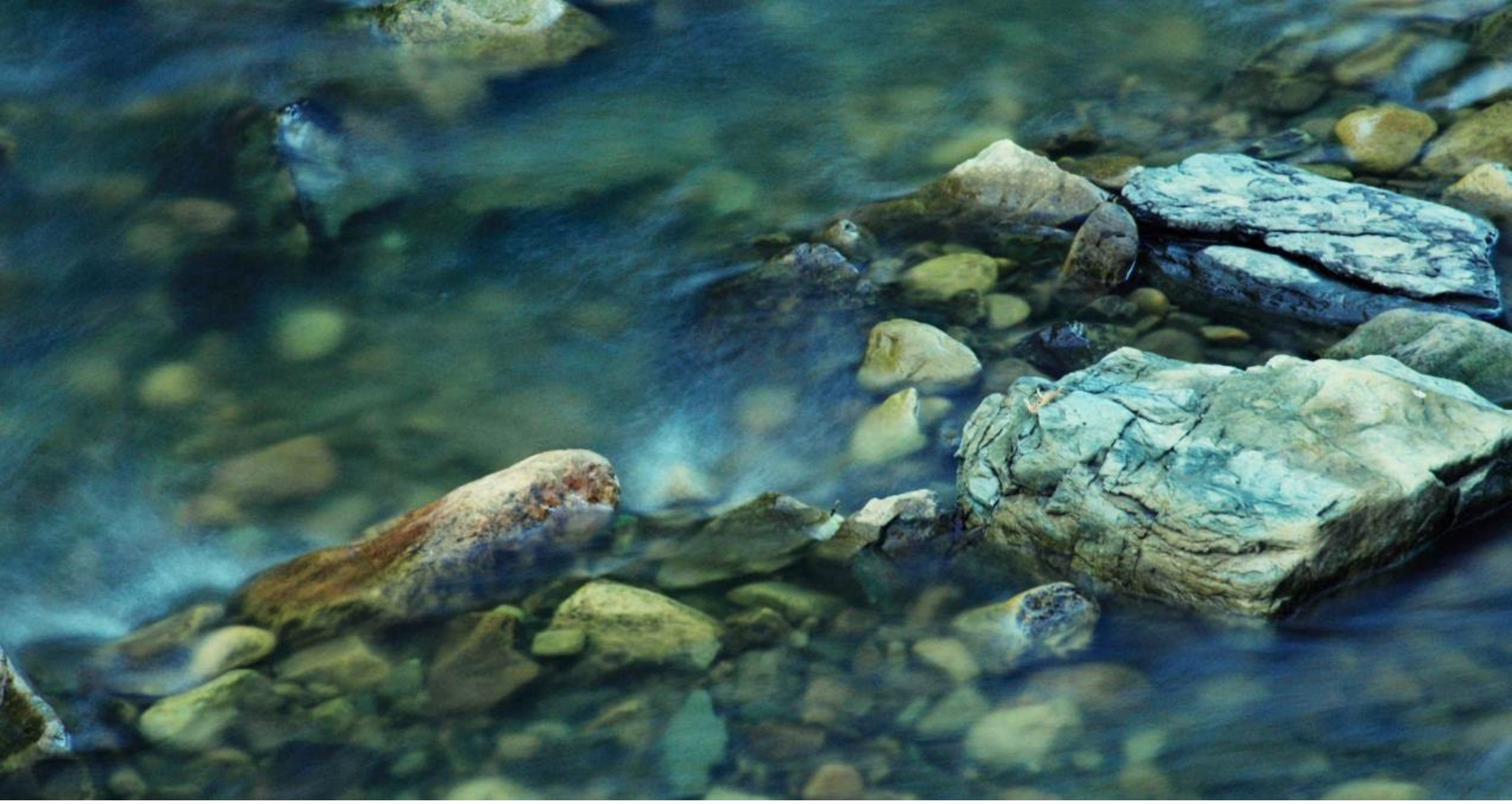

May 2022
Saranac Street Former Manufactured Gas Plant Operable Unit 3

Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River

Prepared for New York State Electric & Gas Corporation.

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Saranac Street Former Manufactured Gas Plant Operable Unit 3

Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River

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ABBREVIATIONS

AWQS/GV	ambient water quality standards/guidance value
CRR-NY	Codes, Rules and Regulations of the State of New York
DOC	dissolved organic carbon
FS	feasibility study
FSP	field sampling plan
HASP	health and safety plan
MAEPH	Massachusetts Extractable Petroleum Hydrocarbons
mg/kg	milligram per kilogram
MGP	manufactured gas plant
mm	millimeter
NAPL	nonaqueous phase liquid
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSEG	New York State Electric and Gas Corporation
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
QAPP	quality assurance project plan
Site	Saranac Street former MGP site in Plattsburg, New York
SGV	sediment guideline value
SIM	selected ion monitoring
SM	standard method
SOP	standard operating procedure
SW	solid waste
TAT	turnaround time
TOC	total organic carbon
TU	toxic unit
USACE	U.S. Army Corps of Engineers

Qualified Environmental Professional Certification Statement

I, Mike Conese, certify that I am currently a NYS registered professional engineer (licensed number 099551) with over 9 years' experience and that this OU3 Supplemental Investigation Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

Mike Conese

1 Introduction

On behalf of New York State Electric & Gas Corporation (NYSEG), Anchor QEA, LLC, has prepared this proposed work plan for supplemental investigations associated with the Saranac Street former manufactured gas plant (MGP) site in Plattsburgh, New York (Figure 1-1). The former Saranac Street MGP operated at the Saranac Street site from the late 1800s to the mid-1900s. The proposed work is concerned with Operable Unit (OU)-3, which comprises the section of the Saranac River downstream of the Green Street public boat launch and the Cumberland Bay portion of the Saranac Street former MGP site (Figure 1-2). OU-1, which has been remediated, includes the former MGP facility and adjacent Saranac River. The upland area was the site of a NYSEG Service Center, which closed in 1980. OU-2, which is currently undergoing remediation, includes the Saranac River downstream from the former MGP to the public boat launch on Green Street. The investigation of OU-3 is being conducted pursuant to a multisite Order on Consent between NYSEG and the New York State Department of Environmental Conservation (NYSDEC), Index No. D0-0002-9309, which was executed on March 25, 1994.

A review of historical data for OU-3 identified the need for additional data to develop the OU-3 Remedial Investigation (RI) and Feasibility Study (FS). This work plan describes the proposed investigations to better understand conditions in OU-3 and to support remedy selection based on evaluations and conclusions in the forthcoming OU-3 RI and FS. Figure 1-2 shows the general OU-3 Study Area.

Specifically, the proposed work plan included herein (2022 Work Plan) refers to the Saranac River portion of OU-3. This proposed work was generally described in the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* submitted September 27, 2021 (2021 Work Plan; Anchor QEA 2021) and approved by the NYSDEC on September 29, 2021. This 2022 Work Plan provides specific detail for each component of the proposed Saranac River OU-3 work.

All field activities and data management will be conducted in accordance with this work plan and field sampling plan (FSP; Attachment A) and the 2021 Work Plan, including the details and procedures provided in the 2021 quality assurance project plan (QAPP) and the Health and Safety Plan (HASP; Anchor QEA 2021).

1.1 Project Background

Numerous investigations have been performed at the former MGP site, the Saranac River, and Cumberland Bay since 1998. An FS developed in 2008 for OU-2, which at that time included both the river and the lake, was rejected by the NYSDEC because NYSDEC determined that sediment conditions in the Saranac River differed significantly from the sediment conditions in Cumberland Bay and that the two areas should be separated for purposes of remedial decision making. Since then, the river and the lake have been separated into OU-2 and OU-3, respectively, although a short stretch of the river connecting to the bay is included in OU-3. A Record of Decision for OU-2 was issued by the NYSDEC in March 2018, and OU-2 is currently undergoing remediation.

Renewed investigation of OU-3 following the split from OU-2 began in 2017 with a resurvey of the lake sediment conditions (GEI Consultants [GEI] 2017), including a single-beam bathymetric survey and sediment probing to delineate surface water sheens in Cumberland Bay. Sediment investigations followed in 2018 and 2019 (Parsons 2019, 2020) and included surface and subsurface sediment collection in Cumberland Bay, additional sediment probing in Cumberland Bay to delineate surface water sheen, and test pitting of the Saranac River to better understand the nature and extent of MGP-related impacts. In October 2021, additional sediment investigations were performed in the Cumberland Bay area of OU-3. Investigations included sediment probing, surface sediment chemistry, grain size characterization and porewater analysis, sediment toxicity testing, and benthic community survey. In addition, surface sediment was collected for a subsequent laboratory treatability study for sheen mitigation.

1.2 Organization

The remainder of this work plan is organized as follows:

- Section 2—Permitting, identifies the permits required to complete the work proposed in this work plan.
- Section 3—Scope of Investigations, describes the tasks that will be undertaken to gather sufficient information to meet the project objectives.
- Section 4—Data Use, briefly describes the intended uses of the data to be collected under this work plan.
- Section 5—Field Work and Report Schedule, presents the approximate project schedule.

The appendix to this work plan provides the following supporting document:

- Appendix A—Saranac River Field Sampling Plan

2 Permitting

Because the proposed work will take place in navigable waters of the United States, it requires a U.S. Army Corps of Engineers (USACE) permit. The work falls under the general conditions of Nationwide Permit No. 6, Survey Activities, so no permit needs to be obtained. However, consistent with the 2021 field investigations, Anchor QEA will notify the USACE prior to commencing work. In addition, because the proposed work is being completed by NYSEG under a Consent Order with NYSDEC, an Article 15 Protection of Waters Permit, is not required.

The proposed work will comprise, in part, a benthic community survey. Collection of benthic invertebrates requires a License to Collect or Possess Scientific Application from NYSDEC. This permit application was approved as part of the 2021 field investigations and is valid through September 26, 2022. The benthic community survey portion of the proposed 2022 field investigations described herein is currently planned to be completed prior to this date, so no new permit is required.

Prior to the beginning of any of the proposed work, a utility mark-out will be coordinated with Dig Safely New York.

3 Scope of Investigations

In addition to the investigation performed in 2021, the proposed investigations described in this section will support the development and screening of any remedial alternatives for the Saranac River portion of OU-3 in the OU-3 FS. The proposed investigations are designed to meet the following objectives for this portion of OU-3:

- **Objective 1:** Conduct an updated surface water sheen delineation in Saranac River (Section 3.1)
- **Objective 2:** Conduct a partial benthic community survey and risk assessment of the Saranac River (Section 3.2)

3.1 Surface Water Sheen Delineation

A sheen probing evaluation will be conducted to update the surface water sheen delineation data for the Saranac River portions of OU-3 (Figure 3-1).

Probing is proposed to delineate the surface water sheen footprint. Consistent with the intent of 6 CRR-NY 703.2, probing is considered the most representative way of accurately and efficiently disturbing surface sediments to the same depth that would potentially result from recreational activities such as wading and anchoring boats. Sediment probing was approved for use in surface water sheen evaluation in OU-3 by the NYSDEC (GEI 2018) and successfully implemented in 2017 and 2018 in Cumberland Bay. Probing was also approved by the NYSDEC and conducted by Anchor QEA in Cumberland Bay in 2021.

Consistent with the 2021 probing investigation conducted by Anchor QEA, probing will take place using a threaded rod, hand-pushed to a maximum depth of 2.0 feet below mudline, or until refusal, to disturb the sediment.

The procedure for probing is provided in detail in the Saranac River FSP (Appendix A), which provides protocols for probing by both boat and wading. Where insufficient water depth in the Saranac River precludes probing by boat, probing at these locations will be conducted by wading.

Sediment at each target location will be probed to two depths below the sediment surface, initially to 0.5 feet and subsequently to 2.0 feet or refusal, using a steel rod or equivalent. Sheen generation results will be separately recorded for each of the two probing depths. The rod will be marked with 1-inch intervals so the field crew can determine probing depth. Additional threaded rod segments will be kept on hand to adjust rod length to the water depth of each probing location. Following penetration into the sediment at 0.5 foot below the sediment surface, the probe will be vertically raised and lowered four additional times (total of five "pushes") to the same target depth. This protocol for sediment agitation is consistent with the prior field effort. A 30-second observation time will follow for documenting any resulting surface water sheen. The probe will then be pushed to

2.0 feet below the sediment surface (or refusal) and sediment agitation and sheen observation protocols will be repeated for the deeper probe.

Probing will be performed during calm conditions to provide the best opportunity to observe sheens on surface water. Field work will operate on a contingency schedule with periods of calm weather utilized to conduct probing, until all probing has been completed, while periods of rougher weather are utilized to conduct the benthic risk assessment sampling program (Section 3.2). Calm conditions are considered to be conditions where the water surface is smooth or has very minor ripples (e.g., 1 to 2 inches) such that a sheen can be easily seen and documented. For safety reasons, probing will also only be performed when discharge from the U.S. Geological Survey gauge station (04273500 Saranac River at Plattsburgh, New York) is at or below 1,000 cubic feet per second. The gauge station will be checked prior to field mobilization each day. Based on monthly flow data (Figure 3-2), appropriate flow conditions may be limited before June. Water surfaces will be photographed immediately prior to probing each location and the pre-probing photograph kept as part of the field log. Consultation with NYSDEC staff, if available on site, will also be conducted to confirm conditions are considered suitable for sheen observations.

Surface water sheen descriptions will follow those used during the 2021 probing event in Cumberland Bay that were agreed upon by Anchor QEA and NYSDEC. These descriptions are slightly different from and supersede the description methods documented in the 2021 Work Plan. The main criteria for determining the type of sheen are color and size. Duration of sheen observed on the surface will also be recorded but will factor in less because of the varying lengths of time that it takes for a sheen to dissipate, which is, in part, controlled by surface water conditions (i.e., wind/wave and flow conditions). Below are the general criteria for each sheen type:

- None means no sheen was observed.
- Trace includes a sheen that is characterized by only minor gray or *silvery* dots (typically dime size or less) or wisps (less than 6-inch strands). Dissipation times can vary from less than 10 seconds to 3 minutes.
- Moderate implies a more noticeably persistent *silvery or rainbow* patch of sheen. Sizes range from 6-inch to 18-inch strands and up to 18-inch-diameter circular areas. Sheens remain visible generally in the 1- to 3-minute range.
- Heavy sheens are characterized by widespread patches of persistent *rainbow or brown* sheen*, that remain visible for 3 minutes or longer*.
- Number of contiguous stringers or patches will be noted to provide additional information for sheen evaluation.

Probing will be conducted at the four types of locations described below (see Figure 3-1 and Table 3-1). Location ID nomenclature is based on location (i.e., SR for Saranac River), year (i.e., 22), and sequential numbering to provide a unique ID.

- **Resample Locations:** Probing at Resample Locations will include all 2019 test pit locations in the Saranac River. There are 14 Resample Locations proposed in the Saranac River for this scope of work (Figure 3-1; Table 3-1). Two of the probing Resample Locations, SR22-19 and SR22-28, are located in close proximity to Colocated with Benthic Risk Location probing locations SR22-04 and SR22-10, respectively (Figure 3-1). This occurs because the two Resample Locations are colocated with 2018 historical probing locations P-804 and P-803, while the Benthic Risk Locations are colocated with 2019 test pit locations. Regardless of close proximity, all prior sampling locations will be probed.
- **New Locations:** Probing at New Locations in the Saranac River portion of OU-3 will expand the footprint to areas where historical probing data were unavailable. The Saranac River locations were selected by overlaying a 50-foot grid in the area and selecting target locations on a 100- to 150-foot spacing (i.e., approximately every third grid; Figure 3-1 and Table 3-1). A total of 22 New Locations are proposed in the Saranac River.
- **Step-Out Locations:** As needed based on real-time surface water sheen observations in the field during probing, sample Step-Out Locations will be collected to bound trace, moderate, or heavy sheens. If the field team observes trace, moderate, or heavy sheen at a bounding location, Step-Out Locations will be probed to bound the sheen footprint. Step-Out Locations will be approximately 25 feet in the Saranac River, angled about 90 degrees apart, outward from the point where sheen was observed. (See the example Step-Out Locations in Figure 3-1.) If trace, moderate, or heavy sheen is observed at a Step-Out Location, additional pairs of Step-Out Locations will be probed until no sheen is observed.
- **Colocated with Benthic Risk Locations:** Each of the 13 proposed locations in the Saranac River portion of OU-3 and the three reference area locations associated with the benthic risk assessment sampling program (Section 3.2) will be probed. In addition to defining the surface water sheen footprint, probing at Benthic Risk Locations will provide additional information for benthic risk assessment. Benthic Risk probing locations include three new locations that are in reference areas outside of OU-3. These three locations are in the Saranac River upstream reference area. Reference area locations are further discussed in Section 3.2.

