. Allow the bentonite chips/pellets to adequately hydrate for approximately 30 to 45-minutes. Cap or cover the well top of riser.

9. Mix cement/bentonite grout to a smooth consistency using a centrifugal or reciprocating pump. Do not hand mix. All water used must be potable quality. Record the volume of water used.

10. Fill the remaining annulus between the well and the auger stem with grout by surface pouring or pumping, and begin withdrawal of the auger string. Periodically top the auger string off with additional grout. If groundwater is present within the annulus above the bentonite chip/pellet seal, cement/bentonite grout will be pressure tremie grouted from bottom to top in order to displace groundwater from the borehole.

11. When the auger string is withdrawn, center the upper portion of the well riser within the borehole, and place drums or barricades around the well for protection while the grout cures. Place and lock a security cap (i.e., J-plug) in the opening of the well riser.

12. Leave the well undisturbed for at least 24 hours to allow the grout to cure. If excessive grout fallback occurs, top off as necessary with bentonite chips or additional grout.

13. Construct the surface completion as shown in the attached Typical Monitoring Well Detail (Figure 1). Select flush completions for all locations in active operational or high traffic areas, or in other areas where an above grade completion would be undesirable. Use aboveground completions in all other areas.

14. Place a dedicated lock on the well or protective casing, and keep well locked when not actively attended.

15. Permanently label the well with the appropriate well identifier as determined by the Project Manager or specified in the Work Plan.

16. Permanently mark a survey location on the north side at the top of the casing with a saw cut. Survey all wells for horizontal location and elevation, using a surveyor licensed by the State of New York. Coordinates and elevations will be provided in a coordinate system consistent with previous well surveys at the Site. Information obtained will include location (*x* and *y*) of the well, and elevation (*z*) of the ground surface, the pad, and the top of riser.

17. Develop the well as described in the Benchmark Field Operating Procedure for Monitoring Well Development.

18. Manage all waste materials generated during well installation and development as described in the Benchmark Field Operating Procedure for Management of Investigation Derived Waste.

ATTACHMENTS

Field Borehole/Monitoring Well Installation Log (sample)
Typical Monitoring Well Detail (Figure 1)

REFERENCES

Benchmark FOPs:

015 *Documentation Requirements for Drilling and Well Installation*
026 *Hollow Stem Auger Drilling Procedures*
032 *Management of Investigation Derived Waste*
036 *Monitoring Well Development Procedures*

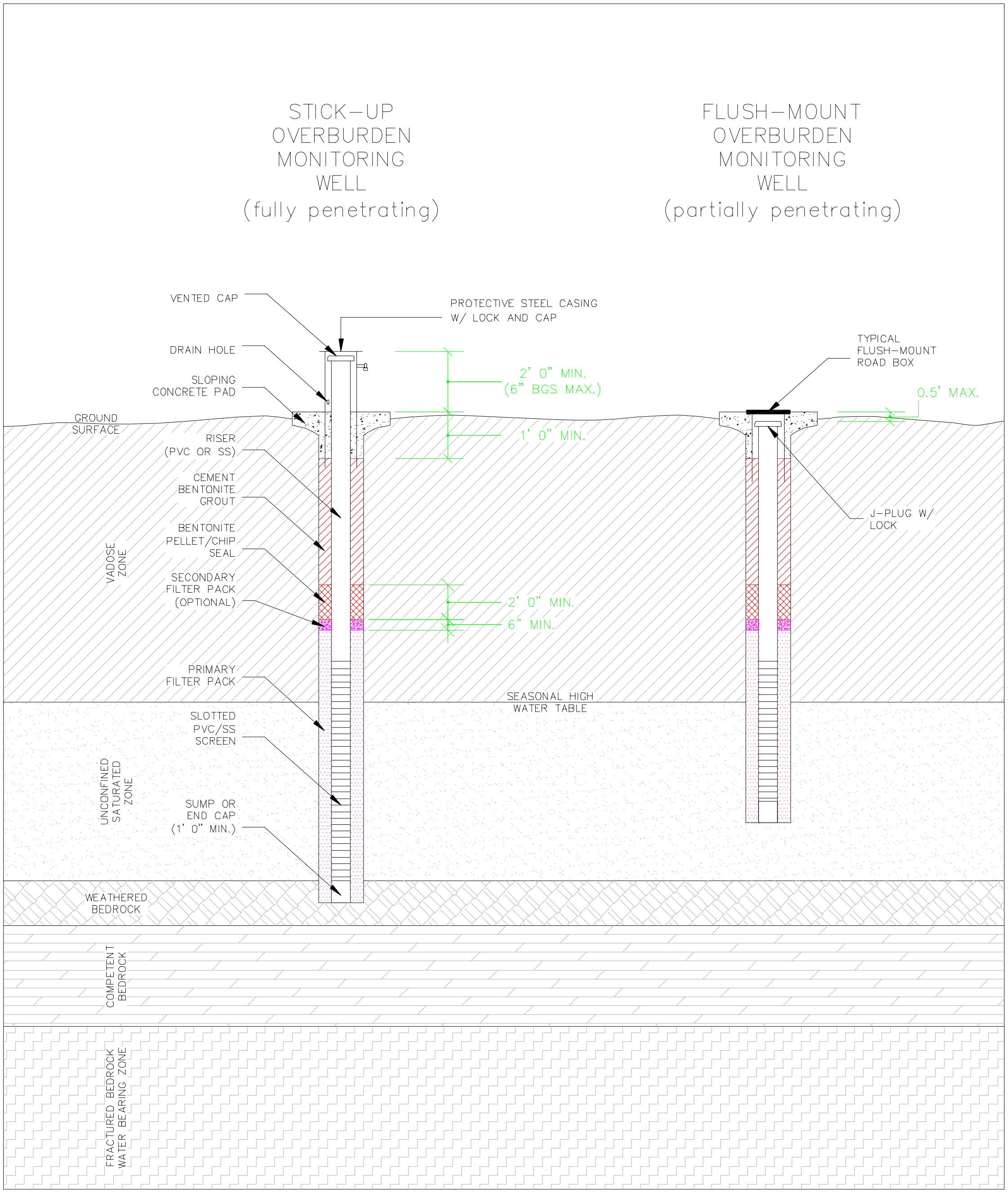
FIELD BOREHOLE/MONITORING WELL INSTALLATION LOG

PROJECT:		**Log of Well No.:**				
BORING LOCATION:		ELEVATION AND DATUM:				
DRILLING CONTRACTOR:		DATE STARTED:			DATE FINISHED:	
DRILLING METHOD:		TOTAL DEPTH:			SCREEN INTERVAL:	
DRILLING EQUIPMENT:		DEPTH TO WATER:	FIRST:	COMPL.:	CASING:	
SAMPLING METHOD:		LOGGED BY:				
HAMMER WEIGHT:	DROP:	RESPONSIBLE PROFESSIONAL:				REG. NO.

Depth (fbgs)	SAMPLES Sample No.	 Sample	 Blows (per 6")	 SPT N-Value	 Recovery	PID Scan (ppm)	SAMPLE DESCRIPTION USCS Classification: Color, Moisture Condition, % of Soil Type, Texture, Plasticity, Fabric, Bedding, Weathering/Fracturing, Odor, Other SURFACE ELEVATION (FMSL):	WELL CONSTRUCTION DETAILS AND/OR DRILLING REMARKS

Project No:	**Benchmark Environmental Engineering & Science, PLLC**	Figure

FIGURE 1


STICK–UP
OVERBURDEN
MONITORING
WELL
(fully penetrating)
FLUSH–MOUNT
OVERBURDEN
MONITORING
WELL
(partially penetrating)
VENTED CAP
PROTECTIVE STEEL CASING
W/ LOCK AND CAP
DRAIN HOLE
SLOPING
CONCRETE PAD
2' 0" MIN.
(6" BGS MAX.)
1' 0" MIN.
TYPICAL
FLUSH–MOUNT
ROAD BOX
0.5' MAX.
GROUND
SURFACE
RISER
(PVC OR SS)
CEMENT
BENTONITE
GROUT
J–PLUG W/
LOCK
BENTONITE
PELLET/CHIP
SEAL
VADOSE
ZONE
SECONDARY
FILTER PACK
(OPTIONAL)
2' 0" MIN.
6" MIN.
PRIMARY
FILTER PACK
SEASONAL HIGH
WATER TABLE
SLOTTED
PVC/SS
SCREEN
UNCONFINED
SATURATED
ZONE
SUMP OR
END CAP
(1' 0" MIN.)
WEATHERED
BEDROCK
COMPETENT
BEDROCK
FRACTURED BEDROCK
WATER BEARING ZONE

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FIELD OPERATING PROCEDURES

Monitoring Well Development Procedures

FOP 036.0

MONITORING WELL DEVELOPMENT PROCEDURES

PURPOSE

This procedure describes the methods for the development of newly installed monitoring wells and re-development of existing monitoring wells that have been inactive for an extended period of time (i.e., one year or more). Monitoring wells are developed after installation in order to remove introduced water and drilling fluids, reduce the turbidity of the water, and improve the hydraulic communication between the well and the water-bearing formation. Well development will not commence until the annular grout seal has cured, but will be performed within ten calendar days of well installation.

PROCEDURE

1. All well development will include surge blocking or false bailing with one or more of the following fluid removal methods. Well development activities may include:

    - Bailing
    - Air Lifting
    - Submersible Pumping
    - Other methods as approved by the Benchmark Field Team Leader.
    - The appropriate water removal method will be selected based on water level depth and anticipated well productivity.

2. Assemble and decontaminate equipment (if necessary), and place in the well. Reference the Benchmark Field Operating Procedure for Non-Disposable and Non-Dedicated Sampling Equipment Decontamination.

3. Alternate the use of agitation methods with water removal methods, using the former to suspend solids in the well water, and the latter to remove the turbid water. For example, use a vented surge block to agitate the well, moving up and down within the screened interval and then use a pump to clear the well. A bailer may be used for both purposes, by surging with the bailer (false

bailing) for a period within the screened interval, then bailing a volume of water from the well.

4. When using surging methods, initiate this activity gradually, with short (2 to 3 feet) strokes. After several passes across the screened interval, increase the speed and length of the surge strokes.

5. Continue development until the following objectives are achieved:

   - Field parameters stabilize to the following criteria:
     - Dissolved Oxygen: ± 0.3 mg/L
     - Turbidity: ± 10%
     - Specific Conductance: ± 3%
     - ORP: ± 10 mV
     - pH: ± 0.1 units
   - The well will generate non-turbid water during continued pumping typically less than 50 NTU.
   - A minimum of 10 well volumes has been evacuated from the well.
   - In the case of lost water during drilling activities, the volume of water removed exceeds twice the volume of water lost to the formation during the drilling process, as indicated by the water balance.

6. Document the development methods, volumes, field parameter measurements, and other observations on the attached Benchmark Groundwater Well Development Log (sample attached).

ATTACHMENTS

Groundwater Well Development Log (sample)

REFERENCES

<u>Benchmark FOPs:</u>

040 Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

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GROUNDWATER WELL DEVELOPMENT LOG

Project Name: WELL NUMBER:
Project Number: Sample Matrix:
Client: Weather:

WELL DATA:

DATE: TIME:

Casing Diameter (inches):	Casing Material:
Screened interval (fbTOR):	Screen Material:
Static Water Level (fbTOR):	Bottom Depth (fbTOR):
Elevation Top of Well Riser (fmsl):	Datum Ground Surface: Mean Sea Level
Elevation Top of Screen (fmsl):	Stick-up (feet):

PURGING DATA:

DATE: START TIME: END TIME:

VOLUME CALCULATION:

(A) Total Depth of Well (fbTOR):	
(B) Casing Diameter (inches):	
(C) Static Water Level (fbTOR):	
One Well Volume (V, gallons): $V = 0.0408 [(B)^2 \times \{ (A) - (C) \}]$	

*Use the table to the right to calculate one well volume.

Field Personnel:

Volume Calculation

Well Diameter	Volume gal/ft
1"	0.041
2"	0.163
3"	0.367
4"	0.653
5"	1.020
6"	1.469
8"	2.611

Stabilization Criteria

Parameter	Criteria
DO	+/- 0.3 mg/L
Turbidity	+/- 10%
SC	+/- 3%
ORP	+/- 10 mV
pH	+/- 0.1 unit

EVACUATION STABILIZATION TEST DATA:

Time	Water Level (fbTOR)	Accumulated Volume (gallons)	pH (units)	Temperature (degrees C)	Specific Conductance (μS/cm)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor

REMARKS:

PREPARED BY:

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Field Operating Procedures

Non-Disposable and Non-Dedicated Sampling Equipment Decontamination

FOP 040.1

NON-DISPOSABLE AND NON-DEDICATED SAMPLING EQUIPMENT DECONTAMINATION

PURPOSE

This procedure is to be used for the decontamination of non-disposable and non-dedicated equipment used in the collection of environmental samples. The purpose of this procedure is to remove chemical constituents from previous samples from the sampling equipment. This prevents these constituents from being transferred to later samples, or being transported out of controlled areas.

HEALTH AND SAFETY

Nitric acid is a strong oxidizing agent as well as being extremely corrosive to the skin and eyes. Solvents such as acetone, methanol, hexane and isopropanol are flammable liquids. Limited contact with skin can cause irritation, while prolonged contact may result in dermatitis. Eye contact with the solvents may cause irritation or temporary corneal damage. Safety glasses with protective side shields, neoprene or nitrile gloves and long-sleeve protective clothing must be worn whenever acids and solvents are being used.

PROCEDURE – GENERAL EQUIPMENT

Bailers, split-spoons, steel or brass split-spoon liners, Shelby tubes, submersible pumps, soil sampling knives, and similar equipment will be decontaminated as described below.

1. Wash equipment thoroughly with non-phosphate detergent and potable-quality water, using a brush where possible to remove any particulate matter or surface film. If the sampler is visibly coated with tars or other phase-separated hydrocarbons, pre-wash with acetone or isopropanol, or by steam cleaning. Decontamination will adhere to the following procedure:

a. Rinse with potable-quality water; if the sampling equipment is very oily and use of a solvent is necessary, rinse with pesticide-grade isopropanol.

b. Rinse with potable-quality water;

c. Rinse with deionized water demonstrated analyte-free, such as distilled water;

d. Air dry; and

e. Store in a clean area or wrap in aluminum foil (shiny side out) or new plastic sheeting as necessary to ensure cleanliness.

2. All non-dedicated well evacuation equipment, such as submersible pumps and bailers, which are put into the well, must be decontaminated following the procedures listed above. All evacuation tubing must be dedicated to individual wells (i.e., tubing cannot be reused). However, if submersible pump discharge tubing must be reused, the tubing and associated sample valves or flow-through cells used in well purging or pumping tests will be decontaminated as described below:

   a. Pump a mixture of potable water and a non-phosphate detergent through the tubing, sample valves and flow cells, using the submersible pump.

   b. Steam clean or detergent wash the exterior of the tubing, sample valves, flow cells and pump.

   c. Pump potable water through the tubing, sample valve, and flow cell until no indications of detergent (e.g. foaming) are observed.

   d. Double rinse the exterior of the tubing with potable water.

   e. Rinse the exterior of the tubing with distilled water.

   f. Store in a clean area or wrap the pump and tubing assembly in new plastic sheeting as necessary to ensure cleanliness until ready for use.

3. All unused sample bottles and sampling equipment must be maintained in such a manner that there is no possibility of casual contamination.

4. Manage all waste materials generated during decontamination procedures as described in the Benchmark Field Operating Procedure for Management of Investigation Derived Waste.

PROCEDURE – SUBMERSIBLE PUMPS

Submersible pumps used in well purging or purging tests will be decontaminated thoroughly each day before use as well as between well locations as described below:

Daily Decontamination Procedure:

1. Pre-rinse: Operate the pump in a basin containing 8 to 10 gallons of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

2. Wash: Operate the pump in 8 to 10 gallons of non-phosphate detergent solution (i.e., Alconox) for 5 minutes and flush other equipment with fresh detergent solution for 5 minutes.

3. Rinse: Operate the pump in a basin of potable water for 5 minutes and flush other equipment with potable water for 5 minutes.

4. Disassemble pump.

5. Wash pump parts with a non-phosphate detergent solution (i.e., Alconox). Scrub all pump parts with a test tube brush or similar device.

6. Rinse pump with potable water.

7. Rinse the inlet screen, the shaft, the suction interconnection, the motor lead assembly, and the stator housing with distilled/deionized water.

8. Rinse the impeller assembly with 1% nitric acid (HNO_3).

9. Rinse the impeller assembly with isopropanol.

10. Rinse the impeller assembly with distilled/deionized water.

Between Wells Decontamination Procedure:

1. Pre-rinse: Operate the pump in a basin containing 8 to 10 gallons of potable water for 5 minutes.

2. Wash: Operate the pump in 8 to 10 gallons of non-phosphate detergent solution (i.e., Alconox) for 5 minutes.

3. Rinse: Operate the pump in a basin of potable water for 5 minutes.

4. Final rinse the pump in distilled/deionized water.

ATTACHMENTS

None

REFERENCES

Benchmark FOPs:

032 Management of Investigation-Derived Waste

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FIELD OPERATING PROCEDURES

Sample Labeling, Storage, and Shipment Procedures

FOP 046.0

SAMPLE LABELING, STORAGE & SHIPMENT PROCEDURES

PURPOSE

The collection and analysis of samples of environmental media, including soils, groundwater, surface water, and sediment, are the central activities of the field investigation. These samples must be properly labeled to preserve its identity, and properly stored and shipped in a manner that preserves its integrity and chain of custody. This procedure presents methods for these activities.

SAMPLE LABELING PROCEDURE

1. Assign each sample retained for analysis a unique 9-digit alphanumeric identification code or as indicated in the Project Work Plan. Typically, this code will be formatted as follows:

Sample I.D. Example: GW051402047	
GW	**Sample matrix** GW = groundwater; SW = surface water; SUB = subsurface soil; SS = surface soil; SED = sediment; L = leachate; A = air
05	Month of sample collection
14	Day of sample collection
02	Year of sample collection
047	Consecutive sample number

2. Consecutive sample numbers will indicate the individual sample's sequence in the total set of samples collected during the investigation/sampling event. The sample number above, for example, would indicate the 47th sample retained for analysis during the field investigation, collected on May 14, 2002.

3. Affix a non-removable (when wet) label to each sample container. The following information will be written on the label with black or blue ink that will not smudge when wet:

   - Project number
   - Sample ID (see Step 1 above)
   - Date of sample collection
   - Time of sample collection (military time only)
   - Specify "grab" or "composite" sample with an "X"
   - Sampler initials
   - Preservative(s) (if applicable)
   - Analytes for analysis (if practicable)

4. Record all sample label information in the Project Field Book and on a Sample Summary Collection Log (see attached samples), keyed to the sample identification number. In addition, add information regarding the matrix, sample location, depth, etc. to provide a complete description of the sample.

SAMPLE STORAGE PROCEDURE

1. Immediately after collection, placement in the proper container, and labeling, place samples to be retained for chemical analysis into resealable plastic bags.

2. Place bagged samples into an ice chest filled approximately half-full of double bagged ice. Blue ice is not an acceptable substitute for ice.

3. Maintain samples in an ice chest or in an alternative location (e.g. sample refrigerator) as approved by the Benchmark Field Team Leader until time of shipment. Periodically drain melt-water off coolers and replenish ice as necessary.

4. Ship samples on a daily basis, unless otherwise directed by the Benchmark Field Team Leader.

5. Maintain appropriate custody procedures on coolers and other sample storage containers at all times. These procedures are discussed in detail in the Project Quality Assurance Project Plan, Monitoring Plan or Work Plan.

6. Samples shall be kept in a secure location locked and controlled (i.e., locked building or fenced area) so that only the Project Field Team Leader has access to the location or under the constant visual surveillance of the same.

SAMPLE SHIPPING PROCEDURE

1. Fill out the chain-of-custody form completely (see attached sample) with all relevant information. The white original goes with the samples and should be placed in a resealable plastic bag and taped inside the sample cooler lid; the sampler should retain the copy.

2. Place a layer of inert cushioning material such as bubble pack in the bottom of cooler.

3. Place each bottle in a bubble wrap sleeve or other protective wrap. To the extent practicable, then place each bottle in a resealable plastic bag.

4. Open a garbage bag (or similar) into a cooler and place sample bottles into the garbage bag (or similar) with volatile organic analysis (VOA) vials near the center of the cooler.

5. Pack bottles with ice in plastic bags. At packing completion, cooler should be at least 50 percent ice, by volume. Coolers should be completely filled, so that samples do not move excessively during shipping.

6. Duct tape (or similar) cooler drain closed and wrap cooler completely in two or more locations to secure lid, specifically covering the hinges of the cooler.

7. Place laboratory label address identifying cooler number (i.e., 1 of 4, 2 of 4 etc.) and overnight delivery waybill sleeves on cooler lid or handle sleeve (Federal Express).

8. Sign the custody seal tape with an indelible soft-tip marker and place over the duct tape across the front and back seam between the lid and cooler body.

9. Cover the signed custody seal tape with an additional wrap of transparent strapping tape.

10. Place "Fragile" and "This Side Up" labels on all four sides of the cooler. "This Side Up" labels are yellow labels with a black arrow with the arrowhead pointing toward the cooler lid.

11. For coolers shipped by overnight delivery, retain a copy of the shipping waybill, and attach to the chain-of-custody documentation.

ATTACHMENTS

Soil/Sediment Sample Summary Collection Log (sample)
Groundwater/Surface Water Sample Summary Collection Log (sample)
Wipe Sample Summary Collection Log (sample)
Air Sample Summary Collection Log (sample)
Chain-Of-Custody Form (sample)

REFERENCES

None

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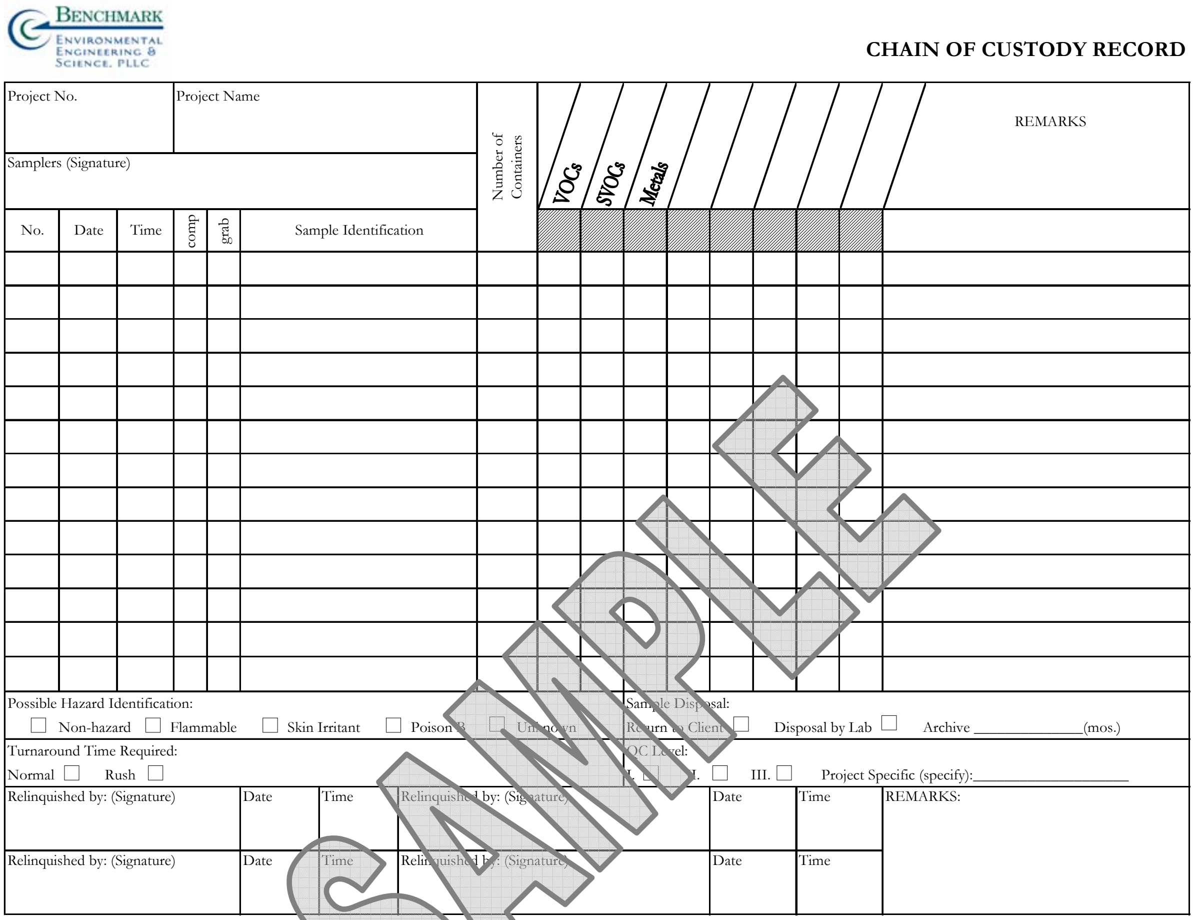
AIR SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:

1. See QAPP for sampling frequency and actual number of QC samples.
2. SC - Summa Canister.
3. TB - Tedlar Bag (quantity).
4. No Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blanks, Field Duplicates, Field Blanks or Rinsates collected for air samples.



CHAIN OF CUSTODY RECORD

Project No.

Project Name

Samplers (Signature)

No.	Date	Time	comp	grab	Sample Identification	Number of Containers	VOCs	SVOCs	Metals						REMARKS

Possible Hazard Identification:

☐ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal:

Return to Client ☐ Disposal by Lab ☐ Archive ____________(mos.)