3.2 Porewater Toxicity and Benthic Community Survey in the Saranac River

Due to the rocky substrate throughout most of the OU-3 portion of the Saranac River, a full benthic risk assessment is not feasible. Bulk sediment finer than gravel is rare, precluding analysis of sediment bulk chemistry or the use of sediment for toxicity tests. But exposure to polycyclic aromatic hydrocarbons (PAHs) dissolved in porewater is potentially a risk for benthic invertebrates. To evaluate this risk, porewater will be collected in situ and concentrations compared to the porewater PAH dose-response curve developed for Cumberland Bay samples collected in 2021. In addition, sampling will be conducted for benthic invertebrate community using a multiplate apparatus.

3.2.1 Study Design and Target Locations

The proposed study design for the Saranac River includes collecting porewater samples and performing benthic community surveys at 13 locations in OU-3 (Table 3-2; Figure 3-3) selected based on test pit excavations performed in 2019. Locations were selected to represent a range of reported sheen/tar observations during test pitting at various depths below mudline as follows:

- Two locations were selected where no sheen or tar impacts were observed.
- Nine locations were selected where sheen was observed in the 0- to 2-foot interval of sediment. Five of these locations had no tar observed in the test pits. Four of these locations had tar first observed at 4 to 6 feet below mudline. Porewater collected at these locations can be used to evaluate how sheen in the surface sediments and tar that is present at depth may impact porewater PAH concentrations and the benthic community.
- Two locations where tar was first observed from the 1- to 2-foot interval of sediment are included to capture benthic and porewater results in areas where tar was observed in shallower sediments.

Three reference locations upstream of OU-1 were selected to further evaluate site-related impacts on the benthic community. Due to their upstream position, these locations have not been exposed to site-related contaminants, but otherwise are believed to have comparable physical and chemical characteristics (Table 3-2, Figure 3-4). Location SR22-16 near the South Catherine Street bridge was sampled in 2004 (sample ID PL14) and sediment toxicity test results indicated no toxicity (RETEC 2006). Locations SR22-14 and SR22-15, which were not sampled previously, are between the upstream boundary of OU-1 and SR22-16. A site reconnaissance will be conducted prior to probing and sampling at SR22-14, SR22-15, and SR22-16 to (1) confirm site conditions of proposed reference locations are similar to conditions within the OU-3 portion of the Saranac River; and (2) confirm the proposed locations are not in close proximity to point source discharges, which could mis-represent reference conditions.

3.2.2 Porewater Evaluation

Because collecting sediment is not feasible in much of the Saranac River portion of OU-3, porewater samples will be collected using emplaced ceramic shells that will prevent entrainment of non-aqueous phase liquid (NAPL) in the porewater should it be present (Gefell et al. 2018) and enable evaluation of only dissolved phase contaminants. As described in the Saranac River FSP (Appendix A), at each target location (Figure 3-3 and Figure 3-4), divers will deploy four inert, porous, capped ceramic tubes filled with deionized water (approximately 120 milliliters per tube) 0.25 to 0.5 foot below mudline for in situ equilibration with ambient porewater. Four ceramic tubes will be deployed to account for potential breakage or spillage in the field. At least 200 milliliters of porewater, which can be obtained with two tubes, is required for method detection limits to be in a range where non-detect concentrations will not have a measurable effect on the toxic unit (TU) calculations that will be performed during data analysis. The porous ceramic tubes will remain in the surface sediment for at least 30 days so the de-ionized water initially present in the tubes can equilibrate with local porewater and then will be retrieved by divers. Laboratory studies have shown that PAHs reach equilibrium in porous ceramic tubes in less than 30 days (Gefell et al. 2018). Tube removal will be coordinated with collection of benthic multiplate samplers described in Section 3.2.3, which will be deployed simultaneously with the ceramic tubes, and which must remain for at least 35 days. Upon removal of ceramic tubes, Anchor QEA field staff will remove the caps and transfer the equilibrated porewater sample from the porous ceramic tubes at each location to laboratory-provided containers and ship them to Alpha Analytical for PAH (SW 846 8270D SIM) and DOC (SM 5310C) analysis.

Laboratory standard operating procedures (SOPs) for all analytical tests are included in the 2021 Work Plan QAPP (Anchor QEA 2021). Per discussion with NYSDEC and based on research detailed in Gefell et al. (2018), the porewater results from in situ collection and from ex situ porewater collection methods described in the NYSDEC-approved 2021 Work Plan are appropriate for comparison in porewater toxicity analysis.

3.2.3 Multiplate Benthic Community Survey

Multiplate samplers are a type of artificial-substrate sampling device developed by Hester and Dendy (NYSDEC 2019; the devices are therefore referred to as "Hester Dendys"). They are used in flowing waters too deep for kick sampling. A benthic community study using multiplate samplers will be conducted at the same 13 Saranac River OU-3 locations and the 3 upstream reference locations that have been selected for the in situ porewater sampling described in Section 3.2.2 (Figures 3-3 and 3-4). This method of sampling allows colonization of an emplaced artificial substrate by benthic organisms and is suitable for locations, such as rocky streams and rivers, where sediment cannot be collected.

Benthic community samples will be collected using a modified version of the methods described in *SOP #208-19 – Revision 1.2: Biological Monitoring of Surface Waters in New York State* (NYSDEC 2019). We anticipate divers or waders will install multiplate samplers on the surface of the riverbed in June or July (pending Saranac River conditions) and use weights to keep the samplers stationary. Three samplers will be installed at each station to address the potential for sampler loss issues (washout or mishandling during retrieval, sampler loss, etc.). Samplers will remain in place for a minimum of 35 days to allow macroinvertebrate colonization per NYSDEC (2019) protocol.

To retrieve a sampler, divers or waders will disconnect it from the weights and immediately transfer the sampler into a 500-micrometer mesh bag under water, taking care to limit macroinvertebrates leaving the sampler.

Each sampler found intact will be processed and sieved using a U.S. Standard No. 40 mesh sieve. All retained material will be preserved with 95% ethyl alcohol and submitted to the taxonomic laboratory (Watershed Assessment Associates, LLC) where one of the intact samples from each location will be processed and the other samplers (if found in good condition) will be archived.

The taxonomic laboratory (Watershed Assessment Associates) will perform taxonomic identification and enumeration. Laboratory SOPs for all analytical tests are included in the 2021 Work Plan QAPP. Individuals of each species (or lowest practicable taxonomic level) will be counted, and the lowest taxonomic level for each sample will be summed. The results of the taxonomic analysis will be used to evaluate whether the infauna benthic community in OU-3 shows statistically significant evidence of impairment compared to the reference locations. Indices that can be used to evaluate the infauna benthic community include total abundance, species richness, Ephemeroptera, Plecoptera and Trichoptera richness, Hilsenhoff's biotic index, species diversity, and Margalef's species richness. Evaluations of benthic community will be developed in consultation with NYSDEC.

3.2.4 Sample Protection

Human interference and physical damage from the elements are always a risk for in situ sampling. The following conditions and approaches are expected to minimize risk of sample loss or interference. Ceramic cups used for porewater collection will be buried and therefore not visible to the public. The ceramic cups have been demonstrated to withstand a person standing on overlying sediment without breaking, which means they should be resistant to breakage, should a wader stand on an area where the cups are buried. The multiplate samplers, in accordance with NYSDEC SOP #208-19 (NYSDEC 2019), will be deployed on the sediment surface at the targeted locations (Figures 3-3 and 3-4), which are co-located with the ceramic cups. To secure the samplers from displacement in high flows while reducing risk from possible human disturbance, the samplers will be secured with wide, but low-profile (approximately 5 inches high) cement blocks colored to blend with the surrounding surface sediment and rocks. This will limit the ability of the public to see the samplers. Care will be taken to deploy the samplers in locations that are less visible from shore and that will not be exposed during times of low water levels. In addition, due to construction in OU2, OU3 will be closed to public fishing and other recreation in 2022, limiting public access to the deployed samplers. Anchor QEA will have GPS coordinates of each location and will be able to navigate to the location without being able to see the samplers.

4 Data Use

The data collected during the investigations proposed in this work plan will be presented in the OU-3 RI Report and used to support the OU-3 FS evaluations. Contents of the RI and FS will be developed in consultation with NYSDEC. The following subsections describe the general intended use of the newly collected data to ensure the data are collected in a manner that will be consistent with these objectives.

4.1.1 Surface Water Sheen Delineation

Prior characterization of surface water sheens from Saranac River were done with test pitting (Parsons 2020). A more consistent sediment disturbance (as described in Section 3.1) to a defined depth of 2 feet better reflects potential recreational activities in the Saranac River based on the intent of 6 CRR-NY-703.2. The results of the sediment probing program will replace previously collected surface water sheen data using test pits to better understand the applicability of 6 CRR-NY 703.2 to OU-3 during FS development.

4.1.2 Assessment and Delineation of Benthic Risk in Saranac River

Multiple lines of evidence (LOEs) will be used to evaluate potential risks to the benthic community in Saranac River including porewater PAH concentrations and benthic community surveys. Porewater PAH concentrations and benthic community impacts within the study site will be compared to the PAH dose-response curve developed for Cumberland Bay samples collected in 2021, upstream reference locations, and will be considered in the context of sheen and NAPL observations and sediment chemistry (where available) from 2019 test pitting. The overall objective is to determine locations where exposure to PAHs may result in adverse effects to benthic organisms, considering both the TU toxicity threshold determined using the 2021 Cumberland Bay sediment toxicity bioassay data and any observed impacts to the benthic community compared to upstream reference locations which appear attributable to PAHs. The use of reference areas is critical in order to understand whether the benthic community may be impacted by conditions that are not related to exposure to site-related releases of PAHs, so that these impacts are taken into consideration during the benthic risk assessment. Because these LOEs are based on site-specific data collected, there is inherently a high degree of confidence in the relevance of each LOE to the evaluation of benthic risk in the Saranac River. However, given the practical uncertainties associated with the data generated for each LOE, based on the evaluation of the quality of each of the studies, one or more of the LOEs may in fact be assigned a greater weight in decision-making based on the overall quality of the LOE.

Chapter 11 of NYSDEC's *Screening and Assessment of Contaminated Sediments* provides useful guidance that can be used initially to evaluate the LOEs. Ultimately, the evaluation of the results of the benthic risk assessment will be completed in consultation with NYSDEC.

4.1.2.1 Benthic Community Assessment

As noted in Section 3.2.3, the results of the taxonomic analysis will be used to evaluate whether the benthic community in OU-3 shows statistically significant evidence of impairment compared to the reference locations. Indices that can be used to evaluate the benthic community include, but are not limited to, total abundance, species richness, Ephemeroptera, Plecoptera and Trichoptera richness, Hilsenhoff's biotic index, species diversity, and Margalef's species richness. The metrics that are most appropriate to use to complete the benthic community assessment will be selected in consultation with NYSDEC; however, it is important to note that it is most critical to evaluate whether there is a difference between the benthic community measured at the site compared to the reference sites, and not on a hypothetical benthic community that might be found in the Saranac River. For that reason, there may be value in using readily understood metrics such as, for example, abundance, richness, and diversity.

In addition, locations influenced by anthropogenic activities (e.g., upstream impacts, impacts from the City of Plattsburgh Water Pollution Control Plant discharge) may see a shift toward a more impacted benthic community relative to a pristine environment, regardless of the chemical contamination under evaluation. The metrics that are used to complete the assessment of the benthic community at the selected reference locations will be compared to the site results (including site results up and downstream of the Water Pollution Control Plant outfall pipe) to determine whether site-related benthic community impacts are observed.

5 Field Work and Report Schedule

The field investigation will be conducted as soon as possible following NYSDEC's approval of this work plan. A revised project and report schedule with specific time frames will be provided following completion of the field work. The preliminary schedule for the project is as follows:

- **April 2022:** Saranac River Draft Work Plan was submitted to NYSDEC.
- **May 2022:** Saranac River Work Plan will be revised per NYSDEC comments and final version submitted to NYSDEC.
- **June or July 2022:** Saranac River field investigation will be conducted, pending NYSDEC approval of the Saranac River Benthic Toxicity Work Plan and safe working conditions in the Saranac River (i.e., flow conditions allow work to be completed in a safe manner).
- **December 2022:** The data usability summary report for Saranac River Work Plan will be submitted to the NYSDEC within 60 days following validation of all chemistry data (assumed to be completed in October). All data will be provided to NYSDEC in Microsoft Excel spreadsheet format exported from EQuIS and as an EQuIS EDD.
- **January or February 2022:** The OU-3 RI report, including a revised Fish & Wildlife Impact Analysis, will be submitted to NYSDEC.
- **2023:** An OU-3 FS report will be submitted to NYSDEC 180 days following approval of the RI.

These milestones are subject to change based on NYSDEC approval, procurement and scheduling of subcontractors, and delays caused by weather or other unforeseen circumstances.

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Tables

Table 3-1
Target Saranac River Probing Locations

Proposed Probing Location ID	Sample Type	X Coordinate[1]	Y Coordinate[1]
SR22-01	Colocated with Benthic Toxicity Sample	766451.25	2139743.41
SR22-02	Colocated with Benthic Toxicity Sample	766305.32	2139660.32
SR22-03	Colocated with Benthic Toxicity Sample	766507.17	2139580.93
SR22-04	Colocated with Benthic Toxicity Sample	766603.81	2139534.91
SR22-05	Colocated with Benthic Toxicity Sample	766737.69	2139526.05
SR22-06	Colocated with Benthic Toxicity Sample	766522.12	2139437.90
SR22-07	Colocated with Benthic Toxicity Sample	766219.67	2139411.87
SR22-08	Colocated with Benthic Toxicity Sample	765954.09	2139321.37
SR22-09	Colocated with Benthic Toxicity Sample	766410.05	2139340.36
SR22-10	Colocated with Benthic Toxicity Sample	766600.92	2139328.07
SR22-11	Colocated with Benthic Toxicity Sample	765664.63	2139246.33
SR22-12	Colocated with Benthic Toxicity Sample	765827.46	2139238.41
SR22-13	Colocated with Benthic Toxicity Sample	766338.11	2139230.19
SR22-14	Reference - Colocated with Benthic Toxicity Sample	765056.71	2135555.29
SR22-15	Reference - Colocated with Benthic Toxicity Sample	764699.52	2135056.31
SR22-16	Reference - Colocated with Benthic Toxicity Sample	763169.27	2135054.71
SR22-17	Re-Sample Location	766389.60	2139639.93
SR22-18	Re-Sample Location	766415.31	2139527.35
SR22-19	Re-Sample Location	766587.53	2139519.49
SR22-20	Re-Sample Location	766118.27	2139494.01
SR22-21	Re-Sample Location	766110.34	2139468.79
SR22-22	Re-Sample Location	766094.71	2139455.95
SR22-23	Re-Sample Location	766307.77	2139456.43
SR22-24	Re-Sample Location	766682.96	2139421.32
SR22-25	Re-Sample Location	765765.58	2139314.73
SR22-26	Re-Sample Location	766010.90	2139319.99
SR22-27	Re-Sample Location	766124.67	2139343.34
SR22-28	Re-Sample Location	766586.66	2139317.19
SR22-29	Re-Sample Location	766510.00	2139259.82
SR22-30	Re-Sample Location	765769.76	2139157.69
SR22-31	New Sample Location	766345.56	2139732.01
SR22-32	New Sample Location	766642.10	2139629.21

Table 3-1
Target Saranac River Probing Locations

Proposed Probing Location ID	Sample Type	X Coordinate[1]	Y Coordinate[1]
SR22-33	New Sample Location	766196.64	2139581.40
SR22-34	New Sample Location	766345.94	2139587.46
SR22-35	New Sample Location	766194.03	2139483.92
SR22-36	New Sample Location	766747.36	2139428.55
SR22-37	New Sample Location	766046.28	2139391.70
SR22-38	New Sample Location	766345.72	2139388.65
SR22-39	New Sample Location	766646.31	2139382.74
SR22-40	New Sample Location	765594.50	2139335.84
SR22-41	New Sample Location	766196.54	2139333.19
SR22-42	New Sample Location	766493.50	2139336.85
SR22-43	New Sample Location	765896.47	2139285.52
SR22-44	New Sample Location	766047.42	2139282.92
SR22-45	New Sample Location	766345.64	2139287.16
SR22-46	New Sample Location	766646.58	2139273.80
SR22-47	New Sample Location	765746.17	2139233.15
SR22-48	New Sample Location	766194.80	2139232.31
SR22-49	New Sample Location	765596.58	2139184.58
SR22-50	New Sample Location	765923.19	2139193.75
SR22-51	New Sample Location	766045.15	2139183.49
SR22-52	New Sample Location	766493.11	2139181.26
SR22-xx	Example Step-Out Location	766166.58	2139571.91
SR22-xx	Example Step-Out Location	766210.41	2139607.39

Notes:

1. Coordinates are target locations only. Final location will be determined following utility mark out and field conditions. Horizontal datum is New York State Plane East, North American Datum of 1983, U.S. Feet.

SR: Saranac River

Table 3-2
Saranac River Porewater and Benthic Community Survey Sample Locations

Proposed 2022 Biotoxicity Sample Location ID	2019 Test Pit Location ID	Original Sample Year	X Coordinate[a]	Y Coordinate[a]
SR22-01	TP-9B	2019	766451.25	2139743.41
SR22-02	TP-9A	2019	766305.32	2139660.32
SR22-03	TP-12A	2019	766507.17	2139580.93
SR22-04	TP-15	2019	766603.81	2139534.91
SR22-05	TP-13A	2019	766737.69	2139526.05
SR22-06	TP-11	2019	766522.12	2139437.90
SR22-07	TP-18	2019	766219.67	2139411.87
SR22-08	TP-2	2019	765954.09	2139321.37
SR22-09	TP-16	2019	766410.05	2139340.36
SR22-10	TP-14	2019	766600.92	2139328.07
SR22-11	TP-21	2019	765664.63	2139246.33
SR22-12	TP-20	2019	765827.46	2139238.41
SR22-13	TP-7	2019	766338.11	2139230.19
SR22-16	PL14[c]	2004	763169.27[b]	2135054.71[b]
SR22-14	—	—	765056.71	2135555.29
SR22-15	—	—	764699.52	2135056.31

Notes:

a. Coordinates are target locations only. Final location will be determined following utility mark-out and field conditions. Horizontal datum is New York State Plane East, North American Datum of 1983, U.S. Feet.

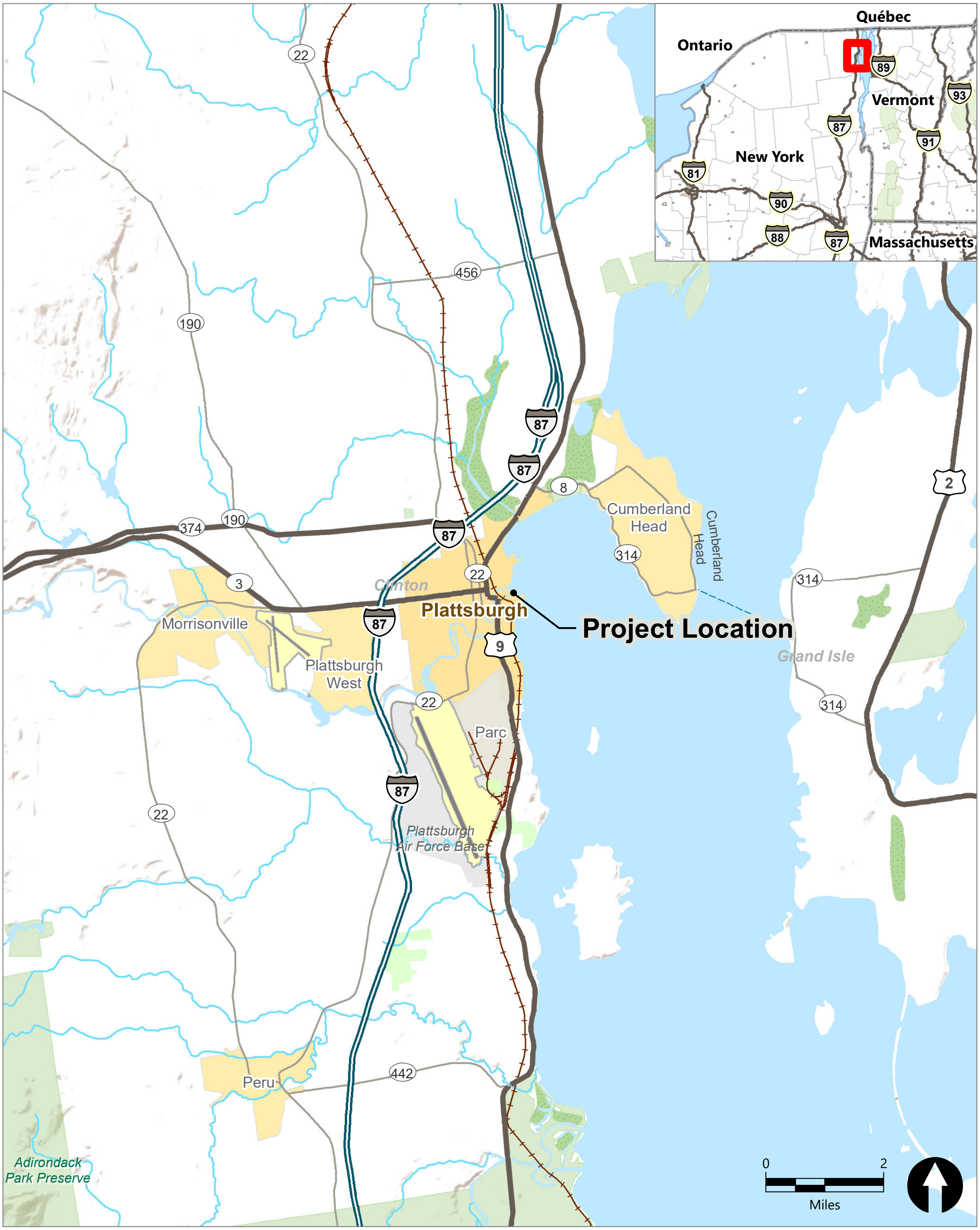
b. Coordinates for PL14 estimated from Figure 2-1 in RETEC Group, Inc. (2007).

c. Sample collected prior to 2019 test pit field effort.

—: no historical sample location

SR: Saranac River

Figures



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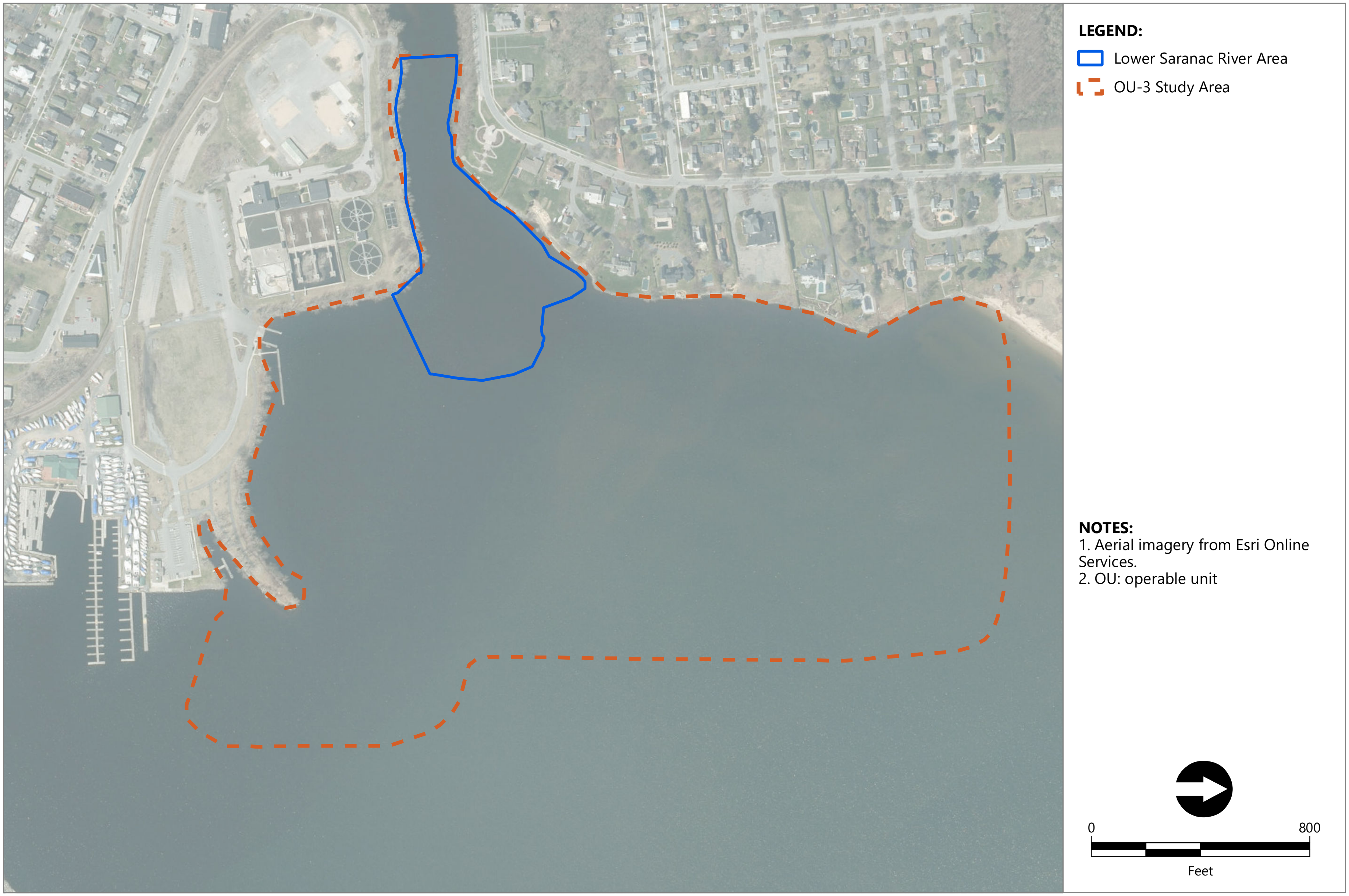
ANCHOR QEA

Figure 1-1
Plattsburgh Site Vicinity Map
Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River
Saranac Street Former Manufactured Gas Plant Operable Unit 3



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ANCHOR QEA

Figure 1-2
Site Operable Unit 3
Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River
Saranac Street Former Manufactured Gas Plant Operable Unit 3

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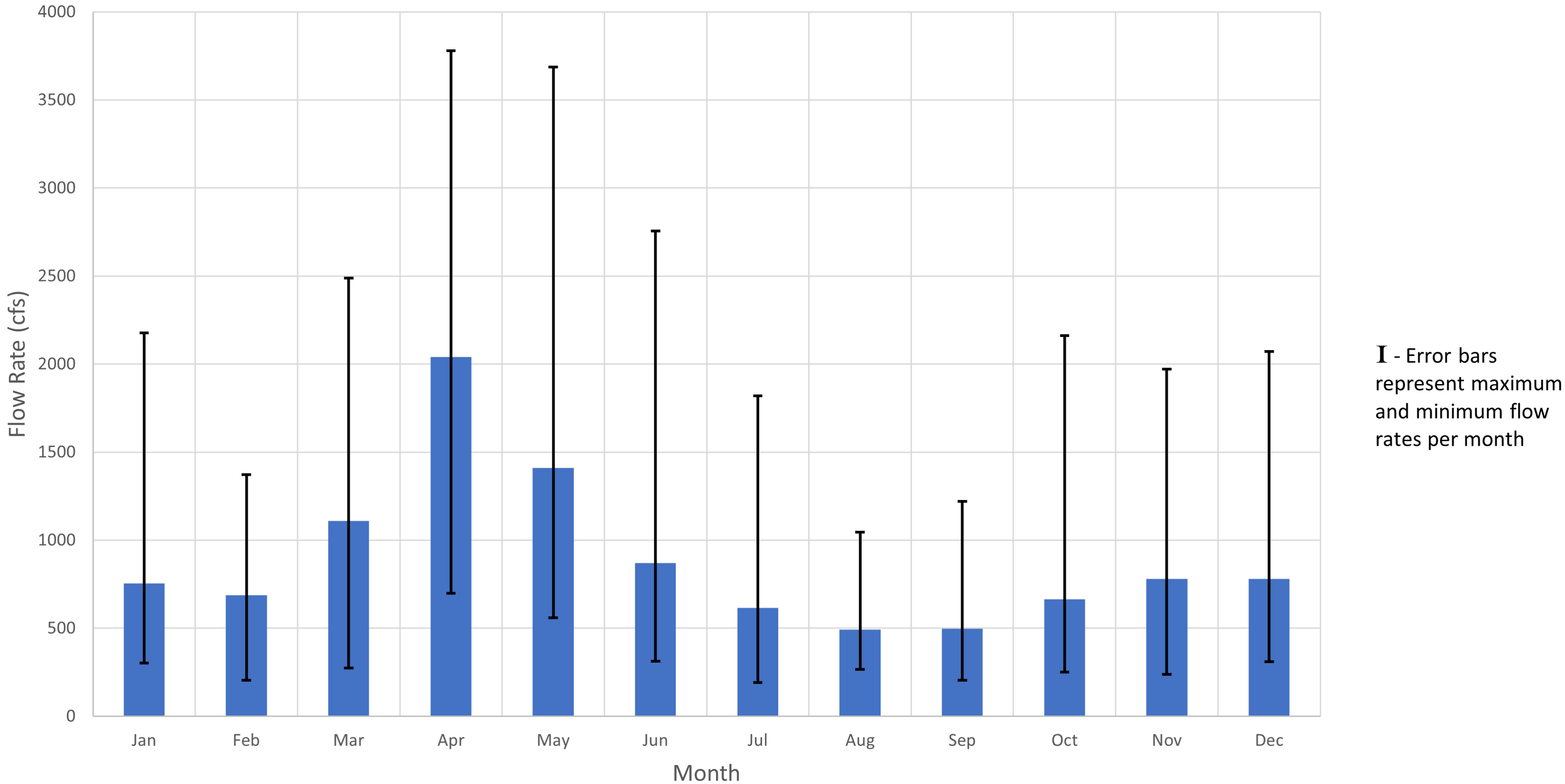
Figure 3-1
Target Saranac River Sheen Probing Locations
Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River
Saranac Street Former Manufactured Gas Plant Operable Unit 3



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ANCHOR QEA

Figure 3-2
Saranac River Monthly Mean Flow Rates

Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River
Saranac Street Former Manufactured Gas Plant Operable Unit 3