Turnaround Time Required:

Normal ☐ Rush ☐

QC Level:

I. ☐ II. ☐ III. ☐ Project Specific (specify):__________________

Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	REMARKS:
Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	

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WIPE SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:

1. See QAPP for sampling frequency and actual number of QC samples.
2. CWM - clear, wide-mouth glass jar with Teflon-lined cap.
3. FD - Field Duplicate.
4. FB - Field Blank.
5. RS - Rinsate.
6. No Matrix Spike, Matrix Spike Duplicate or Matrix Spike Blanks for wipe samples.
7. Rinsates should be taken at a rate of 1 per day during wipe sampling. Only take when reusable equipment is used.
8. Wipe sample FB collected by wiping unused glove (and any other sampling equipment coming into contact with sampled surface) with prepared gauze pad and place in sample jar. Take at a rate of 1 FB per 20 samples.
9. Wipe sample FDs taken adjacent to original sample at a rate of 1 FD per 20 samples.
10. **EH :** Extract and Hold

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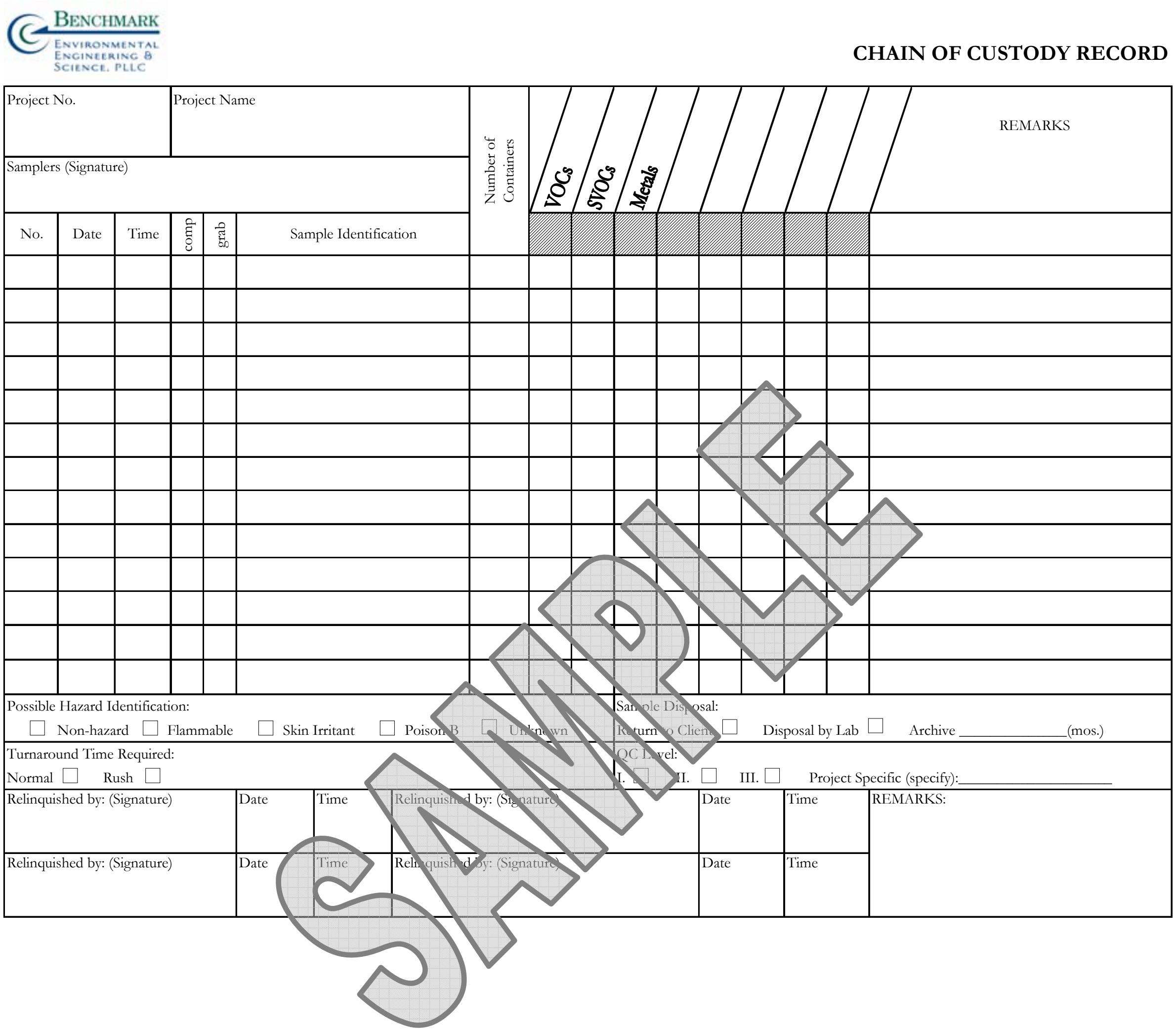
AIR SAMPLE COLLECTION SUMMARY LOG

Field ID	Location	QC Type	Analytical Parameters	Containers	Date	Time	Sampler Initials	Comments (e.g. problems encountered, ref. to variance, location changes, important observations or descriptions, etc.)

Notes:

1. See QAPP for sampling frequency and actual number of QC samples.
2. SC - Summa Canister.
3. TB - Tedlar Bag (quantity).
4. No Matrix Spike, Matrix Spike Duplicate, Matrix Spike Blanks, Field Duplicates, Field Blanks or Rinsates collected for air samples.



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CHAIN OF CUSTODY RECORD

Project No.

Project Name

Samplers (Signature)

No.	Date	Time	comp	grab	Sample Identification	Number of Containers	VOCs	SVOCs	Metals					REMARKS
							▨	▨	▨	▨	▨	▨	▨	

Possible Hazard Identification:
☐ Non-hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal:
Return to Client ☐ Disposal by Lab ☐ Archive ______________(mos.)

Turnaround Time Required:
Normal ☐ Rush ☐

QC Level:
I. ☐ II. ☐ III. ☐ Project Specific (specify):____________________

Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	REMARKS:
Relinquished by: (Signature)	Date	Time	Relinquished by: (Signature)	Date	Time	

SAMPLE

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FIELD OPERATING PROCEDURES

Soil Description Procedures Using The Visual-Manual Method

FOP 054.2

SOIL DESCRIPTION PROCEDURES USING THE VISUAL-MANUAL METHOD

PURPOSE

This guideline presents a means for insuring consistent and proper field identification and description of collected soils during a project (via, split-spoon (barrel) sampler, hand auger, test pit etc.). The lithology and moisture content of each soil sample will be physically characterized by visual-manual observation in accordance with ASTM Method D2488, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). When precise classification of soils for engineering purposes is required, the procedures prescribed in ASTM Method D2487 (Standard Practice for Classification of Soils for Engineering Purposes [Unified Soil Classification System, USCS]) will be used. The method of soil characterization presented herein describes soil types based on grain size, liquid and plastic limits, and moisture content based on visual examination and manual tests. When using this FOP to classify soil, the detail of description provided for a particular material should be dictated by the complexity and objectives of the project. However, more often than not, "after the fact" field information is required later in the project, therefore, every attempt to describe the soil as completely as possibly should be made.

Intensely weathered or decomposed rock that is friable and can be reduced to gravel size or smaller by normal hand pressure should be classified as a soil. The soil classification would be followed by the parent rock name in parenthesis. Projects requiring depth to bedrock determinations should always classify weathered or decomposed bedrock as bedrock (i.e., landfill siting). The project manager should always be consulted prior to making this determination.

PROCEDURE

Assemble necessary equipment and discuss program requirements with drilling contractor.

1. Calibrate air-monitoring equipment in accordance with the appropriate Benchmark's Field Operating Procedures or manufacturers recommendations for calibration of field meters.

2. Collect desired soil sample in accordance with appropriate Benchmark FOP (i.e., split-spoon sampling, hand augering, test pitting etc.).

3. Shave a thin layer off the entire length of the sample to expose fresh sample.

4. Photograph and scan the sample with a photoionization detector (PID) at this time, if applicable, in accordance with Benchmark's Screening of Soil Samples for Organic Vapors During Drilling Activities FOP.

5. Describe the sample using terminology presented in the Descriptive Terms section below.

6. Record all pertinent information in the Project Field Book and Field Borehole Log (sample attached) or Field Borehole/Monitoring Well Installation Log (sample attached).

7. After the sample has been described, place a representative portion of the sample in new, precleaned jars or self-sealing plastic bags for archival purposes (if required). Label the jar or bag with the sample identification number, sample interval, date, project number and store in a secure location.

8. If the soil is to be submitted to a laboratory for analysis, collect the soil sample with a dedicated stainless steel sampling tool, place the sample into the appropriate laboratory-supplied containers, and store in an ice-chilled cooler staged in a secure location in accordance with Benchmark's Sample Labeling, Storage and Shipment Procedures FOP.

9. All remaining soil from soil sample collection activities shall be containerized in accordance with Benchmark's Management of Investigative-Derived Waste (IDW) FOP and/or the Project Work Plan.

DESCRIPTIVE TERMS

All field soil samples will be described using the Unified Soil Classification System (USCS) presented in Figures 1 and 2 (attached). In addition to ASTM Method D2488, Method D1586, Standard Test Method for Penetration Test and Split-Barrel Sampling of Soils (a.k.a., Standard Penetration Test, STP), when implemented, can also be used to classify the resistance of soils. In certain instances, it is desirable to supplement the USCS classification with a geologic interpretation of the soil sample that is supported by the soil descriptive terms presented in this section. The project manager should be consulted when making any geologic interpretation. Field test methods are provided to assist field personnel in classifying soil and are identified by a bold blue **FTM** and shaded. Classification of sampled soils will use the following ASTM descriptive terms and criteria:

- **Group Name** (USCS, see Figure 2)
- **Group Symbol** (USCS, see Figure 2) – only use if physical laboratory testing has been performed to substantiate. The USCS can be applied to most unconsolidated materials, and is represented by a two-letter symbol, except Peat (Pt).
  - The first letter includes: G (gravel), S (sand), M (silt), C (clay), and O (organic).
  - The second letter includes: P (poorly graded or uniform particle sizes), W (well graded or diversified particle sizes), H (high plasticity), and L (low plasticity).
  - Examples:
    - GW = well graded gravels and gravel-sand mixtures, little or no fines
    - GP = poorly graded gravels and gravel-sand mixtures, little or no fines
    - GM = silty gravels, gravel-sand-silt mixtures

    - GC = clayey gravels, gravel-sand-clay mixtures
    - SW = well graded sands and gravelly sands, little or no fines
    - SP = poorly graded sands and gravelly sands, little or no fines
    - SM = silty sand, sand-silt mixtures
    - SC = clayey sand sand-clay mixtures
    - ML = inorganic silts, very fine sands, rock flour, silty or clayey fine sands
    - CL = inorganic clays of low to medium plasticity, gravelly/sandy/silty/lean clays
    - OL = organic silts and organic silty clays of low plasticity
    - MH = inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts (very rare)
    - CH = inorganic clays of high plasticity, fat clays
    - OH = organic clays of medium to high plasticity
    - Pt = peat, muck, and other highly organic soils

- **Angularity** (ASTM D2488; Table 1)
  - Angular – particles have sharp edges and relatively planar sides with unpolished surfaces
  - Subangular – particles are similar to angular description but have rounded edges
  - Subrounded – particles have nearly planar sides but have well-rounded corners and edges
  - Rounded – particles have smoothly curved sides and no edges
- **Particle Shape** (ASTM D2488; Table 2)
  - Flat – particles with width/thickness > 3
  - Elongated – particles with length/width > 3
  - Flat and Elongated – particles meet criteria for both flat and elongated
- **Moisture Condition** (ASTM D2488; Table 3)
  - Dry – absence of moisture, dusty, dry to the touch
  - Moist – damp, but no visible water
  - Wet – visible free water, usually soil is below water table
- **Reaction with Hydrochloric Acid (HCL)** (ASTM D2488; Table 4)
  - None – no visible reaction

  - Weak – some reaction, with bubbles forming slowly
  - Strong – violent reaction, with bubbles forming immediately
- **Consistency of Cohesive Soils** (ASTM D2488; Table 5)
  - Very soft – squeezes between fingers when fist is closed; easily penetrated several inches by fist (SPT = 2 or less)
  - Soft – easily molded by fingers; easily penetrated several inches by thumb (SPT = 2 to 4)
  - Firm – molded by strong pressure of fingers; can be penetrated several inches by thumb with moderate effort (SPT = 4 to 8)
  - Stiff – dented by strong pressure of fingers; readily indented by thumb but can be penetrated only with great effort (SPT = 8 to 15)
  - Very stiff – readily indented by thumbnail (SPT = 15 to 30)
  - Hard – indented with difficultly by thumbnail (SPT >30)
- **Cementation** (ASTM D2488; Table 6)
  - Weak – crumbles or breaks with handling or slight finger pressure
  - Moderate – crumbles or breaks with considerable finger pressure
  - Strong – will not crumble or break with finger pressure
- **Structure (Fabric)** (ASTM D2488; Table 7)
  - Varved – alternating 1 mm to 12 mm (0.04 – 0.5 inch) layers of sand, silt and clay
  - Stratified – alternating layers of varying material or color with the layers less than 6 mm (0.23 inches) thick; note thickness
  - Laminated – alternating layers of varying material or color with the layers less than 6 mm (0.23 inches) thick; note thickness
  - Fissured – contains shears or separations along planes of weakness
  - Slickensided – shear planes appear polished or glossy, sometimes striated

  - Blocky – cohesive soil that can be broken down into small angular lumps which resist further breakdown
  - Lensed – inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
  - Homogeneous or Massive – same color and appearance throughout

- **Inorganic Fine-Grained Soil Characteristics** (ASTM D2488; Table 12)

  Several field tests can be performed to determine the characteristics of fine-grained soils (material passing the No. 40 sieve), such as dry strength, dilatency, and toughness. These field testing methods are described below.

  - **Dry Strength** (ASTM D2488; Table 8)

    FTM (Dry Strength): Select enough material and moisten with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit) into a ball about 1 inch in diameter. From this ball, form three balls about ½ inch in diameter and allow to dry in air, or sun, or by artificial means (temperature not to exceed 60° C (140° F). Soil containing natural dry lumps about ½ inch in diameter may be used in place of molded balls, however the dry strengths are usually lower. Test the strength by crushing the dry balls or lumps between your fingers using the descriptions below.