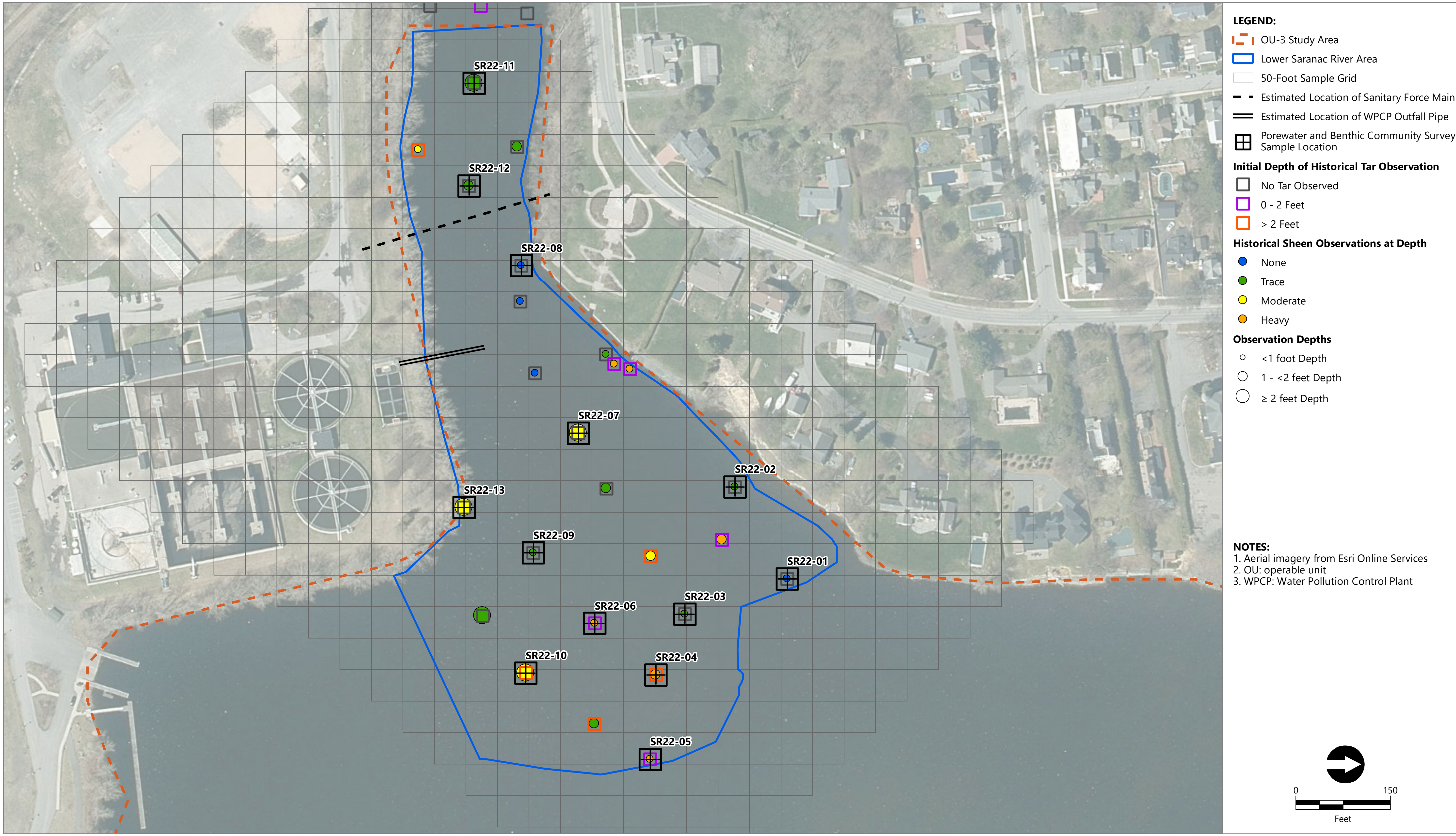

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Figure 3-3
Target Saranac River Porewater and Benthic Community Survey Locations
Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River
Saranac Street Former Manufactured Gas Plant Operable Unit 3

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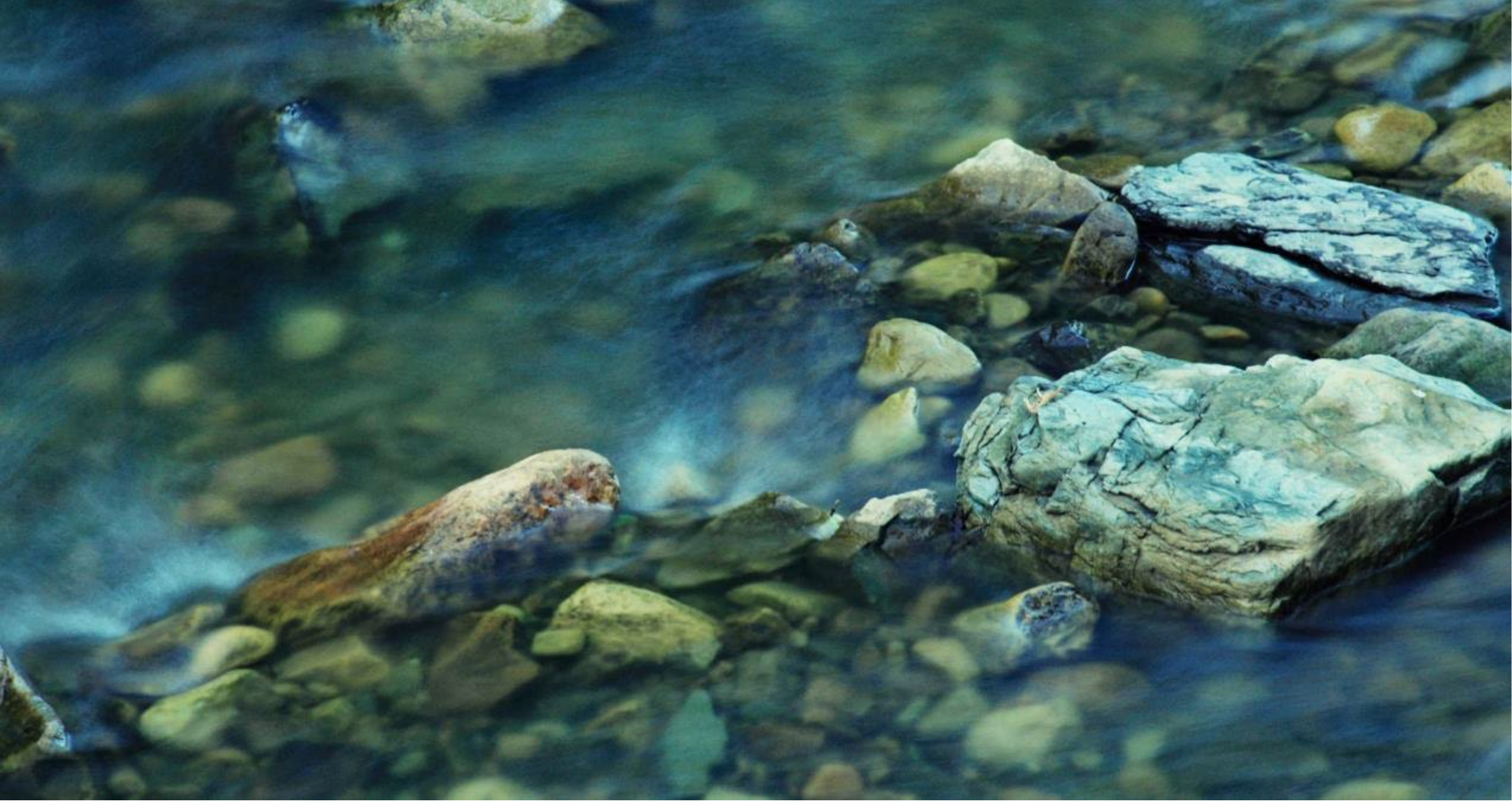
Figure 3-4
Target Saranac River Porewater and Benthic Community Survey Locations Showing Upstream Reference Locations

Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River
Saranac Street Former Manufactured Gas Plant Operable Unit 3

Appendix A
Saranac River Field Sampling Plan



May 2022
Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

Field Sampling Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River

Prepared for New York State Electric and Gas Corporation

May 2022
Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

Field Sampling Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River

Prepared by
Anchor QEA, LLC
290 Elwood Davis Road, Suite 340
Liverpool, New York 13088

Project Number: 210644-01.01
\\iris\woodcliff\Projects\Avangrid\Documents\Anchor_QEA\2022_Saranac_River_Work_Plan\7_Final\Appendix_A_FSP_adendum\Plattsburgh_OU-3_FieldSamplingPlan_5-26-22_rev1.docx

TABLE OF CONTENTS

ATTACHMENTS

ABBREVIATIONS

DGPS	Differential Global Positioning System
DOC	dissolved organic carbon
FSP	field sampling plan
HASP	*Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (Anchor QEA 2021b)
IDW	investigation-derived waste
MS/MSD	Matrix Spike / Matrix Spike Duplicate
NAPL	non-aqueous phase liquid
NYSDEC	New York State Department of Environmental Conservation
OU	operable unit
PAH	polycyclic aromatic hydrocarbon
QAPP	quality assurance project plan
QA/QC	quality assurance/quality control
RTK	Real-Time Kinematic
Site	Saranac Street former Manufactured Gas Plant site in Plattsburg, New York
SIM	selected ion monitoring
SM	standard method
SOP	standard operating procedure
SW	solid waste
USEPA	U.S. Environmental Protection Agency
2021 Work Plan	*Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021a)
Saranac River Work Plan	*Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River* (Anchor QEA 2022)

1 Field Sampling Approach

The field sampling plan (FSP) described in this document covers the activities that will be performed to conduct a partial benthic risk assessment of the Saranac River as described in the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River* (Anchor QEA 2022; Saranac River Work Plan). The Saranac River Work Plan specifically covers work to be performed in the Saranac River in 2022 and is an addendum to the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021a; 2021 Work Plan). Standard operating procedures (SOP) from 2021 are attached without change from the 2021 Work Plan except SOP 004, which has been updated with additional detail.[1]

2 Health and Safety

Health and safety procedures and issues for the work associated with this FSP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021b). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel, and each field day will start and end with a health and safety meeting for all crew members as specified in Anchor QEA (2021b).

3 Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this FSP. Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection. Boat navigation and positioning will only be performed by field team staff or subcontractors experienced with boat operations and GPS operations.

4 Sample and Location Identification

The location and sample identification scheme for this FSP will be used for both field records and sample labeling purposes. All locations will be identified with project, sampling area and date, as follows:

SR22-##-2022XXXX-YYY

where:

SR= Saranac River

[1] All SOPs from the 2021 Work Plan FSP (Anchor QEA 2021a) are included in Attachments 2 through 7 of this Saranac River FSP in order to avoid confusion between the 2021 Work Plan and the Saranac River Work Plan (i.e., avoid having the same SOP having a different SOP number).

22= Year

##= unique identification number for each location

All samples collected will be identified with the location ID from which it originated, as noted above, and appended with the appropriate sample type (e.g., "Station ID-Sample Type"). Sample types and their identifiers will include the following:

SR22-01-2022XXXX-[YYY]

Where YYY may be:

- Probing – PRB
- Porewater – PW
- Benthic Community – BC

Quality assurance/quality control (QA/QC) sample IDs will be listed after the date, as follows: SR22-01-2022XXXX-ZZ

Where ZZ may be:

- Rinse Blank – RB
- Matrix Spike / Matrix Spike Duplicate – MS/MSD

Duplicate sample IDs will use the following structure: SR22-DUP-2022XXXX. If multiple duplicate samples are collected on the same day, then a unique number ID will be included after the date.

5 Field Records

Field documentation will consist of sample collection forms, electronic field forms, photographs, and electronically recorded field measurements. Example forms are provided in Attachment 1.

Equipment and supplies required for field records include the following, at a minimum:

- Daily logs or log book
- Chain-of-custody forms
- Field Deviation Form
- Other field forms and records
- Waterproof pen
- Camera
- Whiteboard and pens
- Electronic field application/data entry tablet

Sample documentation will be recorded using an electronic field application such as Field Scribe. The electronic field application will be used to document sample collection dates and times, sample processing dates and times, location IDs, location coordinates, and sample IDs; develop chains of custody (COCs); and note any important features (e.g., probing results) at each target location (see Figures 3-1, 3-3 and 3-4 of the Saranac River Work Plan). The electronic field application will be developed by the data manager referenced in the Quality Assurance Project Plan (QAPP; Anchor QEA 2021c).

Hand-written field notes, for general site observations (see lists below), written in log books will be kept on water-resistant paper, and all field documentation will be made using a pen with indelible, waterproof ink. Corrections will be made by drawing a single line through the error, writing in the correct information, then dating and initialing the change. Blank pages or lines in the field logbook will be lined-out, dated, and initialed at the end of each sampling day. The field forms will be scanned into the project file directory as convenient during the sampling event or upon completion of each sampling event.

Field team members will keep a daily record of significant events, observations, visitors, and field activities (e.g., the collection of samples or the gathering of environmental data). All field activities will be recorded as specified in this FSP on electronic or field forms specific to the collection activity and more general information will be recorded in a project log book.

All records will be reviewed by the field team leader prior to leaving each sampling location and at the end of each field day. Information pertinent to the investigation to be recorded includes at a minimum, the following information:

- General Information
  - Project name
  - Field personnel on site
  - Visitors
  - Health and safety discussions
- Sample location information
  - Sampling method and description of activities
  - Location coordinates
  - Location and sample identification numbers
  - Weather at the time of sample initiation
  - Significant changes in weather during location occupation
  - Date and collection time of each sample
  - Other observations made during sample collection, including weather condition complications, vessel traffic, and other details associated with the sampling effort
  - Any deviations from the FSP
  - Conferences associated with field sampling activities

Additional specific field reporting requirements and checklists for sediment probing and Saranac River porewater and benthos sampling are itemized under those sections in this FSP. In general, sufficient information will be recorded during sampling so that the sampling event can be reconstructed without relying on the memory of field personnel.

6 Sediment Probing for Surface Water Sheen Delineation in the Cumberland Bay and Saranac River

6.1 Target Locations

Sediment probing will be performed at a total of 52 locations in the Saranac River (Saranac River Work Plan Figure 3-1, Anchor QEA 2022). A Differential Global Positioning System (DGPS) capable of sub-meter accuracy will be used to navigate by vessel or by wading to within 10 feet of the target locations. See SOP 001 – Boat and Wading Positioning and Navigation (Attachment 2) for specific sample location and equipment protocols. Vessels will be anchored or spudded in place during probing to maintain position.

Two general types of target locations exist: those where only probing will occur and those where in situ porewater and benthic community sampling will also occur. In cases where additional sampling is expected to occur, probing will take place before other sampling activities, and in situ sampling will occur at least 1 foot away from probing locations if occurring during the same anchoring or wading event, or within 10 feet from the probing location if occurring during a separate anchoring or wading event, so that sampling activities do not occur in sediment recently disturbed by probing.

Probing will only be performed during calm conditions with no precipitation to provide the best opportunity to observe sheens on surface water. Weather conditions will be recorded and a confirmation that conditions were judged appropriate for probing will be recorded in the field log at each target location.

6.2 Supplies and Equipment

The following is a list of equipment necessary to carry out the probing procedures. Additional equipment may be required, pending field conditions.

- Approved documents including FSP, HASP, and QAPP
- Appropriate personal protective equipment and clothing as defined in the HASP
- Target coordinates for probing locations
- Electronic field database and field logbook
- A standard survey rod (approximately 2-inch diameter)
- A threaded steel rod or equivalent marked in 1-inch intervals, approximately 6 feet in length
- Additional threaded rod segments to allow probing in deeper water depths

- Decontamination materials as described in Section 11
- Boat and Navigation equipment as described in SOP 001 – Boat and Wading Positioning and Navigation (Attachment 2)
- Tape measure
- Digital camera
- Underwater camera
- Rule (for scale)
- 1-meter white cross marked in 10-centimeter intervals attached to a threaded rod (for scale)

6.3 Probing Method

At each target location, sediment will be probed at two depths below the sediment surface, 0.5 feet and 2 feet or refusal, using a steel rod or equivalent. The rod will be sharpened at the penetrating tip and marked in 1-inch increments to record depth of refusal if less than the target depth. Additional threaded rod segments will be kept on hand to adjust rod length to the water depth of each probing location.

Following penetration into the sediment at 0.5-feet below the sediment surface, the probe will be vertically raised and lowered 4 additional times (total of five "pushes") to the same target depth. This protocol for sediment agitation is consistent with the prior field effort. A 30 second observation time will follow for documenting any resulting surface water sheen after sediment agitation at which point the probe will be pushed to 2 feet below the sediment surface (or refusal) and sediment agitation and sheen observation protocols will be repeated for the deeper probe.

If refusal is encountered prior to the probe being pushed 0.5 foot below the sediment surface, relocate the pointed end of the probing rod within 5 feet of the original location and attempt again. If refusal is met again, conduct one more attempt within 5 feet of the original location. If refusal is met prior to 0.5 foot after three attempts, document depth to refusal and sheen observations (in accordance with Section 6.4) in field log book or field database prior to moving to next location.

As part of the probing program, field crew will document where gravel, cobble, and boulders are observed and approximate proportion of coverage of these sediment size classes at each probing location. Field crew will photo-document a subset of the gravel, cobble, and boulder locations,

Sediment probing will be performed using the following procedures:

1. Confirm utility locate has been performed and that any existing utilities have been clearly marked or confirmation that no existence of utilities is present. Utilities will be cleared before sampling is commenced. This may be accomplished through notifying Dig Safely New York (800-962-7962).

2. Record surface water conditions. Probing shall only be conducted during calm conditions. Calm conditions are considered to be conditions where the water surface is smooth or has very minor ripples (e.g., 1 to 2 inches), such that a sheen can be easily seen and documented. Water surface will be photographed immediately prior to probing each location and the pre-probing photograph kept as part of the field log. Consultation with NYSDEC staff, if available on site, will also be conducted to confirm conditions are considered suitable for sheen observations.
3. Record water depth using hand-held depth finder (or similar).
4. Navigate to the target location via the vessel or wading depending upon water depth as described in SOP 001 – Boat and Wading Positioning and Navigation (Attachment 2).
5. A steel rod or equivalent will be used to probe the sediment. The probe will be sharpened on one end and calibrated in 1-inch intervals.
6. Advance the probing rod using hand pressure into the sediment bed until it reaches 0.5 foot below mudline or refusal. Following penetration into the sediment to the target depth, raise the probe vertically to the sediment surface.
7. Repeat Step 6 four times.
8. Record description, amount, size, and duration of sheen generated by probing as described in Section 6.4. Make observation for 30 seconds or until any observed sheen dissipates (whichever is longer).
9. Still at the same probing location, advance the probing rod using hand pressure into the sediment until it reaches the 2 feet below mudline or refusal. Record depth of penetration. Following penetration into the sediment to the target depth or refusal, raise the probe vertically to the sediment surface.
10. Repeat Step 9 four times.
11. Record sheen classification as described in Step 8.
12. Record the coordinates of the actual probing location using Differential Global Positioning System (DGPS) or Real-Time Kinematic (RTK) GPS, water depth or top-of-sediment elevation (to the nearest inch), type of resistance (e.g., minimal, difficult, rough, abrasive), and sediment type (e.g., rock, fine-grained) in the field logbook or field database.
13. Probing equipment will be decontaminated prior to the start of the work and between locations (see SOP 002 – Equipment Decontamination [Attachment 3]). Site water will be utilized to decontaminate probing equipment that is lowered through the water column during probing.
14. If gravel, cobble, or boulders are observed at the probing location, field crew will document on field forms or electronic field application. Field crew will photo-document at a select subset of probing locations using a digital camera or underwater camera. A 1-meter, clearly incremented white cross attached to the end of a rod lowered to the sediment surface will provide a scale reference at locations selected for photo-documentation.

6.4 Field Records for Probing

General field observations will be recorded as described in Section 5 and Section 6.3.

Surface water sheen descriptions will follow those used during the 2021 probing event in Cumberland Bay that were agreed upon by Anchor QEA and NYSDEC. These descriptions are slightly different from and supersede the description methods documented in the 2021 Work Plan (Anchor QEA 2021a). The main criteria for determining the type of sheen are color and size. Duration of sheen observed on the surface will also be recorded but will factor in less because of the varying lengths of time that it takes for a sheen to dissipate, which is, in part, controlled by surface water conditions (i.e., wind/wave and flow conditions). Below are the general criteria for each sheen type:

- None means no sheen was observed.
- Trace includes a sheen that is characterized by only minor gray or *silvery* dots (typically dime size or less) or wisps (less than 6-inch strands). Dissipation times can vary from less than 10 seconds to 3 minutes.
- Moderate implies a more noticeably persistent *silvery or rainbow* patch of sheen. Sizes range from 6-inch to 18-inch strands and up to 18-inch-diameter circular areas. Sheens remain visible generally in the 1- to 3-minute range.
- Heavy sheens are characterized by widespread patches of persistent *rainbow or brown* sheen*, that remain visible for 3 minutes or longer*.
- Number of contiguous stringers or patches will be noted to provide additional information for sheen evaluation.

7 Porewater Toxicity and Benthic Community Survey in the Saranac River

At each target location described in Section 7.1., ceramic tubes will be emplaced in the sediment for in situ porewater sampling and multiplate benthic collection devices will be placed on the sediment for benthic community collection and evaluation.

7.1 Target Locations

The proposed study design for the Saranac River will include collecting porewater samples and performing benthic community surveys, selected based on test pit excavations performed in 2019. Thirteen locations are in the Saranac River portion of OU-3 and three reference locations are located in the Saranac River upstream of OU-1.

7.2 Supplies and Equipment

Refer to SOP 004 – Water Sampling with Porous Ceramic Devices (Attachment 5) for list of supplies and equipment for porewater toxicity sampling in the Saranac River. Refer to Section 9.4.3 of

Appendix D of the 2021 Work Plan (Anchor QEA 2021a) for list of supplies and equipment for the benthic community analysis in the Saranac River.

7.3 Sample Collection

The subsections below outline the sample collection process for porewater and benthic community sampling in the Saranac River.

7.3.1 Porewater Collection

Refer to SOP 004 – Water Sampling with Porous Ceramic Devices (Attachment 5) for the standard method for installing ceramic tubes in situ. Because collecting sediment is infeasible in much of the Saranac River portion of OU-3, porewater samples will be collected using emplaced ceramic tubes that will allow equilibration of internal deionized water with porewater while preventing entrainment of NAPL (if present) in the porewater sample (Gefell et al. 2018). Four ceramic filters will be deployed at all 16 of the Saranac River sampling locations, including the three reference locations upstream of OU-3. If water levels do not permit field crew to enter the river by wading, then divers will deploy the ceramic tubes at the river bottom. Each ceramic filter tube will be pre-filled with approximately 120 milliliters of deionized water. Each filter will be deployed 0 to 0.5 feet below mudline and remain in surface sediment for 35 days. After 35 days[2], the samples will be retrieved by field crew in waders or divers and placed in Alpha Analytical containers. Sediment porewater will be shipped under chain of custody to Alpha Analytical Laboratory, for analysis of PAHs (SW 846 8270D SIM) and dissolved organic carbon (DOC; SM 5310C). If loss or breakage of one or more ceramic tubes results in limited water volume, PAH analysis will take precedence over DOC analysis.

Field crew and divers will communicate and use judgement to ensure the flow rate of the Saranac River is not a health and safety concern. If flow rate is an issue, the Project Manager will be notified, and sampling will not occur as described above on that day.

7.3.2 Multiplate Benthic Community Survey

The benthic community study will follow the procedures described in Section 9.4.3 of the *NYSDEC Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State (SOP #208-19) – Revision 1.2.2019* (NYSDEC 2019; included as 2021 Work Plan Attachment D; Anchor QEA 2021a). Sampling will occur using multiplate samplers installed by the field crew via wading or by divers where the water depths prevent wading. Samplers will be secured to low profile concrete blocks to prevent displacement and minimize vertical profile. Three samplers will be deployed at each location. Per guidance in NYSDEC 2019, the samplers will remain in place for at least 35 days to allow macroinvertebrate colonization. As soon after 35 days as is practicable

[22] The tubes must be in place for 30 days or longer according to Gefell et al. 2018. A target of 35 days is set to allow coordination with the collection of the co-located multiplate samplers (Section 7.3.2), which must be in place for 35 days or longer.

depending on flow conditions and diver availability, the field crew wading and divers will disconnect samplers from the concrete blocks and immediately transfer each sampler into a 500-micrometer mesh bag under water, taking care to limit macroinvertebrates leaving the sampler. All three or all remaining samplers at each location will be preserved for processing and sieved using a U.S. Standard No. 40 mesh sieve. All retained material will be preserved with 95% ethyl alcohol and submitted to the taxonomic laboratory (Watershed Associates Inc. or similar). Watershed Associates will select one of the samplers from each location to process based on their professional judgement. Taxonomic identification and enumeration will be performed as described in Section 3.2.4 of the 2021 Work Plan (Anchor QEA 2021a).

7.3.3 Sample Protection

Human interference and physical damage from the elements are always a risk for in situ sampling. The following conditions and approaches are expected to minimize risk of sample loss or interference. Ceramic cups used for porewater collection will be buried and therefore not visible to the public. The ceramic cups have been demonstrated to withstand a person standing on overlying sediment without breaking, which means they should be resistant to breakage, should a wader stand on an area where the cups are buried. The multiplate samplers, in accordance with NYSDEC SOP #208-19 (NYSDEC 2019), will be deployed on the sediment surface at the targeted locations (Figures 3-3 and 3-4), which are co-located with the ceramic cups. To secure the samplers from displacement in high flows while reducing risk from possible human disturbance, the samplers will be secured with wide, but low-profile (approximately 5 inches high) cement blocks colored to blend with the surrounding surface sediment and rocks. This will limit the ability of the public to see the samplers. Care will be taken to deploy the samplers in locations that are less visible from shore and that will not be exposed during times of low water levels. In addition, due to construction in OU2, OU3 will be closed to public fishing and other recreation in 2022, limiting public access to the deployed samplers. Anchor QEA will have GPS coordinates of each location and will be able to navigate to the location without being able to see the samplers.

8 Real-Time Corrective Action

If sampling requirements cannot be met due to sampling or measurement system failure, field conditions, or other factors that cannot be controlled, corrective action will be discussed with the field team and project manager or field superintendent. A corrective action will be agreed upon based on the critical/non-critical nature of the parameter. The corrective action will be documented in the field logbook, and the action will be communicated to the sampling team. All deviations from the QAPP/FSP will be documented and described in the Data Summary Report. In general, if critical measurements or samples cannot be collected, then sampling may be rescheduled. If a non-critical measurement or sample cannot be collected, then the deviation will be documented, but no additional measures will be deemed necessary. The Project Manager will review corrective actions to assess their effectiveness.

9 Management and Disposal of Investigation-Derived Waste

Field sampling and sample preparation activities will be conducted to minimize generation of waste materials. Investigation-derived waste (IDW) will be containerized and treated for disposal at the ongoing OU-2 construction site, in accordance with SOP 005 – Investigation-Derived Waste Handling and Disposal (Attachment 6). If any invasive species are brought on deck as a result of sampling activities, they will not be returned to the water, and will be managed as solid waste. All solid waste (e.g., gloves, paper towels) will be bagged or otherwise contained prior to disposal in standard refuse containers.

10 Decontamination and Avoidance of Cross Contamination

Sample integrity can be compromised by contamination from outside sources (e.g., vessel, equipment, atmosphere) and other samples (cross-contamination). Throughout sample collection activities, care will be taken to avoid sample contamination. Disposable gloves will be worn by all field crew who may come into contact with sample media and gloves will be changed between each sampling location. Sample containers, instruments, working surfaces, personnel protective gear, and other items that may come into contact with sample media must meet high standards of cleanliness. All equipment and instruments that are in direct contact with the sample media will be decontaminated before initiation of sampling as part of the project mobilization process, prior to use at each sampling location in the field, and at the end of each field day. The decontamination procedure will follow SOP-002 – Equipment Decontamination (Attachment 3).

11 Sample Documentation and Shipment

The field team will handle and process samples as prescribed in SOP-006 Sample Handling, Packaging, and Shipping (Attachment 7) and in accordance with the QAPP (Anchor QEA 2021c). The Field Lead will communicate with the Project Manager and the Quality Assurance Manager, should any issue arise.

12 References

Anchor QEA (Anchor QEA, LLC), 2021a. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection.* Prepared on behalf of New York State Electric and Gas Corporation. July 2021.

Anchor QEA, 2021b. *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations.* Prepared on behalf of New York State Electric and Gas Corporation. July 2021.

Anchor QEA, 2021c. Quality Assurance Project Plan – *Operable Unit-3 2021 Supplemental Investigations.* Prepared on behalf of New York State Electric and Gas Corporation. July 2021.

Anchor QEA (Anchor QEA, LLC), 2022. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection: Saranac River.* Prepared on behalf of New York State Electric and Gas Corporation. April 2022.

Gefell, M.J., M. Kanematsu, D. Vlassopoulos, and D.S. Lipson, 2018. "Aqueous-Phase Sampling with NAPL Exclusion Using Ceramic Porous Cups." *Groundwater* 56(6):847–851.

NYSDEC 2019. New York State Department of Environmental Conservation Division of Water Standard Operation Procedure: Biological Monitoring of Surface Waters in New York State. March 2019.

Parsons, 2020. Letter to: NYSDEC. Regarding: Saranac Street Former MGP Site Operable Unit 3 (OU3). 2019 Supplemental Remedial Investigation Data Summary Report. Plattsburgh, New York. NYSDEC Site No. 5-10-007. March 2020.

Attachment 1
Field Forms

Daily Log

ANCHOR QEA

PROJECT NAME: **DATE:**

SITE ADDRESS: **PERSONNEL:**

WEATHER:	**WIND FROM:**	N	NE	E	SE	S	SW	W	NW	LIGHT	MEDIUM	HEAVY
		SUNNY		CLOUDY		RAIN			?	**TEMPERATURE:**	° F .	° C

[Circle appropriate units]

TIME	COMMENTS
See notes on bottom of page for detailed logging	
Equipment on site:	
Samples delivered to laboratory:	

Notes: Work performed, Phone calls made, Problems Issues/Resolutions, Visitors on site, Deviations from the Workplan Safety infractions, Important comments/instructions to contractors

Signature:______________________________

Field Deviation Form

Form No. _____

Deviation subject:

Project name:

Standard procedure for field collection:

Reason for deviation:

Description of deviation:

Special equipment, materials, or personnel required:

Initiator's name:	Date:
Project Manager:	Date:

Attachment 2
Standard Operating Procedure 001 – Boat and Wading Positioning and Navigation

Standard Operating Procedure Acknowledgement Form

Project No. 210644-01.01 Project Name: Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

Scope and Application

This Standard Operating Procedure (SOP) describes the methods to be used for positioning boats and wading for the Supplemental Investigations to Support Remedy Selection at the Saranac Street Former Manufactured Gas Plant Site Operable Unit 3. Deviations from the procedures detailed in this SOP will be described on the Daily Log and in a Field Deviation Form (see Section 5 of the Field Sampling Plan).

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021a). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel.

Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP, the Field Sampling Plan, and the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021b). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection. Boat navigation and positioning will only be performed by field team staff or subcontractors experienced with boat operations and GPS operation.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents, including the HASP, Field Sampling Plan, and Quality Assurance Project Plan
- Daily Float Plan (Attachment 1) listing stations to be sampled, target station coordinates, access points along the site, and sample transfer and transport locations
- Ballpoint black ink pens
- Personal protective equipment as required by the HASP, including personal floatation devices
- Chest waders
- Sampling vessel equipped with necessary GPS navigation and communication equipment or handheld GPS if wading to location.
- Weighted tape measure (lead line) for water depth measurements
- Electronic depth finder for water depth measurements

- Boat spuds and an anchor system to stabilize boat on station
- Pre-determined sampling coordinates/waypoints and location figures

Horizontal Positioning Procedures

Horizontal positioning will be determined using a GPS based on target coordinates listed in the Field Sampling Plan. As described in the Field Sampling Plan, the sample locations may be modified based on field conditions. Measured geographic coordinates for station positions will be recorded using GPS equipment with submeter accuracy. In addition, all sampling locations and survey information will be collected in the following coordinate systems:

- Horizontal datum: New York State Plane, East Zone, North American Datum of 1983 (NAD83), U.S. feet
- Vertical datum: North American Vertical Datum of 1988 (NAVD88) U.S. feet

The following procedures describe the steps used to establish a position at a location, as well as the steps to adjust the positioning for the collection of additional samples:

1. Sampling locations to be occupied will be selected by the Field Lead and communicated to field team staff each day. Coordinates for each sampling location will be entered as a waypoint into the GPS unit. The accuracy of each entry will be checked against the coordinates established in the Field Sampling Plan.
2. The GPS antennae will be maintained in a safe location that accurately represents the actual sample or measurement collection point (e.g., mounted to the top of the davit or A-frame used for raising or lowering the sampling equipment or in hands of assistant field crew member standing at target location with sampler).
3. Using navigational data from the GPS, the boat operator or wader will navigate to and approach the actual sampling/measurement station.
4. For sediment sampling from vessel, the boat will be secured within 10 feet of the sampling station by lowering anchors or spuds. For sediment sampling via wading, the wader will station within 10 feet of the sampling location.
5. Once the boat or wader is on location, the coordinates from the GPS unit will be noted. With the boat or wader on location, the coordinates will be stored electronically in the GPS unit and recorded on the appropriate field form.
6. For repeated attempts at a sampling location, the boat or wader will be moved within the radius of 10 or fewer feet parallel to the shoreline or 10 or fewer feet perpendicular to the shoreline surrounding the target coordinates. The boat will be repositioned by adjusting an anchor line or spuds until the new position for the sampling device has been established. The new position will be recorded on the appropriate field form or in the field database.