    - None – the dry specimen crumbles with the slightest pressure of handling
    - Low – the dry specimen crumbles with some finger pressure
    - Medium – the dry specimen breaks into pieces or crumbles with considerable finger pressure
    - High – the dry specimen cannot be broken with finger pressure. The specimen will break into pieces between the thumb and a hard surface.
    - Very High – the dry specimen cannot be broken between the thumb and a hard surface

  - **Dilatency** (ASTM D2488; Table 9)

    FTM (Dilatency): Place enough material in your hand to form a ball approximately ½ inch in diameter and moisten with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit). Smooth the ball in the palm of one hand with the blade of a knife or small spatula. Shake horizontally, striking the side of the hand vigorously against the other several times. Note the reaction of water appearing on the surface of the soil. The soil is said to have given a reaction to this test if, when it is shaken, water comes to the surface of the sample producing a smooth, shiny appearance. Squeeze the sample between the thumb and forefinger and note the reaction as follows:

- None – no visible change in the specimen
- Slow – water slowly appears on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
- Rapid – water quickly appears on the surface of the specimen during shaking and disappears upon squeezing

- **Toughness** (ASTM D2488; Table 10)

  FTM (Toughness): Following the dilatency test above, shape the test specimen into an elongated pat and roll by hand on a smooth surface or between palms into a thread about 1/8 inch in diameter. Fold the sample threads and re-roll repeatedly until the thread crumbles at a diameter of about 1/8 inch (e.g., near the plastic limit). Note the pressure required to roll the thread near the plastic limit as well as the strength of the thread. After the thread crumbles, lump the pieces together and knead the lump until it crumbles. Describe the toughness as follows:

  - Low – only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and very soft.
  - Medium – medium pressure is required to roll the thread to near the plastic limit. The thread and the lump are soft.
  - High – considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump are firm.

Using the results of the dry strength, dilatency, and toughness test described above, classify the soil according to the following:

Soil Symbol	Dry Strength	Dilatency	Toughness
Silt (ML)	None to low	Slow to rapid	Low or thread cannot be formed
Lean clay (CL)	Medium to high	None to slow	Medium
Elastic Silt (MH)	Low to medium	None to slow	Low to medium
Fat Clay (CH)	High to very high	None	Low to medium high

- **Plasticity** (ASTM D2488; Table 11)

  Two field test methods can be used to determine plasticity of fine-grained soils (material passing the No. 40 sieve): the roll or thread test and the ribbon test. Each test is described below.

  FTM (Roll or Thread Test): As with the toughness test above, mix a representative portion of the soil sample with water until it can be molded or shaped without sticking to your fingers (slightly below the sticky limit). Place an elongated cylindrical sample on a nonabsorbent rolling surface (e.g., glass or was paper on a flat surface) and attempt to roll it into a thread approximately 1/8 inch in diameter. The results of this test are defined below (non-plastic to high plasticity).

  FTM (Ribbon Test): Form a roll from a handful of moist soil (slightly below the sticky limit) about ½ to ¾ inches in diameter and about 3 to 5 inches long. Place the material in the palm of your hand and, starting at one end, flatten the roll between your thumb and forefinger to form the longest and thinnest ribbon possible that can be supported by the cohesive properties of the material before breaking. If the soil sample holds together for a length of 6 to 10 inches without breaking, the material is considered to be both highly plastic and highly compressive (Fat Clay, CH). If the soil cannot be ribboned, it is non-plastic (Silt, ML or MH). If it can be ribboned only with difficulty into short lengths, it has low plasticity (Lean Clay, CL). Use the following terms to describe the plasticity of soil:

  - Nonplastic (ML or MH) – a 3 mm (0.12 inches) thread cannot be rolled at any water content
  - Low Plasticity (CL, ML, or MH) – the thread can barely be rolled, and crumbles easily
  - Medium Plasticity (CL) – the thread is easy to roll and not much time is required to reach the plastic limit before crumbling
  - High Plasticity (CH) – it takes considerable time rolling and kneading to reach the plastic limit; the thread can be rolled several times before crumbling

Note: A soil with as little as 20% clay will behave as a clayey soil. A soil needs 45% to over 60% medium to coarse sand to behave as a sandy soil. In a soil with 20% clay and 80% sand, the soil will behave as a clayey soil.

- **Relative Density of Cohesionless (Granular) Soils**
  - Very loose – easily penetrated 30 cm (1.2 inches) with 13 mm (0.5 inch) rebar pushed by hand (SPT = 0 to 4)
  - Loose – easily penetrated several cm with 13 mm (0.5 inch) rebar pushed by hand (SPT = 4 to 10)
  - Medium dense – easily to moderately penetrated with 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = 10 to 30)
  - Dense – penetrated 0.3 m (1 foot) with difficulty using 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = 30 to 50)
  - Very dense – penetrated only a few cm with 13 mm (0.5 inch) rebar driven by 2.3 kg (6 pound) hammer (SPT = >50)
- **Color** (use Munsel® Color System, as necessary)
- **Particle Size** (see Figure 3)
  - Boulder – larger than a basketball
  - Cobble – grapefruit, orange, volleyball
  - Coarse Gravel – tennis ball, grape

  - Fine Gravel – pea
  - Coarse Sand – rock salt
  - Medium Sand – opening in window screen
  - Fine Sand – sugar, table salt
  - Fines (silt and clay) – cannot visually determine size (unaided)
- **Gradation**
  - Well Graded (GW, SW) – full range and even distribution of grain sizes present
  - Poorly-graded (GP, SP) – narrow range of grain sizes present
  - Uniformly-graded (GP, SP) – consists predominantly of one grain size
  - Gap-graded (GP-SP) – within the range of grain sizes present, one or more sizes are missing
- **Organic Material** – Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, black to brown, when exposed to the air. Some organic soils will lighten in color significantly when air-dried. Organic soils normally will not have a high toughness or plasticity. The thread of the toughness test will be spongy.
  - PEAT – 50 to 100 percent organics by volume, primary constituent
  - Organic (soil name) – 15 to 50 percent organics by volume, secondary organic constituent
  - (Soil name) with some organics – 5 to 15 percent organics by volume, additional organic constituents
- **Fill Materials** – All soils should be examined to see if they contain materials indicative of man-made fills. Man-made fill items should be listed in each of the soil descriptions. Common fill indicators include glass, brick, dimensioned lumber, concrete, pavement sections, asphalt, metal, plastics, plaster etc. Other items that could suggest fill include buried vegetation mats, tree limbs, stumps etc. The soil description for a fill material should be followed by the term “FILL”, i.e., for a sandy silt with some brick fragments the description would be “SANDY

SILT (ML), with brick fragments (Fill)". The size and distribution of fill indicators should be noted. The limits (depth range) of fill material should be determined and identified at each exploration location.

- **Other Constituents/Characteristics**
    - Additional constituents and/or pertinent soil characteristics not included in the previous categories should be described depending on the scope and objectives of the project. Observations that may be discussed include:
        - Oxide staining
        - Odor
        - Origin
        - Presence of root cast
        - Presence of mica
        - Presence of gypsum
        - Presence of calcium carbonate
        - Percent by volume of cobbles & boulders with size description and appropriate rock classification
    - Other pertinent information from the exploratory program should be recorded, if it would be useful from a biddability/constructability perspective. The conditions that should be listed include caving or sloughing, difficulty in drilling and groundwater infiltration.

SOIL DESCRIPTIONS

Generally, soil descriptions collected during most investigations are not intended for civil engineering (construction) purposes, but rather for hydrogeologic and contaminant transport purposes. As such, the ASTM visual-manual assessments are somewhat limited in that they are only performed in order to indicate important information about potential hydraulic properties of a soil. Soil descriptions should be concise, stressing major constituents and characteristics, and should be given in a consistent order and format. The following order is recommended:

- Soil name. The basic name of the predominant grain size and a single-word modifier indicating the major subordinate grain size (i.e., mostly clay with some silt). The feel test can be used to determine the texture of the soil by rubbing some moist soil between your fingers; sand feels gritty, silt feels smooth, and clays feel sticky. The terms representing percentages of grain size to be used include:
    - Trace – particles are present, but estimated to be less than 5%
    - Few – 5 to 10%
    - Little – 15 to 25%
    - Some – 30 to 45%
    - Mostly – 50 to 100%
- Color (using Munsell® charts, as necessary). Color is an important property in identifying organic soils, and within a given locality it may also be useful in identifying materials of similar geologic origin. It the sample contains layers or patches of varying colors (e.g., mottled), this shall be noted and all representative colors shall be described. The color shall be described for moist samples, however if the color represents a dry condition, it must be stated as such in the log. Generally, colors become darker as the moisture content increases and lighter as the soil dries. Examples include:
    - Some fine-grained soils (OL, OH) with dark drab shades of brown or gray, including almost black, contain organic colloidal matter.
    - In contrast, clean, bright looking shades of gray, olive green, brown, red, yellow, and white are associated with inorganic soils.
    - Gray-blue or gray- and yellow-mottled colors frequently result from poor drainage.
    - Red, yellow, and yellowish brown result from the presence of iron oxides.

  - White to pink may indicate considerable silica, calcium carbonate, or aluminum compounds.

- Field moisture condition as dry, moist, or wet;
- Gradation or Plasticity. Granular soils (i.e., sands or gravels) should be described as well-graded, poorly graded, uniform, or gap-graded, depending on the gradation of the minus 3-inch fraction. Cohesive soils (i.e., silts and clays) should be described as non-plastic, low, medium, or high, depending on the results of the manual evaluation for dry strength, dilatency, toughness, and plasticity discussed previously.
- Consistency/Density. An estimate of consistency of a cohesive soil or density of a granular soil, usually based on the SPT results (see Descriptive Terms section of this FOP);
- Soil Structure or Mineralogy. Description of discontinuities, inclusions, and structures, including joints, fissures, and slickensides.
- Odor. Describe the odor if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation. This is especially apparent in fresh samples, but if the samples are dried, the odor may often be revived by heating a moistened sample. If the odor is unusual (petroleum, chemical, etc.), it should be noted in the log.
- Other important geologic information such as consolidation, gravel size and shape, visible internal structure, root holes, mica, odors, etc.

The first step when describing soil is to determine if the sample is predominantly fine-grained or coarse-grained (see Figures 3 and 4). Coarse-grained soils are relatively easy to identify, however descriptions of fine-grained soils can be more difficult, requiring additional field tests to assist the field geologist arrive at the proper soils classification (see **FTMs** under Descriptive Terms above). These tests are explained in detail in the ASTM Standard D2488 and briefly herein. Generally, the differentiation between silt and clay is based on plasticity and “texture”. However, tests for dry strength and dilatency, along with plasticity, can be very helpful and are recommended in the ASTM Standard. If additional tests are performed, in addition to plasticity, to classify the fines, record them with the soil description on the logs. Doing this will assist the reader (i.e., Project Manager) to follow the logic used to describe a soil (e.g., medium plasticity, low dry strength = elastic silt [MH]; not a lean clay [CL]).

Fines described in the classification should be modified by their plasticity (e.g., non-plastic fines, low plasticity fines, etc.) reserving the words "silt" and "clay" for the soil name.

In summary, adhering to the ASTM Standard and the guidelines outlined in this FOP will provide uniformity in soil descriptions provided by all field personnel. Prior to mobilization to the field, field staff should make sure to have laminated copies of the ASTM Standard flow charts and tables as well as this FOP (as necessary). Some examples of complete soil descriptions are as follows:

Coarse-grained Soil

POORLY GRADED FINE SAND w/ SILT: Dark grey, wet, mostly fine sand with some non-plastic fines, some iron-stained mottling, laminated, medium dense

Fine-grained Soil

LEAN CLAY: Dark reddish/brown, moist, mostly fines, medium plasticity, firm, no dilatency, medium dry strength, root holes.

Soil/Fill (option 1) – visual evidence of fill

FILL: Black, moist, mostly fines with some fine sand, slag, cinders, metal, brick, non-plastic, loose when disturbed, strong odor

Soil/Fill (option 2) – no visual evidence of fill, suspected reworked material

FILL (reworked): Black, moist, mostly fines with some fine sand and few coarse angular gravel, non-plastic, hard, loose when disturbed, mild odor

BORING AND MONITORING WELL INSTALLATION LOGS

Currently, Benchmark utilizes WinLoG software to construct subsurface logs and a template of the log is included in this FOP as an example. One of the most important functions of a boring/monitoring well installation log, besides transmitting the soil description, is to indicate where the "data" (soil samples) were collected, giving the reader an idea of how reliable or representative the description is. On each sample log, depths of attempted and recovered or non-recovered interval are shown. Odor, if noted, should be considered subjective and not necessarily indicative of specific compounds or concentrations.

Remember: all field logs should be NEAT, ACCURATE, and LEGIBLE. Don't forget that the well completion diagram completed for each well requires details of the surface completion (i.e., flush-mount, stick-up etc.). It is the responsibility of the field staff to double-check each log (i.e., soil names, classifications, well construction details etc.) prior to implementing into a final report. A registered professional (i.e., professional engineer, PE or professional geologist, PG) must review each log and will be ultimately responsible for its content and accuracy.