Vertical Elevation Measurement Procedures

1. At each sampling station where elevation data are required, the water depth (from the top of the water level surface to the top of sediment surface) will be determined using a weighted line, electronic depth finder, or survey rod.
2. The date and time of the measurement will be recorded on the appropriate data form.
3. Water surface elevations will be determined based on published data from the local gauging stations or from water level monitoring conducted as a part of parallel survey efforts. If gauging stations are necessary, the following gauges will be used:
   a. U.S. Geological Survey Station 04294500 (Lake Champlain at Burlington, VT)

   The water surface elevation from the station closest to the measurement will be recorded.
4. Vertical elevation of each measurement station will be converted to the vertical datum (NAVD88) after the field sampling event.

Quality Assurance/Quality Control

GPS system performance checks using built-in accuracy measurements and ground truths will be performed daily to confirm GPS accuracy. Minimum performance standards for horizontal accuracy will be +/- 3.28 feet or 1 meter horizontal. GPS users will complete and conform to the attached Location Data Checklist and Metadata Recording Form (Attachment 2) (U.S. Environmental Protection Agency, Great Lakes National Program Office). The following procedures describe the steps used to verify GPS accuracy and will be recorded on Attachment 2.

1. Prior to utilizing the GPS for the sampling event, measure and record horizontal coordinates at two control points.
2. Prior to utilizing the GPS for the sampling event, measure and record elevation at two vertical control points.
3. Calculate displacement between known positions/elevation of control points and observed GPS position/elevation.
4. Establish three reference points. Record horizontal coordinates, elevation, and physical description for each reference point.

It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

References

Anchor QEA (Anchor QEA, LLC), 2021a. *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations*. Prepared for New York State Electric and Gas Corporation. July 2021.

Anchor QEA, 2021b. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection*. Prepared for New York State Electric and Gas Corporation. July 2021.

List of Attachments

Attachment 1 – Daily Float Plan

Attachment 2 – Location Data Checklist and Metadata Recording Form

ANCHOR QEA

DAILY FLOAT PLAN

Today's Date: ______________________________

Vessel Name: ______________________________

Operator: ______________________________

Departure Time: ______________ **Expected Time of Return:** ______________

Cell Phone Number(s) ______________________________

Office Contact Person Notified of Departure and Return: ______________________________

Destination and Itinerary:

____

____

____

Names of Personnel on Board:

____

____

____

If expected time of return is exceeded by 1 hour, the following steps will be taken:

1. Office Contact Person will attempt to contact crew members.
2. Office Contact Person will notify Field Manager, if not the same person.

If Office Contact Person is not able to establish contact with crew the following steps will be taken in a logical order:

3. Field Manager will contact Health and Safety Officer.
4. Field Manager will contact Project Manager.
5. Local hospitals and emergency centers will be contacted.
6. Local search and rescue will be notified.

This document accompanies *GLNPO's Great Lakes Legacy Act Data Reporting Standard* , Version 1.0, March 2010, which provides detailed data reporting guidance for project data including required electronic data deliverables (EDD). In addition to the EDD and project field forms, project participants are required to complete this checklist at the end of each sampling event. Copies of completed forms should be submitted to the GLNPO Project Lead.

Contact Information

Contact Name: ______________________ Phone Number: ______________________

Affiliation: ______________________ E-mail Address: ______________________

Study Information

Project Title: ______________________

Site Name: ______________________

Sampling Start Date: ______________ Sampling Stop Date: ______________

Preparation Activities (please confirm each activity in the boxes to the right)

1. Sampling staff are trained in GPS Field Data Collection and have familiarized themselves with the GPS unit used for this project (certified training recommended). ☐

2. Determined window of satellite availability. http://www.trimble.com/planningsoftware_ts.asp ☐

3. Established at least two control points for both vertical and horizontal accuracy. ☐
   For assistance locating control points visit http://www.ngs.noaa.gov/cgi-bin/datasheet.prl or http://www.geocaching.com/mark/. This may not be feasible if the GPS unit is mounted to a vessel. *

4. Located 3 reference points. * ☐

Data Collection Activities (please confirm each activity in the boxes to the right)

1. GPS unit was configured to collect data only when the following requirements were met:
   a. A minimum of four satellites ☐
   b. Position dilution of precision (PDOP)<=6 ☐
   c. Satellite elevation >=15° above the horizon ☐
   d. A minimum signal-to-noise ratio (refer to GPS user manual for recommendation) ☐

2. Collected point data based on the nearest base station's logging interval. ☐

3. Collected point data for a period of at least 1 minute per location. ☐

4. Reported locational data in WGS 84 or NAD 83 (please specify__________________). ☐

Please provide an explanation if a box was not checked for any of the responses above and specify deviations (include sample IDs if applicable):

____

____

____

*Collect these points on at least the first day of sampling. Collecting on each sampling day is recommended. Record on page 2.

GPS Unit Specifications

GPS Brand and model number: ______________________

Model accuracy: ______________________

Data Processing

Which of the following best describes any data correction that may have been performed:

☐ real-time correction - specify type ______________________

☐ post processed differential correction - provide base station id and location ______________________

☐ no correction

☐ other, please specify ______________________

Quality Information

Describe any difficulties in collecting locational data: ______________________

List final post-processed accuracy of the data: ______________________

Data Collector:

Confirm required information has been provided.

______________________ ______________

Signature Date

GLNPO Project Lead:

Confirm required information has been provided.

______________________ ______________

Signature Date

Collect these data on at least the first day of sampling. Collecting on each sampling day is recommended.

Project Title: ____________________

Date: ____________________

Horizontal Control Point 1

Benchmark ID: ____________________ Time: ____________________

Established Latitude: ____________________ Measured Latitude: ____________________

Established Longitude: ____________________ Measured Longitude: ____________________

Displacement (include UOM): ____________________

Horizontal Control Point 2

Benchmark ID: ____________________ Time: ____________________

Established Latitude: ____________________ Measured Latitude: ____________________

Established Longitude: ____________________ Measured Longitude: ____________________

Displacement (include UOM): ____________________

Vertical Control Point 1

Benchmark ID: ____________________ Time: ____________________

Established Elevation: ____________________ Measured Elevation: ____________________

Displacement (include UOM): ____________________

Vertical Control Point 2

Benchmark ID: ____________________ Time: ____________________

Established Elevation: ____________________ Measured Elevation: ____________________

Displacement (include UOM): ____________________

Reference Point 1

Time: ____________________

Physical/Locational description: ____________________

Measured Latitude: ____________________ Measured Longitude: ____________________

Reference Point 2

Time: ____________________

Physical/Locational description: ____________________

Measured Latitude: ____________________ Measured Longitude: ____________________

Reference Point 3

Time: ____________________

Physical/Locational description: ____________________

Measured Latitude: ____________________ Measured Longitude: ____________________

Attachment 3
Standard Operating Procedure 002 – Equipment Decontamination

Standard Operating Procedure Acknowledgement Form

Project Number: 210644-01.01 Project Name: Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Scope and Application

This Standard Operating Procedure (SOP) describes the decontamination of sampling equipment, instruments, and other materials used during implementation of field tasks. Decontamination is the process of neutralizing, washing, and rinsing field sampling equipment to clean field equipment and minimize the potential for sample cross-contamination.

Procedures for equipment decontamination outlined in this SOP are expected to be followed. Substantive deviations from the procedures detailed in this SOP will be recorded in the Daily Log or field log book, on a Field Deviation Form, and reported to the field lead or project.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021a). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel.

Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and the *Supplemental Investigation Work Plan to Support Remedy Selection* (Anchor QEA 2021b). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Personal protective equipment, as required by the HASP (Anchor QEA 2021a)
- Scrub brushes
- Plastic wash and rinse buckets or tubs
- Phosphate-free biodegradable detergent (e.g., Liquinox® or Alconox®)
- Ethyl acetate (as needed)
- Deionized water (or distilled water)
- Spray bottles
- Aluminum foil
- Deck pump with pressurized freshwater hose
- Paper towels and plastic garbage bags
- Tap water source (any treated municipal water supply)
- Investigation-derived waste storage containers (see SOP 005: Investigation-Derived Waste Handling and Disposal)

Procedures for Decontamination of Sampling Equipment

Sample containers, instruments, working surfaces, personnel protective gear, and other items that may come into contact with sample media must meet high standards of cleanliness. All equipment and instruments that are in direct contact with the sample medium will be decontaminated prior to each use in the field including between each sample location.

The following steps will be used to decontaminate non-disposable sampling equipment that come into contact with sample media. Decontamination of all items will follow the *Field Branches Quality Management Plan* (U.S. Environmental Protection Agency [USEPA] 2009) and *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (USEPA 2013). The decontamination procedure is as follows:

1. Residual sample media on equipment will be rinsed, scrubbed off, and collected according to the procedures outlined in SOP 005: Investigation-Derived Waste Handling and Disposal.
2. Pre-wash/rinse with tap, potable, or lake water.
3. Wash with solution of tap, potable, or lake water and soap (use scrub brush as needed).
4. Wash with ethyl acetate if residual oily sheen, tar or NAPL is present.
5. Rinse with tap, potable, or lake water.
6. Rinse with deionized water.
7. Visually inspect sampler and repeat steps as needed.
8. Use immediately or cover all decontaminated items with aluminum foil.

All used decontamination fluids will be collected and placed in labeled, designated containers suitable for disposal in accordance with investigation-derived waste procedures outlined in SOP 005: Investigation-Derived Waste Handling and Disposal.

Sensitive field instruments, such as water quality meters, will be rinsed daily during field operations at the end of each workday, or as needed, with deionized water at a minimum, or more rigorously according to the manufacturer's instruction.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check to ensure that the procedures are in conformance with those stated in this SOP. Equipment blanks will be collected periodically to validate the effectiveness of decontamination procedures.

References

Anchor QEA (Anchor QEA, LLC), 2021a. *Health and Safety Plan – Operable Unit 3-2021 Supplemental Investigations*. Prepared for New York State Electric and Gas Corporation. June 2021.

Anchor QEA (Anchor QEA, LLC), 2021b. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection.* Prepared on behalf of New York State Electric and Gas Corporation. June 2021.

USEPA (U.S. Environmental Protection Agency), 2009. *Field Branches Quality Management Plan*. May 8, 2009.

USEPA, 2013. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*. USEPA SW-846. Available at: http://www.epa.gov/osw/hazard/testmethods/sw846/online/index.htm.

Attachment 4
Standard Operating Procedure 003 – Sediment Processing

Standard Operating Procedure Acknowledgement Form

Project Number: 210644-01.01 Project Name: Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Scope and Application

This Standard Operating Procedure (SOP) is applicable to the processing of sediment samples to characterize the bulk sediment chemistry, porewater, and benthic toxicity and to perform a benthic community survey. Substantive deviations from the procedures detailed in this SOP will be recorded on the Daily Log and in a Field Deviation Form.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021a). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel.

Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021b). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- Approved documents including Work Plan, HASP, Field Sampling Plan, and Quality Assurance Project Plan
- Appropriate personal protective equipment and clothing as defined in the HASP (Anchor QEA 2021a)
- Decontamination equipment described in SOP 002 – Equipment Decontamination
- Stainless-steel or disposable aluminum pans
- Stainless-steel or disposable plastic utensils
- Physical Description of Sediment and Soil Key (see example provided in Attachment 1) and Sediment and Soil Core Processing Log forms (see example provided in Attachment 2)
- Tape measure
- Camera
- White board and pens
- Paper towels
- Duct tape
- Aluminum foil
- Core-cutting equipment

- Coolers with ice
- Sample containers and labels
- Clear plastic, resealable zippered bags (or equivalent)
- Computer with field application

Sediment Processing Procedures

1. Sediment processing consists of removing the sediment from the core or cutting the core open to access the sediments.
2. Sediment, once collected, will be stored in a decontaminated or new aluminum tray or stainless steel bowl if collected using Ponar or if collected via coring will be kept upright to preserve core sediment or soil integrity and stored out of direct sunlight until processing.
3. Sediment processing will be conducted at the processing area after being transported from the collection boat or field sampling crew location.
4. All working surfaces and instruments will be thoroughly cleaned, decontaminated, and covered with plastic or aluminum foil to minimize outside contamination between sampling events.
5. Disposable gloves will be discarded after processing at each station and replaced prior to handling decontaminated instruments or work surfaces.
6. If sample collected via coring, prior to processing, the core caps will be removed, and each section of the core will be cut longitudinally using a circular saw or a cutting tool; care will be taken not to penetrate the sediment or soil while cutting. Two longitudinal cuts will be made along the sides of the core so that the core can be opened to expose the sediment or soil. The core will be split with decontaminated stainless-steel or new disposable plastic utensils to expose the center of the two halves for sampling.
7. Core and Ponar material will be placed in the same decontaminated or new aluminum tray or stainless steel bowl.
8. Prior to sampling, color photographs will be taken of the total core length.
9. A description of the sample will be recorded on the Sediment and Soil Core Processing Log form (see example provided in Attachment 2) and field database for the following parameters as appropriate:

- Date and time of sample collection
- Sample recovery (depth in feet of penetration compared to recovery)
- Physical soil description along the entire length of the core in accordance with ASTM International (ASTM) procedures (ASTM D2488 – Standard Practice for Description and Identification of Soils [Visual-Manual Procedure] and ASTM D2487 – Standard Classification of Soils for Engineering Purposes [Unified Soil Classification System]) will be recorded including soil type, moisture content, density/consistency of soil, color, and visual evidence of impacts (e.g., hydrocarbon-like sheens)

- Odors (e.g., hydrogen sulfide or petroleum)
- Visual stratification, structure, and texture
- Vegetation and debris
- Photoionization detector readings
- Biological activity (e.g., detritus, shells, tubes, bioturbation, and live or dead organisms)
- Presence of sheen
- Any other distinguishing characteristics or features

10. Sample material in decontaminated stainless-steel or new disposable aluminum tray or bowl will be homogenized. Following homogenization, the sample will be placed in appropriate laboratory-supplied jars.
11. Excess material shall be treated as investigation derived waste in accordance with SOP 005 – Investigation Derived Waste.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that sediment core processing procedures are in conformance with those stated in this SOP.

References

Anchor QEA (Anchor QEA, LLC), 2021a. *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations*. Prepared for New York State Electric and Gas Corporation. July 2021.

Anchor QEA, 2021b. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection.* Prepared for New York State Electric and Gas Corporation. July 2021.