REQUIRED EQUIPMENT

- Knife
- Engineer's rule/measuring tape

- Permanent marker
- Pre-cleaned wide-mouth sample jars (typically provided by the driller)
- Pre-cleaned wide-mouth laboratory sample jars (provided by the laboratory)
- Stainless steel sampling equipment (i.e., spoons, spatulas, bowls etc.)
- 10x hand lens
- Hydrochloric acid
- ASTM D2488 flow charts (preferably laminated)
- ASTM D2488 test procedures (Tables 1 through 12) (preferably laminated)
- Camera (disposable, 35 mm or digital)
- Munsell soil color chart (as necessary)
- Project Field Book/field forms

ATTACHMENTS

Figure 1; Field Guide for Soil and Stratigraphic Analysis
Figure 2; USCS Soil Classification Flow Chart (modified from ASTM D2488)
Figure 3; Illustration of Particle Sizes
Figure 4; Grain-Size Scale (Modified Wentworth Scale)

Field Borehole Log (sample)

REFERENCES

American Society for Testing and Materials, 2008a. *ASTM D1586: Standard Test Method for Standard Penetration Test (SPT) and Split-Barrel Sampling of Soils.*

American Society for Testing and Materials, 2010. *ASTM D2487: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).*

American Society for Testing and Materials, 2009a. *ASTM D2488: Standard Practice for Description and Identification of Soils (Visual-Manual Procedure).*

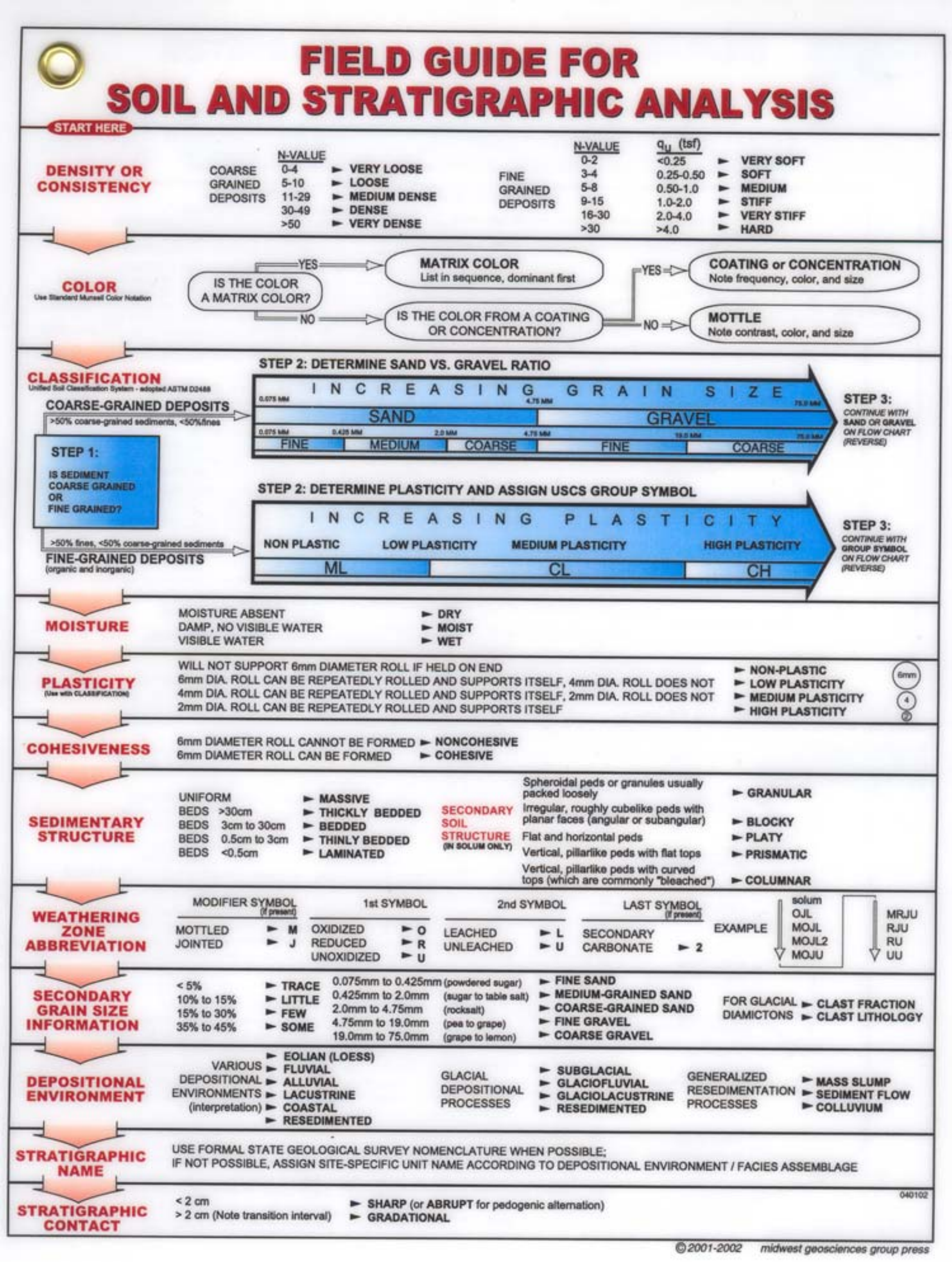
State of California, Department of Transportation, Engineering Service Center, Office of Structural Foundations, August 1996. *Soil & Rock Logging Classification Manual (Field Guide), by Joseph C. de Larios.*

Benchmark FOPs:

010	*Calibration and Maintenance of Portable Flame Ionization Detector*
011	*Calibration and Maintenance of Portable Photoionization Detector*
015	*Documentation Requirements for Drilling and Well Installation*
025	*Hand Augering Procedures*
032	*Management of Investigation-Derived Waste*
046	*Sample Labeling, Storage and Shipment Procedures*
047	*Screening of Soil Samples for Organic Vapors During Drilling Activities*
058	*Split-Spoon Sampling Procedures*
065	*Test Pit Excavation and Logging Procedures*

FIGURE 1

FIELD GUIDE FOR SOIL AND STRATIGRAPHIC ANALYSIS



FIELD GUIDE FOR SOIL AND STRATIGRAPHIC ANALYSIS

START HERE

DENSITY OR CONSISTENCY

COARSE GRAINED DEPOSITS N-VALUE		FINE GRAINED DEPOSITS N-VALUE	q_u (tsf)	
0-4	► VERY LOOSE	0-2	<0.25	► VERY SOFT
5-10	► LOOSE	3-4	0.25-0.50	► SOFT
11-29	► MEDIUM DENSE	5-8	0.50-1.0	► MEDIUM
30-49	► DENSE	9-15	1.0-2.0	► STIFF
>50	► VERY DENSE	16-30	2.0-4.0	► VERY STIFF
		>30	>4.0	► HARD

COLOR
Use Standard Munsell Color Notation

IS THE COLOR A MATRIX COLOR?
YES ▷ MATRIX COLOR — List in sequence, dominant first
NO ▷ IS THE COLOR FROM A COATING OR CONCENTRATION?
YES ▷ COATING or CONCENTRATION — Note frequency, color, and size
NO ▷ MOTTLE — Note contrast, color, and size

CLASSIFICATION
Unified Soil Classification System - adopted ASTM D2488

STEP 1: IS SEDIMENT COARSE GRAINED OR FINE GRAINED?

COARSE-GRAINED DEPOSITS
>50% coarse-grained sediments, <50%fines

STEP 2: DETERMINE SAND VS. GRAVEL RATIO

STEP 3: CONTINUE WITH SAND OR GRAVEL ON FLOW CHART (REVERSE)

FINE-GRAINED DEPOSITS (organic and inorganic)
>50% fines, <50% coarse-grained sediments

STEP 2: DETERMINE PLASTICITY AND ASSIGN USCS GROUP SYMBOL

STEP 3: CONTINUE WITH GROUP SYMBOL ON FLOW CHART (REVERSE)

MOISTURE

MOISTURE ABSENT ► DRY
DAMP, NO VISIBLE WATER ► MOIST
VISIBLE WATER ► WET

PLASTICITY
(Use with CLASSIFICATION)

WILL NOT SUPPORT 6mm DIAMETER ROLL IF HELD ON END ► NON-PLASTIC
6mm DIA. ROLL CAN BE REPEATEDLY ROLLED AND SUPPORTS ITSELF, 4mm DIA. ROLL DOES NOT ► LOW PLASTICITY
4mm DIA. ROLL CAN BE REPEATEDLY ROLLED AND SUPPORTS ITSELF, 2mm DIA. ROLL DOES NOT ► MEDIUM PLASTICITY
2mm DIA. ROLL CAN BE REPEATEDLY ROLLED AND SUPPORTS ITSELF ► HIGH PLASTICITY

COHESIVENESS

6mm DIAMETER ROLL CANNOT BE FORMED ► NONCOHESIVE
6mm DIAMETER ROLL CAN BE FORMED ► COHESIVE

SEDIMENTARY STRUCTURE

UNIFORM ► MASSIVE
BEDS >30cm ► THICKLY BEDDED
BEDS 3cm to 30cm ► BEDDED
BEDS 0.5cm to 3cm ► THINLY BEDDED
BEDS <0.5cm ► LAMINATED

SECONDARY SOIL STRUCTURE (IN SOLUM ONLY)

Spheroidal peds or granules usually packed loosely ► GRANULAR
Irregular, roughly cubelike peds with planar faces (angular or subangular) ► BLOCKY
Flat and horizontal peds ► PLATY
Vertical, pillarlike peds with flat tops ► PRISMATIC
Vertical, pillarlike peds with curved tops (which are commonly "bleached") ► COLUMNAR

WEATHERING ZONE ABBREVIATION

MODIFIER SYMBOL (if present)		1st SYMBOL		2nd SYMBOL		LAST SYMBOL (if present)	
MOTTLED	► M	OXIDIZED	► O	LEACHED	► L	SECONDARY CARBONATE	► 2
JOINTED	► J	REDUCED	► R	UNLEACHED	► U		
		UNOXIDIZED	► U				

EXAMPLE

solum	
OJL	MRJU
MOJL	RJU
MOJL2	RU
MOJU	UU

SECONDARY GRAIN SIZE INFORMATION

< 5% ► TRACE
10% to 15% ► LITTLE
15% to 30% ► FEW
35% to 45% ► SOME

0.075mm to 0.425mm (powdered sugar) ► FINE SAND
0.425mm to 2.0mm (sugar to table salt) ► MEDIUM-GRAINED SAND
2.0mm to 4.75mm (rocksalt) ► COARSE-GRAINED SAND
4.75mm to 19.0mm (pea to grape) ► FINE GRAVEL
19.0mm to 75.0mm (grape to lemon) ► COARSE GRAVEL

FOR GLACIAL DIAMICTONS ► CLAST FRACTION
► CLAST LITHOLOGY

DEPOSITIONAL ENVIRONMENT

VARIOUS DEPOSITIONAL ENVIRONMENTS (interpretation)
► EOLIAN (LOESS)
► FLUVIAL
► ALLUVIAL
► LACUSTRINE
► COASTAL
► RESEDIMENTED

GLACIAL DEPOSITIONAL PROCESSES
► SUBGLACIAL
► GLACIOFLUVIAL
► GLACIOLACUSTRINE
► RESEDIMENTED

GENERALIZED RESEDIMENTATION PROCESSES
► MASS SLUMP
► SEDIMENT FLOW
► COLLUVIUM

STRATIGRAPHIC NAME

USE FORMAL STATE GEOLOGICAL SURVEY NOMENCLATURE WHEN POSSIBLE;
IF NOT POSSIBLE, ASSIGN SITE-SPECIFIC UNIT NAME ACCORDING TO DEPOSITIONAL ENVIRONMENT / FACIES ASSEMBLAGE

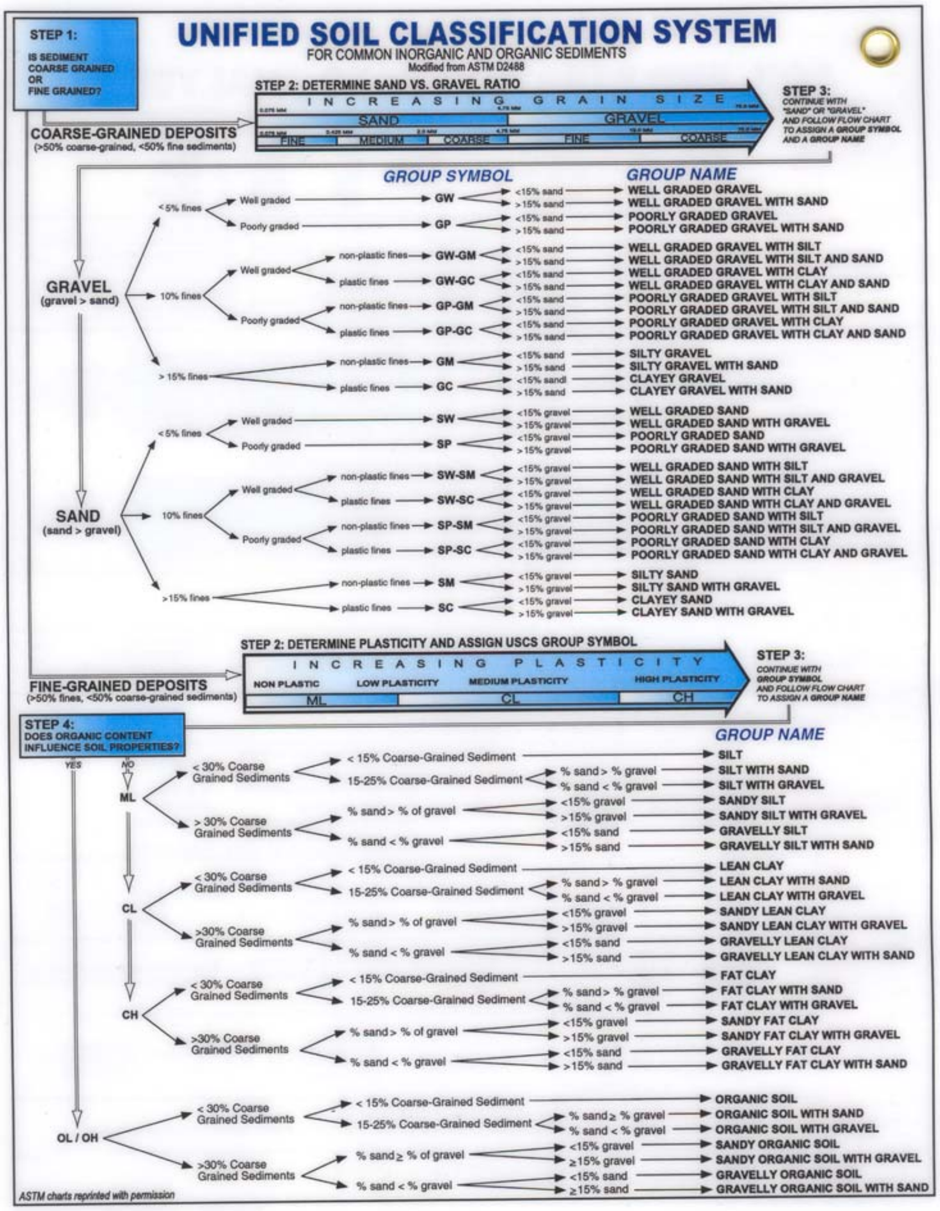
STRATIGRAPHIC CONTACT

< 2 cm ► SHARP (or ABRUPT for pedogenic alternation)
> 2 cm (Note transition interval) ► GRADATIONAL

040102

FIGURE 2

USCS SOIL CLASSIFICATION FLOW CHART
(MODIFIED FROM ASTM D2488)



ASTM charts reprinted with permission

FIGURE 3

ILLUSTRATION OF PARTICLE SIZES

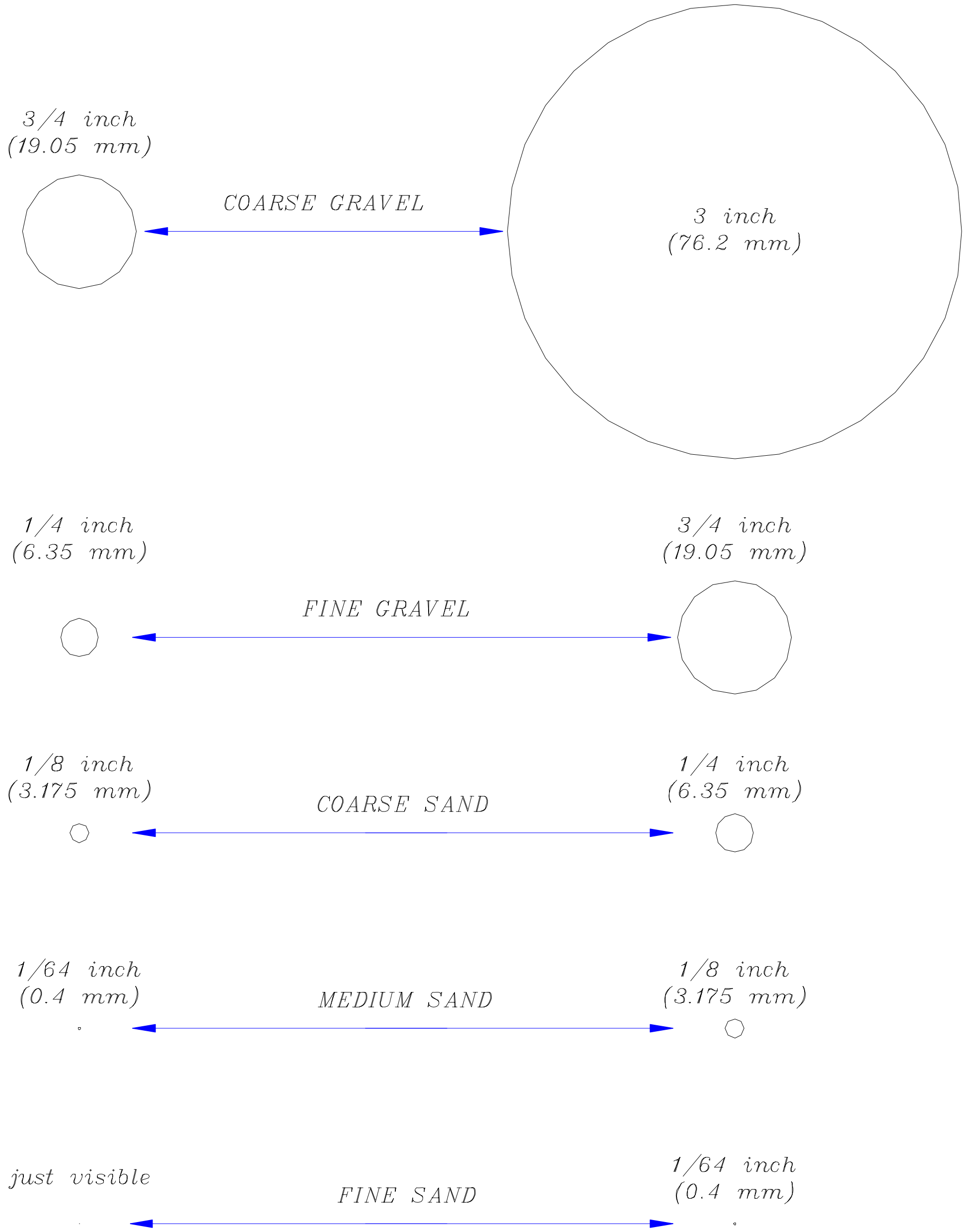


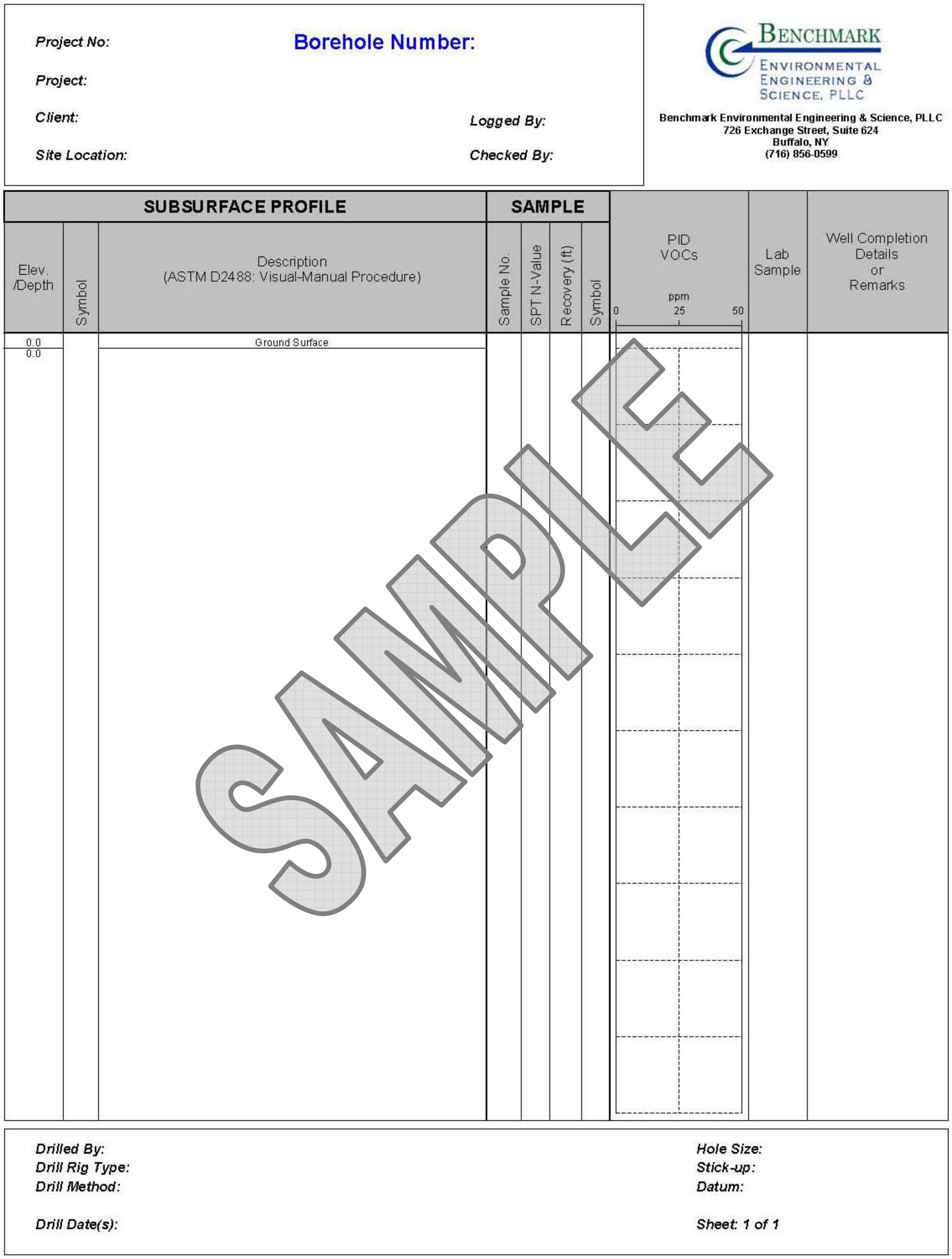
FIGURE 4

GRAIN-SIZE SCALE (MODIFIED WENTWORTH SCALE)

Grain size refers to the physical dimensions of particles of rock or other solid. This is different from the crystallite size, which is the size of a single crystal inside the solid (a grain can be made of several single crystals). Grain sizes can range from very small colloidal particles, through clay, silt, sand, and gravel, to boulders. Size ranges define limits of classes that are given names in the Wentworth scale used in the United States. The Krumbein *phi* (φ) scale, a modification of the Wentworth scale created by W. C. Krumbein, is a logarithmic scale computed by the equation: $\varphi = -\log_2(\text{grain size in mm})$.

φ scale	Size range (metric)	Size range (approx. inches)	Aggregate name (Wentworth Class)
< −8	> 256 mm	> 10.1 in	Boulder
−6 to −8	64–256 mm	2.5–10.1 in	Cobble
−5 to −6	32–64 mm	1.26–2.5 in	Very coarse gravel
−4 to −5	16–32 mm	0.63–1.26 in	Coarse gravel
−3 to −4	8–16 mm	0.31–0.63 in	Medium gravel
−2 to −3	4–8 mm	0.157–0.31 in	Fine gravel
−1 to −2	2–4 mm	0.079–0.157 in	Very fine gravel
0 to −1	1–2 mm	0.039–0.079 in	Very coarse sand
1 to 0	½–1 mm	0.020–0.039 in	Coarse sand
2 to 1	¼–½ mm	0.010–0.020 in	Medium sand
3 to 2	125–250 µm	0.0049–0.010 in	Fine sand
4 to 3	62.5–125 µm	0.0025–0.0049 in	Very fine sand
8 to 4	3.90625–62.5 µm	0.00015–0.0025 in	Silt
> 8	< 3.90625 µm	< 0.00015 in	Clay
<10	< 1 µm	< 0.000039 in	Colloid

In some schemes "gravel" is anything larger than sand (>2.0 mm), and includes "granule", "pebble", "cobble", and "boulder" in the above table. In this scheme, "pebble" covers the size range 4 to 64 mm (−2 to −6 φ).



Project No: **Borehole Number:**

Project:

Client: **Logged By:**

Site Location: **Checked By:**

Benchmark Environmental Engineering & Science, PLLC
726 Exchange Street, Suite 624
Buffalo, NY
(716) 856-0599

SUBSURFACE PROFILE			SAMPLE				PID VOCs	Lab Sample	Well Completion Details or Remarks
Elev. /Depth	Symbol	Description (ASTM D2488: Visual-Manual Procedure)	Sample No.	SPT N-Value	Recovery (ft)	Symbol	ppm 0 25 50		
0.0 0.0		Ground Surface							

Drilled By:
Drill Rig Type:
Drill Method:

Drill Date(s):

Hole Size:
Stick-up:
Datum:

Sheet: 1 of 1

BENCHMARK
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FIELD OPERATING PROCEDURES

Well/Piezometer Construction Materials and Design

FOP 070.0

WELL/PIEZOMETER CONSTRUCTION MATERIALS AND DESIGN

PURPOSE

This guideline presents construction materials and design requirements for monitoring well/piezometer installations in accordance with NYSDEC recommended specifications (6NYCRR Part 360).

CONSTRUCTION MATERIALS

1. Well Screen and Riser – Only new flush threaded screen and riser materials will be used. Screen and riser materials, well dimensions, screen slot opening size and length to be determined based on formation characteristics and suspect water quality or as specified by the project geologist/hydrogeologist. A vented cap or J-plug should be placed over the riser. A V-slot cut in the riser or permanent marking, both placed on the north side of the riser, will act as a monitoring reference point.

2. Bentonite Well Seal – The bentonite should be from a commercial source free of chemical additives (granular or powdered for grout and pelletized for seal).

3. Concrete – Low heat of hydration concrete should be used for grout and cementing protective casing if well construction materials are composed of PVC (ASTM Type II or Type IV Portland Cement).

4. Water – Water should be from a potable source of known chemistry and free of chemical constituents which may compromise integrity of installation.

5. Grout – Mixture of bentonite, cement and water in accordance with the following specifications. Premix bentonite and water prior to adding cement.

   Grout Slurry Composition (% Weight)

1.5 to 3.0%	-	Bentonite (Quick Gel)
40 to 60 %	-	Cement (Portland Type I)
40 to 60 %	-	Potable Water

6. Filter Pack – The filter pack should consist of clean, inert, siliceous, rounded to subrounded particles. Filter pack particle size is dependent on the formation and the slot size of the screen.

   A secondary filter about 6-inches thick may be placed between filter pack and the bentonite seal and potentially between the bentonite seal and the grout backfill, to minimize grout penetration of the seal. A uniformly graded fine sand (100% passing No. 30 sieve) should be used as a secondary filter.

7. Protective Casing, Locking Cap and Lock – Protective casing with a lockable cap should be cemented in place around the riser. The inside diameter of the protective casing should be a minimum of 2-inches larger than the outside diameter of the well riser. The annular space between the casing and the riser should be filled with pea gravel or coarse sand. A weep hole should be drilled near the base of the casing to facilitate drainage of standing water. If more than one well is installed, all locks should be keyed alike.

8. A sample of all cement, bentonite and sand used in well construction should be saved in a labeled, Teflon-sealed, precleaned glass jar.