List of Attachments

Attachment 1 – Physical Description of Sediment and Soil Key

Attachment 2 – Sediment and Soil Core Processing Log

Attachment 1
Physical Description of Sediment and Soil Key

GUIDANCE FOR FIELD IDENTIFICATION AND DESCRIPTION OF SOIL/SEDIMENT

1. SCOPE

The field data we collect inform client and regulatory agency decision making related to public health, the environment, engineering design, and construction activities; therefore, field work is a key aspect of our business and important to our clients. Furthermore, in keeping with Anchor QEA's core value of Quality and our commitment to producing high-quality, error-free work products, this guidance memorandum has been developed to achieve the following goals:

- Provide a company reference for field identification and description of soil/sediment.
- Enable a degree of reproducibility and understanding across Anchor QEA for identification and description of soil/sediment and environmental conditions.
- Serve as the basis for the development of project-specific and client-specific soil/sediment identification and description procedures (written or informal).

The sections of this guidance memorandum are organized as follows:

- **Section 2 – Visual Methods for Soil/Sediment Identification:** Identifies accepted industry-standard field identification and description schemes.
- **Section 3 – Procedure:** Outlines a standard approach for Anchor QEA field identification of soil/sediment using industry-standard description schemes.
- **Section 4 – Examples:** Provides example soil/sediment descriptions and example field documents and prepared logs.
- **Section 5 – QA/QC and Reporting:** Provides guidance on applying the Anchor QEA quality assurance (QA)/quality control (QC) program to field identification and description of soil/sediment.
- **Section 6 – References:** Provides the *ASTM D2488 Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)* (ASTM D2488) procedure referenced in this standard, as well as additional references and resources.

2. VISUAL METHODS FOR SOIL/SEDIMENT IDENTIFICATION

The following two soil/sediment identification and description schemes are considered industry standards and are generally accepted by regulatory agencies for use:

- ASTM D2488
- *Suggested Methods of Test for Identification of Soils* (Burmister Method; Burmister 1970)

These standards are typically used as written, but may be modified for project-specific needs. The use of these standards is advantageous because clients, regulatory agencies, and oversight consultants have widespread familiarity and a common understanding of these standards for soil/sediment identification and description.

The most widely used soil/sediment standard is ASTM D2488. ASTM D2488 is Anchor QEA's preferred method for identification and description of soil/sediment in the field and for prepared boring/core logs included in deliverables.[1] ASTM D2488 allows for a soil/sediment sample to be identified by a two-letter group symbol designation (or combination of two-letter designations) and group name based on the percentage of grain-size constituents by using the decision tree flowcharts shown in Figure 1. Grain-size ranges are defined in Attachment A.

Similar to ASTM D2488, the Burmister Method is a method for describing a soil/sediment sample by percentages of the various grain-size ranges present within a sample. The Burmister Method differs from ASTM D2488 and is not Anchor QEA's preferred method for identification and description of soil/sediment in the field.

3. PROCEDURE

The following steps provide a standard procedure for visually identifying and describing soil/sediment in the field. This framework is based on ASTM D2488 (Attachment A) and is modified to include additional field observations relating to the presence of biota, anthropogenic materials (e.g., fill), odors, sheen, and nonaqueous phase liquid (NAPL). The procedure may be modified based on project- or client-specific data objectives.

[1] Note that ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) classifies soil/sediment based on geotechnical analytical data, such as particle-size characteristics, liquid limit, and plasticity index, and is not appropriate for visual identification and description of soil/sediment.

Step 1: Record Collection Data

Record sample collection data after sample retrieval and include the following information:

- Station identification
- Water depth and time of measurement
- Actual coordinates:
  - If more than one attempt is made, record coordinates for each attempt location.
  - Describe site conditions that may require shifting the proposed sample location in the field.
- Date and time of sample collection
- Names of field personnel collecting and handling the sample
- Penetration depth
- Recovered length
- Notes about sample collection, including depth to refusal, effort required to penetrate soil/sediment, and the thickness of surface material (e.g., asphalt, drainage stone) removed to enable sample collection

General environmental observations, including weather conditions, complications, ship traffic, and other details associated with the sampling effort

- Step 2: General Observations

Open the sample and observe the full length, noting:

- Gross lithologic or consistency differences (e.g., bedding or grain-size changes)
- Differences in sample density
- Depths of any voids in the recovered sample
- Gas/vapor concentration, obtained by screening the length of the sample with a photo ionization detector (PID) or flame ionization detector (on a project-specific basis only).

These general observations will support development of a physical description of the sample, and may inform the analytical sampling scheme.

Step 3: Physical Description

Begin physical description of the sample starting at the top (e.g., mudline or ground surface) and work down, noting the following items:

- A description of the depth interval (e.g., 0 to 0.7 feet below mudline [U.S. customary or metric units may be used])
- Density (granular soils)/consistency (cohesive soils)
- Moisture content (dry, moist, or wet)
- Color (using standard colors or the Munsell color system), using the following guidelines:
  - Confine color descriptions to primary colors (e.g., brown, black, or gray).
  - When listing two colors (e.g., gray brown), list the predominant color second.
  - Obtain more accurate color descriptions based on hue and intensity from Munsell Soil Color Charts
- Estimated grain size(s) and percentages (to the nearest 5%), using the following guidelines:
  - Indicate the percentages of grain size(s) to total 100% excluding trace amounts (grain sizes present in quantities less than 5% are not included in this total).
  - For gravel, indicate the roundness or angularity of the particles.
- Structure:
  - Soil structure describes the grouping or arrangement of primary particles (e.g., sand, silt, clay, and organic matter) into larger aggregates in an intact sample such as core samples.
  - Terms commonly used to describe soil structure include homogeneous, interbedded, lens, layer, and washed.

The Soil/Sediment Classification Field Guide (Attachment B) lists the components of a physical soil description and the order in which they should be recorded, as well as relevant tables from ASTM D2488 and terminology for describing soil structure. See Section 4 for example descriptions of soil/sediment.

Step 4: Anthropogenic Description (Optional)

After completing the soil/sediment physical description, describe anthropogenic material, if present. In addition to native soils, a variety of anthropogenic materials may be present, such as bricks, glass, wood timbers, ceramic fragments, ash, and slag. **It is important to base the description of anthropogenic material on its appearance and not the assumed source. Consult with the Anchor QEA Project Manager to develop criteria and terminology for describing types of anthropogenic material encountered.**

When describing anthropogenic material, note the following items:

- Estimated percentage of particles (using secondary constituent terminology [e.g., some or trace])
- Color (using standard colors or the Munsell color system)
- Material type, if discernable (e.g., glass, metal, or brick)
  - If the material type is not obviously discernable, describe only the physical characteristics (e.g., color and size), and avoid guessing or using speculative terms.
- Estimated particle size(s) (e.g., specks or particles)
- Depth interval over which anthropogenic material is present

See Section 4 for an example description of soil/sediment containing anthropogenic material.

Step 5: Description of Odors, Sheens, and Nonaqueous Phase Liquid (Optional)

If present, describe odors, the visual appearance of sheens, and NAPL. The field guide (Attachment B) lists example terminology that may be used when describing odors, sheens, and NAPL. For work in New York State, consult the attached guidance document *Field Descriptions of Samples for Former Manufactured Gas Plant (MGP) Sites* issued by the New York State Department of Environmental Conservation (NYSDEC; Attachment C). If odors, sheens, and/or NAPL are not observed, then no description is required.

Use caution when describing odors, sheens, and NAPL to avoid exposure to potentially hazardous chemicals. Do not sniff the sample or bring it close to your face. If unexpected contamination is encountered, stop work, clear personnel from the area, and contact the Anchor QEA Project Manager and/or a Health and Safety Representative for further instruction.

When describing odors, sheens, and NAPL, it is important to describe only the characteristics of the odor, sheen, or NAPL, and refrain from speculation as to the origin or source of the materials being described. Avoid the use of terms such as oil and commonly used names (e.g., gasoline or motor oil), which imply an assumed source and specific chemical and physical properties that cannot be determined based on field observation. Note the term *product* has specific definitions under some state regulations (e.g., Washington, Ohio, Alaska, and New Jersey), which may require evaluation of chemical and physical properties that may not be available during field sampling (e.g., analytical results or physical properties testing). **Consult with the Project or Task Manager to develop criteria and terminology for describing odors, sheens, and NAPL, if encountered, and before using descriptive terms.**

When describing odors, describe only obvious odors (avoid sniffing the sample), and note:

- Intensity of the odor (e.g., trace, moderate, or strong)
- Odor type (e.g., petroleum-like, H_2S-like):
  - If the odor type is not obviously discernable, describe only the intensity and depth interval of the odor, and avoid guessing or using speculative terms.
- Depth interval over which the odor is present (including depths at which the odor intensity or type changes)

Odors can be difficult to define, and can vary from person to person. If there is uncertainty, classification of an odor should not be attempted.

When describing sheens, note the following characteristics:

- Intensity of the sheen (using secondary constituent terminology to describe the relative amount of the sample surface covered in sheen [e.g., some or trace])
- Sheen type (e.g., rainbow, or metallic)

- Sheen distribution (e.g., 0.5-inch spots of sheen at 5.6 and 5.8 feet, heavy sheen throughout)
- Depth interval over which the sheen is present, including depths at which the sheen intensity, distribution, or nature of sheen changes

When describing NAPL, note the following characteristics:

- Relative amount of NAPL (e.g., blebs, stained, coated, or wetted)
- Color (using standard colors or the Munsell color system)
- Viscosity (e.g., solid, semi-hardened, or liquid)
- Distribution of the material within the soil matrix (e.g., present in discreet pockets)
- Specific gravity (applicable when describing aqueous samples containing NAPL when you can observe whether the NAPL floats or sinks)
- Depth interval over which NAPL is present (including depths at which the relative amount, distribution, or nature of NAPL changes)

4. EXAMPLES

Example Descriptions

The following is a list of examples of soil/sediment identifications and descriptions based on the procedure outlined in Section 3. Please take note of the order of descriptive terms and the use of commas, parentheses, and upper-case letters in these examples.

Example 1

Field log notes: Coordinates entered into field application, penetration = 2.0 feet/recovery = 1.9 feet. Homogeneous sediment with no major color/grain size/density changes; PID = 0.0. 0.0 feet to 1.9 feet, medium stiff, gray green, damp but no visible water. Laminations (approximately 1-inch thick) of dark brown similar material between 0.5 and 0.8 feet and again between 2.3 and 1.6 feet with frequent fine sand partings, occasional medium to fine sand seams throughout. 10% fine gravel, 5% coarse sand, 10% medium sand, 10% fine sand, 65% fines.

Prepared log description: SILT WITH SAND (ML): medium stiff, moist, gray green, laminated, frequent fine sand partings, occasional medium to fine sand seams.

Example 2

Field log notes: Coordinates entered into field application, penetration = 3.0 feet/recovery = 2.0 feet. Void at 1.5 feet (approximately 2 inches in length) and color change gray green to red brown at 1.5 feet, very soft; PID = 0.0. 0.0 feet to 1.5 feet, slight plasticity, gray green, wet. 25% fine sand, 75% fines, 5% seashell fragments and particles, strong H_2S-like odor from 0 to 1.5 feet, trace metallic sheen at 1.2 feet.

Prepared log description: SILT (ML/OL): very soft, wet, gray green, trace seashell fragments and particles, strong H_2S-like odor from 0 to 1.5 feet and trace metallic sheen at 1.2 feet.

Example 3

Field log notes: Coordinates recorded by core collection subcontractor, penetration = 2.0 feet/recovery = 1.9 feet. Homogeneous sediment with no major color/grain size/density changes; PID = 0.0. 0.0 feet to 1.9 feet, soft, wet, brown 15% fines, 85% sand: non-plastic, 5% seashell fragments and anthropogenic particles, and strong H_2S-like odor from 0 to 1.5 feet.

Prepared log description: SILTY SAND (SM): soft, wet, dark brown, trace seashell fragments and particles of brick and coal, strong H_2S-like odor from 0 to 1.5 feet.

Example 4

Field log notes: Coordinates recorded by core collection subcontractor, penetration = 2.0 feet/recovery = 1.9 feet. Homogeneous sediment with no major color/grain size/density changes; PID = 0.0. 0.0 feet to 1.9 feet. Very soft, wet, dark brown, 25% fine sand, 75% fines: slight plasticity, 5% seashell fragments and particles, strong H_2S-like odor from 0 to 1.5 feet, and trace metallic sheen at 1.2 feet with occasional brown NAPL blebs from 0.5 to 1.2 feet.

Prepared log description: SILT (ML/OL): very soft, wet, dark brown, trace seashell fragments and particles, strong H_2S-like odor from 0 to 1.5 feet, trace metallic sheen at 1.2 feet with occasional brown NAPL blebs from 0.5 to 1.2 feet.

Example of Field Notes/Forms and Prepared Logs

Anchor QEA field forms are maintained on the internal SharePoint site along with examples of completed field notes/forms and prepared logs. These are intended to provide guidance in field logging using the procedure outlined in this memorandum. These examples are not intended to show all variations of project-specific data objectives or Unified Soil Classification System use; rather, they are presented as a general reference to the standard procedure logging conventions.

5. QUALITY ASSURANCE/QUALITY CONTROL AND REPORTING

This section describes how the procedure outlined in this guidance memorandum relates to the *Anchor QEA Quality Management Plan* (Anchor QEA 2013), and how QA/QC procedures are integrated into field identification and description of soil/sediment in the field during sampling and later in the office during reporting.

QA is a proactive process that aims to prevent defects or errors during the creation and development of a work product. It focuses on the process used to create the work product. QA of soil/sediment field identification and description is supported by this standard guidance and adequate training of staff in field identification and description methods.

QC is a reactive process that focuses on identifying and correcting defects and errors in work products. QC of soil/sediment field identification and description should occur in the field during sampling and in the office during reporting. QC should include the following steps:

- Peer review of field identification and description
- Peer review of completed field notes (e.g., soil/sediment descriptions)
- Field scientist/engineer review of logs to ensure prepared logs are consistent with the field notes
- Peer review of prepared logs
- Senior review of prepared logs

The role of the peer reviewer is to ensure following actions are completed:

- Soils/sediments were identified and described in accordance with this standard guidance.
- Project-specific data quality objectives for the soil/sediment descriptions are fulfilled.
- Prepared logs are an accurate reproduction of observations in the field and meet Anchor QEA quality standards.

Ideally, the individual identified for the peer review is engaged early in the project, so he or she is familiar with the project and can serve as a technical advisor during fieldwork. In some states, such as California, the peer reviewer is required to be a licensed geologist whose responsibility is to stamp the logs to confirm they are accurate and developed in accordance with applicable state laws. The type and extent of QC may differ, based on project-specific and/or client-specific needs, and should ensure project-specific objectives are met. Consult the Project or Task Manager to develop an appropriate, project-specific QC procedure.