REFERENCES

New York State Department of Environmental Conservation, July 1988, *Drilling and Monitoring Well Installation Guidance Manual.*

Driscoll, F.G., 1987, *Groundwater and Wells*, Johnson Division, St. Paul, Minnesota, p. 1089.

Sara, M. N., *Proposed Recommended Practice for Design and Installation of Ground Water Monitoring Wells in Aquifers: ASTM Subcommittee D18.21.*

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FIELD OPERATING PROCEDURES

Real-Time Air Monitoring During Intrusive Activities

FOP 073.2

REAL-TIME AIR MONITORING DURING INTRUSIVE ACTIVITIES PROCEDURE

PURPOSE

This guideline presents requirements for real-time community air monitoring and required responses during all project required intrusive activities, such as drilling, test pitting, earthwork construction etc. This procedure is consistent with the requirements for community air monitoring for all intrusive projects, including projects conducted at remediation sites, as established by the New York State Department of Health (NYSDOH) and the New York State Department of Environmental Conservation (NYSDEC). Accordingly, it follows procedures and practices outlined under NYSDEC's DER-10 (May 2010) Appendix 1A (NYSDOH's Generic Community Air Monitoring Plan) and Appendix 1B (Fugitive Dust and Particulate Monitoring).

This FOP requires real-time monitoring for constituents of concern (COC) (i.e., volatile organic compounds (VOCs), lower explosive limit (% LEL), particulates (i.e., dust) etc.) at the upwind and downwind perimeter as well as the exclusion zone of a project site during all intrusive activities. This FOP is not intended for use in establishing action levels for worker respiratory protection (see Project Health and Safety Plan (HASP) for worker protection action levels). Rather, its intent is to provide a measure of protection for the surrounding community from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The community, as referenced in this document, includes any off-site residences, public buildings/grounds and commercial or industrial establishments adjacent to the project site. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, this FOP helps to confirm that work activities did not spread contamination off-site through via air transport mechanisms. Community air monitoring shall be integrated with the construction worker personal exposure-monitoring program contained in the project and site-specific HASP.

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for volatile organic compounds (VOCs) and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate NYSDEC/NYSDOH staff.

MONITORING & MITIGATION PROCEDURE

Real-time air monitoring perimeter locations for monitoring stations will be established based on the location of the exclusion zone (i.e., immediate work area) and wind direction. Where wind direction is shifting or winds are calm, the downwind monitoring location will default to the perimeter location nearest the most sensitive receptor (i.e., residential property). All downwind receptors being equal, the downwind monitoring location will default to the perimeter location downwind of the prevailing winds at the site. Although additional site specific COCs may be monitored during real-time air monitoring activities, the most common COCs are discussed in this FOP, including organic vapors (i.e., VOCs), airborne particulates (i.e., fugitive dust) and combustible gases (i.e., methane) and oxygen.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be required during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. "Periodic" monitoring during sample collection might reasonably consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. In some instances, depending upon the proximity of potentially exposed individuals, continuous monitoring may be required during sampling activities. Examples of such situations include groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence

ORGANIC VAPORS

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

- All 15-minute readings must be recorded and be available for State (DEC and DOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

o **<u>Special Requirements for Work Within 20 Feet of Potentially Exposed Individuals or Structures</u>**

  - When work areas are within 20 feet of potentially exposed populations or occupied structures, the continuous monitoring locations for VOCs and particulates must reflect the nearest potentially exposed individuals and the location of ventilation system intakes for nearby structures. The use of engineering controls such as vapor/dust barriers, temporary negative-pressure enclosures, or special ventilation devices should be considered to prevent exposures related to the work activities and to control dust and odors. Consideration should be given to implementing the planned activities when potentially exposed populations are at a minimum, such as during weekends or evening hours in non-residential settings.

- If total VOC concentrations opposite the walls of occupied structures or next to intake vents exceed 1 ppm, monitoring should occur within the occupied structure (s). Background readings in the occupied spaces must be taken prior to commencement of the planned work. Any unusual background readings should be discussed with NYSDOH prior to commencement of the work.

- If total particulate concentrations opposite the walls of occupied structures or next to intake vents exceed 150 mcg/m3, work activities should be suspended until controls are implemented and are successful in reducing the total particulate concentration to 150 mcg/m3 or less at the monitoring point.

- Depending upon the nature of contamination and remedial activities, other parameters (e.g., explosivity, oxygen, hydrogen SUlfide, carbon monoxide) may also need to be monitored Response levels and actions should be pre-determined, as necessary, for each site.

Additionally, if following the cessation of work and efforts to abate the emission source are unsuccessful, and if sustained organic vapor levels exceed 25 ppm above background within the 20-foot zone for more than 30 minutes, then the **Major Vapor Emission Response Plan** (see below) will automatically be placed into effect.

Major Vapor Emission Response Plan

Upon activation of Major Vapor Emission Response Plan, the following activities will be undertaken:

1. All Emergency Response Contacts as listed below and in the Site-Specific Health and Safety Plan will be contacted.

2. The local police authorities will immediately be contacted by the Site Safety and Health Officer and advised of the situation.

3. The Site Safety and Health Officer will determine if site workers can safely undertake source abatement measures. Abatement measures may include covering the source area with clean fill or plastic sheeting, or consolidating contaminated materials to minimize surface area. The Site Safety and Health Officer will adjust worker personal protective equipment as necessary to protect workers from over-exposure to organic vapors.

The following personnel are to be notified by the Site Safety and Health Officer in the listed sequence if the Major Vapor Emission Response Plan is activated:

Contact	**Phone**
Police/Fire Department	911
New York State DOH	(518) 402-7860
New York State DEC Region 8	(585) 226-2466, switchboard

New York State DEC Region 9	(716) 851-7220
State Emergency Response Hotline	(800) 457-7362

In addition, the Site Safety and Health Officer will provide these authorities with a description of the apparent source of the contamination and abatement measures being taken by the contractor, if any.

AIRBORNE PARTICULATES

Fugitive dust suppression and airborne particulate monitoring shall be performed during any intrusive activities involving disturbance or handling of site soil/fill materials. Fugitive dust suppression techniques will include the following minimum measures:

- Spraying potable water on all excessively dry work areas and roads.
- All fill materials leaving the site will be hauled in properly covered containers or haul trailers.
- Additional dust suppression efforts may be required as discussed below.

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (μg/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 μg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 μg/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 μg/m^3 of the upwind level and in preventing visible dust migration.

- All readings must be recorded and be available for State (DEC and DOH) personnel to review.

Visual Assessment

In conjunction with the real-time monitoring program, TurnKey personnel and any subcontractors thereof will be responsible for visually assessing fugitive dust migration from the site. If airborne dust is observed leaving the site, the work will be stopped until supplemental dust suppression techniques are employed in those areas.

Supplemental Dust Suppression

Supplemental dust suppression techniques may include but are not necessarily limited to the following measures:

- Reducing the excavation size, number of excavations or volume of material handled.
- Restricting vehicle speeds.
- Applying water on buckets during excavation and dumping.
- Wetting equipment and excavation faces.
- Wetting haul roads.
- Restricting work during extreme wind conditions.
- Use of a street sweeper on paved haul roads, where feasible.

Work can resume using supplemental dust suppression techniques provided that the measures are successful in reducing the sustained downwind particulate concentration to below 150 ug/m^3 of the upwind level, and in preventing visible dust migration off-site.

COMBUSTIBLE GASES & OXYGEN

Ambient combustible gas and oxygen concentrations should be measured prior to commencing intrusive activities each workday and a minimum of every 30-minutes thereafter. Air monitoring activities should be performed using equipment appropriate to measure combustible gases in percent lower explosive limit (LEL) and percent oxygen and calibrated daily. All combustible gas and oxygen readings must be recorded in the Project Field Book and/or Real-Time Air Monitoring Logs (sample attached) and, if applicable, be made available for State (DEC and DOH) personnel to review.

Mitigation upon the detection of various action levels of organic vapors are presented below:

Combustible Gas:

- If the sustained ambient air concentration of combustible gas at the downwind perimeter of the site exceeds a reading of 10 to 25% LEL, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 10% LEL, work activities can resume with continued monitoring.

- If sustained combustible gas levels at the downwind perimeter of the site persist at levels in excess of 25% LEL, work activities must be halted, the source of explosion hazards identified, corrective actions taken to abate emissions and monitoring continued. Following combustible gas mitigation, work activities can resume provided that the sustained total organic vapor level 200 feet downwind of the exclusions 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 a sustained value of 10% LEL.

Oxygen:

- If the sustained ambient oxygen concentration at the downwind perimeter of the site measures a reading between 19.5% - 21% oxygen, work activities can continue with extreme caution, however attempts to determine the potential source of oxygen displacement must be conducted.

- If the sustained oxygen level readily decreases below 19.5% LEL, work activities should be discontinued and all personnel must leave the area immediately.

- If the sustained oxygen level at the downwind perimeter of the site persists at levels between 21-25%, work activities can resume with caution.

- If the sustained oxygen level at the downwind perimeter of the site persists at levels exceeding 25% (fire hazard potential), work activities should be discontinued and all personnel must leave the area immediately.

ATTACHMENTS

Real-Time Air Monitoring Log (sample)

REFERENCES

<u>TurnKey FOPs:</u>

006	*Calibration and Maintenance of Combustible Gas/Oxygen Meter*
010	*Calibration and Maintenance of Flame Ionization Detector*
011	*Calibration and Maintenance of Portable Photoionization Detector*
084	*Calibration and Maintenance of Portable Particulate Meter*

Benchmark Environmental Engineering & Science, PLLC

REAL TIME AIR MONITORING LOG

Date:
Project Name:
Project Number:
Project Location:
Client:
Purpose of Air Monitoring:

WEATHER CONDITIONS:

Time of Day:	A.M.	P.M.
Ambient Air Temp.:		
Wind Direction:		
Wind Speed:		
Precipitation:		

Date	Personnel	Time	Air Monitoring Meter Measurement (Units)							Location/Activity/Comments
			PID (ppm)	LEL (%)	H_2S (ppm)	O_2 (%)	CO (ppm)	Particulates (mg/m^3)	Other	

NOTE: SEE EQUIPMENT CALIBRATION LOG FOR DESCRIPTION OF EQUIPMENT TYPE.

Prepared By: Date:

APPENDIX I

SITE MANAGEMENT FORMS

Annual Site Inspection Checklist

Oregon Road Site
BCP Site No. C905045

Inspector's Initials____________________ Inspection Date:______________________

Site Use: ____

General Site Conditions: ______________________________________

Cover Inspection			
Hardscape Areas	Yes	No	Notes
Asphalt			
Cover Area			
Grass Cover			
Stone (Drainage ditches and creek)			
Groundwater Monitoring Network			
	Yes	No	Notes
Roadbox Covers /Collars			
Well Condition			

Additional Comments: ______________________________________

Signature: ______________ Company: ______________ Date: ________

GROUNDWATER FIELD FORM

Project Name: Date:

Location: Project No.: Field Team:

Well No.	Diameter (inches):	Sample Date / Time:
Product Depth (fbTOR):	Water Column (ft):	DTW when sampled:
DTW (static) (fbTOR):	One Well Volume (gal):	Purpose: ☐ Development ☐ Sample ☐ Purge & Sample
Total Depth (fbTOR):	Total Volume Purged (gal):	Purge Method:

Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:									
	S1								
	S2								

Well No.	Diameter (inches):	Sample Date / Time:
Product Depth (fbTOR):	Water Column (ft):	DTW when sampled:
DTW (static) (fbTOR):	One Well Volume (gal):	Purpose: ☐ Development ☐ Sample ☐ Purge & Sample
Total Depth (fbTOR):	Total Volume Purged (gal):	Purge Method:

Time	Water Level (fbTOR)	Acc. Volume (gallons)	pH (units)	Temp. (deg. C)	SC (uS)	Turbidity (NTU)	DO (mg/L)	ORP (mV)	Appearance & Odor
	0 Initial								
	1								
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
Sample Information:									
	S1								
	S2								

REMARKS:

Note: All water level measurements are in feet, distance from top of riser.

Volume Calculation

Diam.	Vol. (g/ft)
1"	0.041
2"	0.163
4"	0.653
6"	1.469

Stabilization Criteria

Parameter	Criteria
pH	± 0.1 unit
SC	± 3%
Turbidity	± 10%
DO	± 0.3 mg/L
ORP	± 10 mV

PREPARED BY:

New York State Department of Environmental Conservation
Division of Environmental Remediation, 11th Floor
625 Broadway, Albany, New York 12233-7011
Phone: (518) 402-9553 **Fax:** (518) 402-9577
Website: www.dec.ny.gov

45-Day Reminder Notice: Site Management Periodic Review

,

September 29, 2009
Site Name:
Site No.:
Site Address:
, NY

Dear :

This is a reminder that as part of the last phase of a site's remedial program (i.e., "Site Management" (SM)), a progress report for your site is to be submitted by you, the site owner or Remedial Party, to the New York State Department of Environmental Conservation (Department) by . This report, now referred to as the Periodic Review Report (PRR) documents the implementation of and compliance with the Site Management requirements for this site. SM is a concept defined in regulation (6 NYCRR 375-1.2(at)). A suggested outline for the PRR is enclosed. If the site is comprised of multiple properties or parcels, then you as the owner or Remedial Party must arrange to submit one PRR for all parcels that comprise the site.

Depending on the age of the remedial program for your site, the document(s) governing SM for your site will be different. Previously, SM requirements were contained in separate documents with specific titles (e.g., Operation, Maintenance, and Monitoring Plan or Soil Management Plan) and are now being incorporated into one comprehensive "Site Management Plan" (SMP). A SMP may contain one or all of the following elements as applicable to the site; a plan to maintain institutional and/or engineering controls ("IC/EC Plan"), a plan for monitoring the performance and effectiveness of the selected remedy ("Monitoring Plan"), and/or a plan for the operation and maintenance of the selected remedy ("O&M Plan"). Additionally, the requirements for SM are normally stated in the decision document (e.g., Record of Decision) and/or the legal agreement directing the remediation of the site (e.g., order on consent, voluntary agreement, etc.).

When you submit the PRR (by the due date above), please sign and include the enclosed forms documenting that all SM requirements are being met. If there is some reason you cannot certify that all SM requirements are being met, you should indicate this and include a statement of explanation in the PRR with a schedule for addressing the problem(s). The Periodic Review process will not be considered complete until all necessary corrective measures are completed and any required controls are certified. Instructions for completing the certifications are enclosed.

Enclosures

ec: , Project Manager
, Bureau Director
Hazardous Waste Remediation Engineer, Region
Gary Litwin, DOH

cc:

Enclosure
Periodic Review Report (PRR) General Guidance

I. Introduction: (½-page or less)

- A. Provide a brief summary of site, nature and extent of contamination, and remedial history.
- B. Effectiveness of the Remedial Program - Provide overall conclusions regarding;
    - 1. progress made during the reporting period toward meeting the remedial objectives for the site
    - 2. the ultimate ability of the remedial program to achieve the remedial objectives for the site.
- C. Compliance
    - 1. Identify any areas of non-compliance regarding the major elements of the Site Management Plan (SMP, i.e., the Institutional/Engineering Control (IC/EC) Plan, the Monitoring Plan, and the Operation & Maintenance (O&M) Plan).
    - 2. Propose steps to be taken and a schedule to correct any areas of non-compliance.
- D. Recommendations
    - 1. recommend whether any changes to the SMP are needed
    - 2. recommend any changes to the frequency for submittal of PRRs (increase, decrease)
    - 3. recommend whether the requirements for discontinuing site management have been met.

II. Site Overview (one page or less)

- A. Describe the site location, boundaries (figure), significant features, surrounding area, and the nature and extent of contamination prior to site remediation.
- B. Describe the chronology of the main features of the remedial program for the site, the components of the selected remedy, cleanup goals, site closure criteria, and any significant changes to the selected remedy and site that have been made since remedy selection.

III. Evaluate Remedy Performance, Effectiveness, and Protectiveness

- A. Using tables, graphs, charts and bulleted text to the extent practicable, describe the effectiveness of the remedy in achieving the remedial goals for the site. Base findings, recommendations, and conclusions on objective data. Evaluations should be presented simply and concisely.

IV. IC/EC Plan Compliance Report (if applicable)

- A. IC/EC Requirements and Compliance
    - 1. Describe each control, its objective, and how performance of the control is evaluated.
    - 2. Summarize the status of each goal (whether it is fully in place and its effectiveness).
    - 3. Corrective Measures: describe steps proposed to address any deficiencies in ICECs.
    - 4. Conclusions and recommendations for changes.
- B. IC/EC Certification
    - 1. The certification must be complete (even if there are IC/EC deficiencies), and certified by the appropriate party as set forth in a Department-approved certification form(s).

V. Monitoring Plan Compliance Report (if applicable)

- A. Components of the Monitoring Plan (tabular presentations preferred) - Describe the requirements of the monitoring plan by media (i.e., soil, groundwater, sediment, etc.) and by any remedial technologies being used at the site.
- B. Summary of Monitoring Completed During Reporting Period - Describe the monitoring tasks actually completed during this PRR reporting period. Tables and/or figures should be used to show all data.
- C. Comparisons with Remedial Objectives - Compare the results of all monitoring with the remedial objectives for the site. Include trend analyses where possible.
- D. Monitoring Deficiencies - Describe any ways in which monitoring did not fully comply with the monitoring plan.
- E. Conclusions and Recommendations for Changes - Provide overall conclusions regarding the monitoring completed and the resulting evaluations regarding remedial effectiveness.

VI. Operation & Maintenance (O&M) Plan Compliance Report (if applicable)

- A. Components of O&M Plan - Describe the requirements of the O&M plan including required activities, frequencies, recordkeeping, etc.
- B. Summary of O&M Completed During Reporting Period - Describe the O&M tasks actually completed during this PRR reporting period.
- C. Evaluation of Remedial Systems - Based upon the results of the O&M activities completed, evaluated the ability of each component of the remedy subject to O&M requirements to perform as designed/expected.
- D. O&M Deficiencies - Identify any deficiencies in complying with the O&M plan during this PRR reporting period.
- E. Conclusions and Recommendations for Improvements - Provide an overall conclusion regarding O&M for the site and identify problems, their severity, and any suggested improvements requiring changes in the O&M Plan.

VII. Overall PRR Conclusions and Recommendations

- A. Compliance with SMP - For each component of the SMP (i.e., IC/EC, monitoring, O&M), summarize;
  1. whether all requirements of each plan were met during the reporting period
  2. any requirements not met such as new completed exposure pathways resulting in unacceptable risk
  3. proposed plans and a schedule for coming into full compliance.
- B. Performance and Effectiveness of the Remedy - Based upon your evaluation of the components of the SMP, form conclusions about the performance of each component and the ability of the remedy to achieve the remedial objectives for the site.
- C. Future PRR Submittals
  1. Recommend, with supporting justification, whether the frequency of the submittal of PRRs should be changed (either increased or decreased).
  2. If the requirements for site closure have been achieved, contact the Department's Project Manager for the site to determine what, if any, additional documentation is needed to support a decision to discontinue site management.

VIII. Additional Guidance

- A. Additional guidance regarding the preparation and submittal of an acceptable PRR can be obtained from the Department's Project Manager for the site.

WHERE to mail the signed Certification Form by :

New York State Department of Environmental Conservation

Attn: , Project Manager

Please note that extra postage may be required.

Enclosure 1

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

Site Management Periodic Review Report Notice
Institutional and Engineering Controls Certification Form

Site Details **Box 1**

Site No.

Site Name

Site Address: Zip Code:
City/Town:
County:
Allowable Use(s) (if applicable, does not address local zoning):
Site Acreage:
Owner:
, , NY

Reporting Period: to

Box 2

Verification of Site Details

	YES	NO
1. Is the information in Box 1 correct?	☐	☐
If NO, are changes handwritten above or included on a separate sheet?	☐	
2. Has some or all of the site property been sold, subdivided, merged, or undergone a tax map amendment during this Reporting Period?	☐	☐
If YES, is documentation or evidence that documentation has been previously submitted included with this certification?	☐	
3. Have any federal, state, and/or local permits (e.g., building, discharge) been issued for or at the property during this Reporting Period?	☐	☐
If YES, is documentation (or evidence that documentation has been previously submitted) included with this certification?	☐	
4. If use of the site is restricted, is the current use of the site consistent with those restrictions?	☐	☐
If NO, is an explanation included with this certification?	☐	
5. For non-significant-threat Brownfield Cleanup Program Sites subject to ECL 27-1415.7(c), has any new information revealed that assumptions made in the Qualitative Exposure Assessment regarding offsite contamination are no longer valid?	☐	☐
If YES, is the new information or evidence that new information has been previously submitted included with this Certification?	☐	
6. For non-significant-threat Brownfield Cleanup Program Sites subject to ECL 27-1415.7(c), are the assumptions in the Qualitative Exposure Assessment still valid (must be certified every five years)?	☐	☐
If NO, are changes in the assessment included with this certification?	☐	

SITE NO. Box 3

Description of Institutional Controls

Box 4

Description of Engineering Controls

Box 5

Periodic Review Report (PRR) Certification Statements

1. I certify by checking "YES" below that:

    a) the Periodic Review report and all attachments were prepared under the direction of, and reviewed by, the party making the certification;

    b) to the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program, and generally accepted engineering practices; and the information presented is accurate and compete.

YES NO

☐ ☐

2. If this site has an IC/EC Plan (or equivalent as required in the Decision Document), for each Institutional or Engineering control listed in Boxes 3 and/or 4, I certify by checking "YES" below that all of the following statements are true:

    (a) the Institutional Control and/or Engineering Control(s) employed at this site is unchanged since the date that the Control was put in-place, or was last approved by the Department;

    (b) nothing has occurred that would impair the ability of such Control, to protect public health and the environment;

    (c) access to the site will continue to be provided to the Department, to evaluate the remedy, including access to evaluate the continued maintenance of this Control;

    (d) nothing has occurred that would constitute a violation or failure to comply with the Site Management Plan for this Control; and

    (e) if a financial assurance mechanism is required by the oversight document for the site, the mechanism remains valid and sufficient for its intended purpose established in the document.

YES NO

☐ ☐

3. If this site has an Operation and Maintenance (O&M) Plan (or equivalent as required in the Decision Document);

I certify by checking "YES" below that the O&M Plan Requirements (or equivalent as required in the Decision Document) are being met.

YES NO

☐ ☐

4. If this site has a Monitoring Plan (or equivalent as required in the remedy selection document);

I certify by checking "YES" below that the requirements of the Monitoring Plan (or equivalent as required in the Decision Document) is being met.

YES NO

☐ ☐

IC CERTIFICATIONS
SITE NO.

Box 6

SITE OWNER OR DESIGNATED REPRESENTATIVE SIGNATURE

I certify that all information and statements in Boxes 2 and/or 3 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I ______________________________ at ____,
print name print business address

am certifying as ____(Owner or Remedial Party)

for the Site named in the Site Details Section of this form.

____ ________________
Signature of Owner or Remedial Party Rendering Certification Date

IC/EC CERTIFICATIONS

Box 7

QUALIFIED ENVIRONMENTAL PROFESSIONAL (QEP) SIGNATURE

I certify that all information in Boxes 4 and 5 are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

I ______________________________ at ____,
print name print business address

am certifying as a Qualified Environmental Professional for the ______________________________

(Owner or Remedial Party) for the Site named in the Site Details Section of this form.

____ ________________ _________
Signature of Qualified Environmental Professional, for the Owner or Remedial Party, Rendering Certification Stamp (if Required) Date

Enclosure 2

Certification Instructions

I. Verification of Site Details (Box 1 and Box 2):

Answer the six questions in the Verification of Site Details Section. Questions 5 and 6 only refer to sites in the Brownfield Cleanup Program. The Owner and/or Qualified Environmental Professional (QEP) may include handwritten changes and/or other supporting documentation, as necessary.

II. Certification of Institutional / Engineering Controls (Boxes 3, 4, and 5)

1. Review the listed IC/ECs, confirming that all existing controls are listed, and that all existing controls are still applicable. If there is a control that is no longer applicable the Owner / Remedial Party is to petition the Department requesting approval to remove the control.

2. In Box 5, complete certifications for all Plan components, as applicable, by checking the corresponding checkbox.

3. If you cannot certify "YES" for each Control and/or certify the other SM Plan components that are applicable, continue to complete the remainder of this **Certification** form. Attach supporting documentation that explains why the **Certification** cannot be rendered, as well as a statement of proposed corrective measures, and an associated schedule for completing the corrective measures. Note that this **Certification** form must be submitted even if an IC or EC cannot be certified; however, the certification process will not be considered complete until corrective action is completed.

   If the Department concurs with the explanation, the proposed corrective measures, and the proposed schedule, a letter authorizing the implementation of those corrective measures will be issued by the Department's Project Manager. Once the corrective measures are complete, a new Periodic Review Report (with IC/EC Certification) is to be submitted within 45 days to the Department. If the Department has any questions or concerns regarding the PRR and/or completion of the IC/EC Certification, the Project Manager will contact you.

III. IC/EC Certification by Signature (Box 6 and Box 7):

If you certified "YES" for each Control, please complete and sign the IC/EC Certifications page. Where the only control is an Institutional Control on the use of the property the certification statement in Box 6 shall be completed and may be made by the property owner. Where the site has Institutional <u>and</u> Engineering Controls, the certification statement in Box 7 must be completed by a Professional Engineer or Qualified Environmental Professional (see table below).

Table 1. Signature Requirements for Control Certification Page

Type of Control	Example of IC/EC	Required Signatures
EC which does not include a treatment system or engineered caps.	Fence, Clean Soil Cover, Individual House Water Treatment System, Vapor Mitigation System	A site or property owner or remedial party, and a QEP. (P.E. license not required)
EC that includes treatment system or an engineered cap.	Pump & Treat System providing hydraulic control of a plume, Part 360 Cap.	A site or property owner or remedial party, and a QEP with a P.E. license.

Summary of Green Remediation Metrics for Site Management

Site Name: ____________________Site Code: ____________________
Address: ____________________City: ____________________
State: __________ Zip Code: __________County: ____________________

Initial Report Period (Start Date of period covered by the Initial Report submittal)
Start Date: ____________________

Current Reporting Period
Reporting Period From: ____________________To: ____________________

Contact Information
Preparer's Name: ____________________ Phone No.: ____________________
Preparer's Affiliation: ____________________

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	**Total to Date**
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	**Total to Date (miles)**
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	**Total to Date (gallons)**
Total quantity of water used on-site		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	**Total to Date (acres)**
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR

I, ___________________________ (**Name**) do hereby certify that I am ______________________ (**Title**) of the Company/Corporation herein referenced. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct.

____

Date **Contractor**

APPENDIX J

REMEDIAL SYSTEM OPTIMIZATION TABLE OF CONTENTS

REMEDIAL SYSTEM OPTIMIZATION FOR OREGON ROAD SITE

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4.2.1 Maintenance Improvements

4.2.2 Monitoring Improvements

4.2.3 Process Modifications

4.3 RECOMMENDATIONS TO REDUCE COSTS

4.3.1 Supply Management

4.3.2 Process Improvements or Changes

4.3.3 Optimize Monitoring Program

4.3.4 Maintenance and Repairs

4.4 RECOMMENDATIONS FOR IMPLEMENTATION