6. REFERENCES

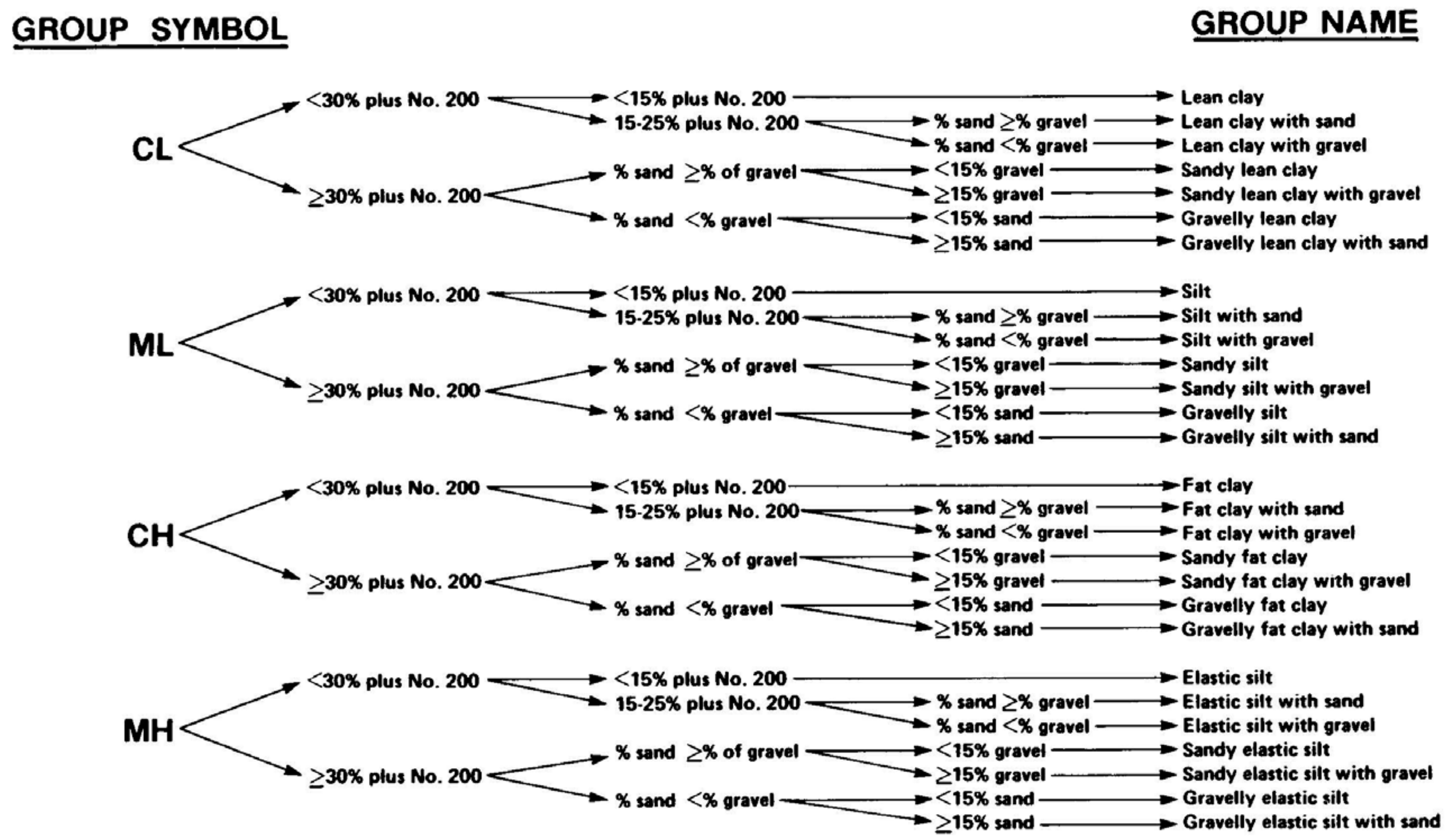
Anchor QEA, 2013. *Anchor QEA Quality Management Plan*. Anchor QEA April, 2013.

Burmister, D.M., 1970. Suggested Methods of Test for Identification of Soils. *Special Technical Publication 479: Special Procedures for Testing Soil and Rock for Engineering Purposes.* Fifth Edition.

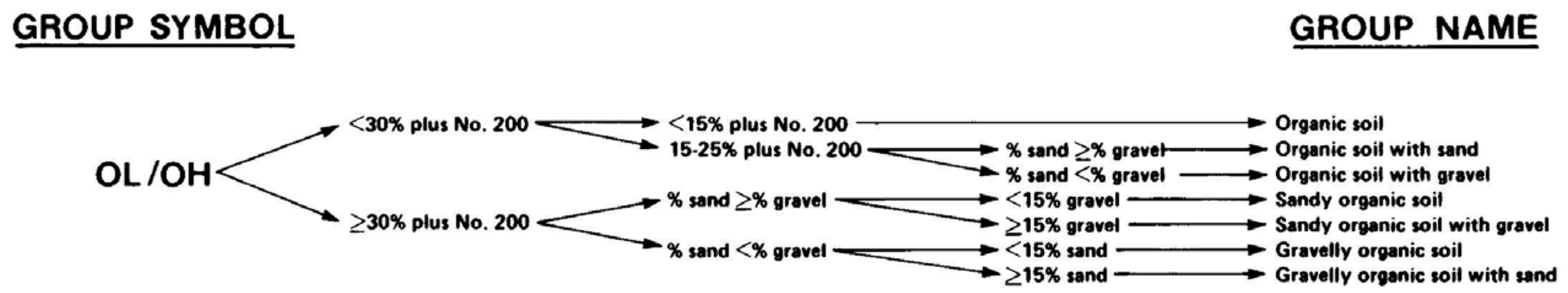
LIST OF FIGURES

LIST OF ATTACHMENTS

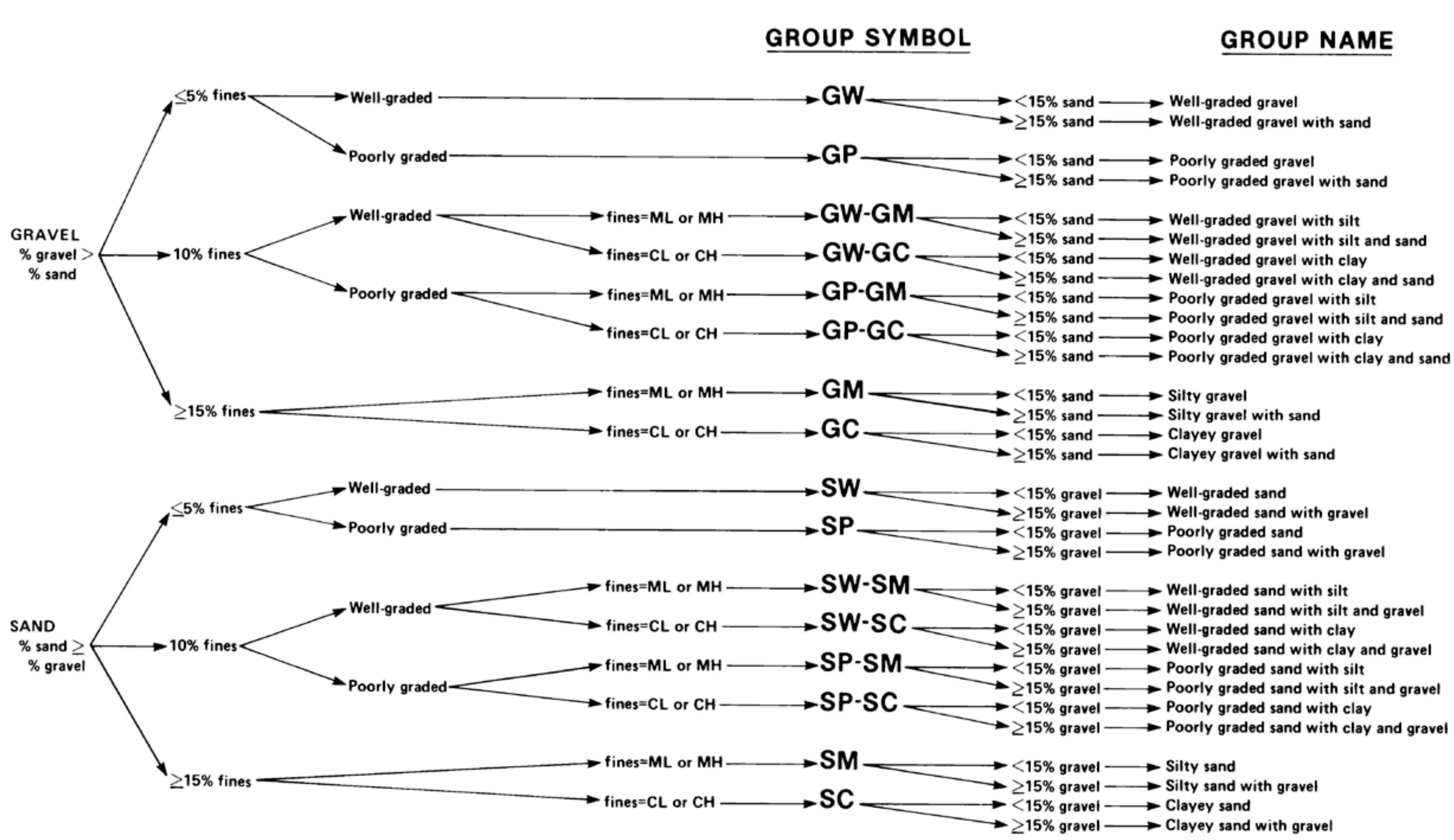
FIGURE 1
ASTM D2488 PHYSICAL DESCRIPTION FLOW CHARTS



Flow Chart for Identifying Inorganic, Fine-Grained Soils (50% or more fines)



Flow Chart for Identifying Organic, Fine-Grained Soils (50% or more fines)



Flow Chart for Identifying Coarse-Grained Soils (50% or less fines)

ATTACHMENT A
ASTM D2488

Designation: D 2488 – 00

Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)[1]

This standard is issued under the fixed designation D 2488; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense.

1. Scope *

1.1 This practice covers procedures for the description of soils for engineering purposes.

1.2 This practice also describes a procedure for identifying soils, at the option of the user, based on the classification system described in Test Method D 2487. The identification is based on visual examination and manual tests. It must be clearly stated in reporting an identification that it is based on visual-manual procedures.

1.2.1 When precise classification of soils for engineering purposes is required, the procedures prescribed in Test Method D 2487 shall be used.

1.2.2 In this practice, the identification portion assigning a group symbol and name is limited to soil particles smaller than 3 in. (75 mm).

1.2.3 The identification portion of this practice is limited to naturally occurring soils (disturbed and undisturbed).

NOTE 1—This practice may be used as a descriptive system applied to such materials as shale, claystone, shells, crushed rock, etc. (see Appendix X2).

1.3 The descriptive information in this practice may be used with other soil classification systems or for materials other than naturally occurring soils.

1.4 The values stated in inch-pound units are to be regarded as the standard.

1.5 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific precautionary statements see Section 8.

1.6 *This practice offers a set of instructions for performing one or more specific operations. This document cannot replace education or experience and should be used in conjunction with professional judgment. Not all aspects of this practice may be applicable in all circumstances. This ASTM standard is not intended to represent or replace the standard of care by which the adequacy of a given professional service must be judged, nor should this document be applied without consideration of a project's many unique aspects. The word "Standard" in the title of this document means only that the document has been approved through the ASTM consensus process.*

2. Referenced Documents

2.1 *ASTM Standards:*

D 653 Terminology Relating to Soil, Rock, and Contained Fluids[2]

D 1452 Practice for Soil Investigation and Sampling by Auger Borings[2]

D 1586 Test Method for Penetration Test and Split-Barrel Sampling of Soils[2]

D 1587 Practice for Thin-Walled Tube Sampling of Soils[2]

D 2113 Practice for Diamond Core Drilling for Site Investigation[2]

D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)[2]

D 3740 Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and rock as Used in Engineering Design and Construction[3]

D 4083 Practice for Description of Frozen Soils (Visual-Manual Procedure)[2]

3. Terminology

3.1 *Definitions*—Except as listed below, all definitions are in accordance with Terminology D 653.

NOTE 2—For particles retained on a 3-in. (75-mm) US standard sieve, the following definitions are suggested:
Cobbles—particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. (75-mm) sieve, and
Boulders—particles of rock that will not pass a 12-in. (300-mm) square opening.

3.1.1 *clay*—soil passing a No. 200 (75-μm) sieve that can be made to exhibit plasticity (putty-like properties) within a range of water contents, and that exhibits considerable strength when air-dry. For classification, a clay is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index equal to or greater than 4, and the plot of plasticity index versus liquid

[1] This practice is under the jurisdiction of ASTM Committee D-18 on Soil and Rock and is the direct responsibility of Subcommittee D18.07 on Identification and Classification of Soils.

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[2] *Annual Book of ASTM Standards*, Vol 04.08.

[3] *Annual Book of ASTM Standards*, Vol 04.09.

***A Summary of Changes section appears at the end of this standard.**

limit falls on or above the "A" line (see Fig. 3 of Test Method D 2487).

3.1.2 *gravel*—particles of rock that will pass a 3-in. (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

coarse—passes a 3-in. (75-mm) sieve and is retained on a ¾-in. (19-mm) sieve.

fine—passes a ¾-in. (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve.

3.1.3 *organic clay*—a clay with sufficient organic content to influence the soil properties. For classification, an organic clay is a soil that would be classified as a clay, except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.4 *organic silt*—a silt with sufficient organic content to influence the soil properties. For classification, an organic silt is a soil that would be classified as a silt except that its liquid limit value after oven drying is less than 75 % of its liquid limit value before oven drying.

3.1.5 *peat*—a soil composed primarily of vegetable tissue in various stages of decomposition usually with an organic odor, a dark brown to black color, a spongy consistency, and a texture ranging from fibrous to amorphous.

3.1.6 *sand*—particles of rock that will pass a No. 4 (4.75-mm) sieve and be retained on a No. 200 (75-µm) sieve with the following subdivisions:

coarse—passes a No. 4 (4.75-mm) sieve and is retained on a No. 10 (2.00-mm) sieve.

medium—passes a No. 10 (2.00-mm) sieve and is retained on a No. 40 (425-µm) sieve.

fine—passes a No. 40 (425-µm) sieve and is retained on a No. 200 (75-µm) sieve.

3.1.7 *silt*—soil passing a No. 200 (75-µm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air dry. For classification, a silt is a fine-grained soil, or the fine-grained portion of a soil, with a plasticity index less than 4, or the plot of plasticity index versus liquid limit falls below the "A" line (see Fig. 3 of Test Method D 2487).

4. Summary of Practice

4.1 Using visual examination and simple manual tests, this practice gives standardized criteria and procedures for describing and identifying soils.

4.2 The soil can be given an identification by assigning a group symbol(s) and name. The flow charts, Fig. 1a and Fig. 1b for fine-grained soils, and Fig. 2, for coarse-grained soils, can be used to assign the appropriate group symbol(s) and name. If the soil has properties which do not distinctly place it into a specific group, borderline symbols may be used, see Appendix X3.

NOTE 3—It is suggested that a distinction be made between *dual symbols* and *borderline symbols.*

Dual Symbol—A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC, CL-ML used to indicate that the soil has been identified as having the properties of a classification in accordance with Test Method D 2487 where two symbols are required. Two symbols are required when the soil has between 5 and 12 % fines or when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart.

Borderline Symbol—A borderline symbol is two symbols separated by a slash, for example, CL/CH, GM/SM, CL/ML. A borderline symbol should be used to indicate that the soil has been identified as having properties that do not distinctly place the soil into a specific group (see Appendix X3).

5. Significance and Use

5.1 The descriptive information required in this practice can be used to describe a soil to aid in the evaluation of its significant properties for engineering use.

5.2 The descriptive information required in this practice should be used to supplement the classification of a soil as determined by Test Method D 2487.

5.3 This practice may be used in identifying soils using the classification group symbols and names as prescribed in Test Method D 2487. Since the names and symbols used in this practice to identify the soils are the same as those used in Test Method D 2487, it shall be clearly stated in reports and all other appropriate documents, that the classification symbol and name are based on visual-manual procedures.

5.4 This practice is to be used not only for identification of soils in the field, but also in the office, laboratory, or wherever soil samples are inspected and described.

5.5 This practice has particular value in grouping similar soil samples so that only a minimum number of laboratory tests need be run for positive soil classification.

NOTE 4—The ability to describe and identify soils correctly is learned more readily under the guidance of experienced personnel, but it may also be acquired systematically by comparing numerical laboratory test results for typical soils of each type with their visual and manual characteristics.

5.6 When describing and identifying soil samples from a given boring, test pit, or group of borings or pits, it is not necessary to follow all of the procedures in this practice for every sample. Soils which appear to be similar can be grouped together; one sample completely described and identified with the others referred to as similar based on performing only a few of the descriptive and identification procedures described in this practice.

5.7 This practice may be used in combination with Practice D 4083 when working with frozen soils.

NOTE 5—Notwithstanding the statements on precision and bias contained in this standard: The precision of this test method is dependent on the competence of the personnel performing it and the suitability of the equipment and facilities used. Agencies that meet the criteria of Practice D 3740 are generally considered capable of competent and objective testing. Users of this test method are cautioned that compliance with Practice D 3740 does not in itself assure reliable testing. Reliable testing depends on several factors; Practice D 3740 provides a means for evaluating some of those factors.

6. Apparatus

6.1 *Required Apparatus*:

6.1.1 *Pocket Knife or Small Spatula*.

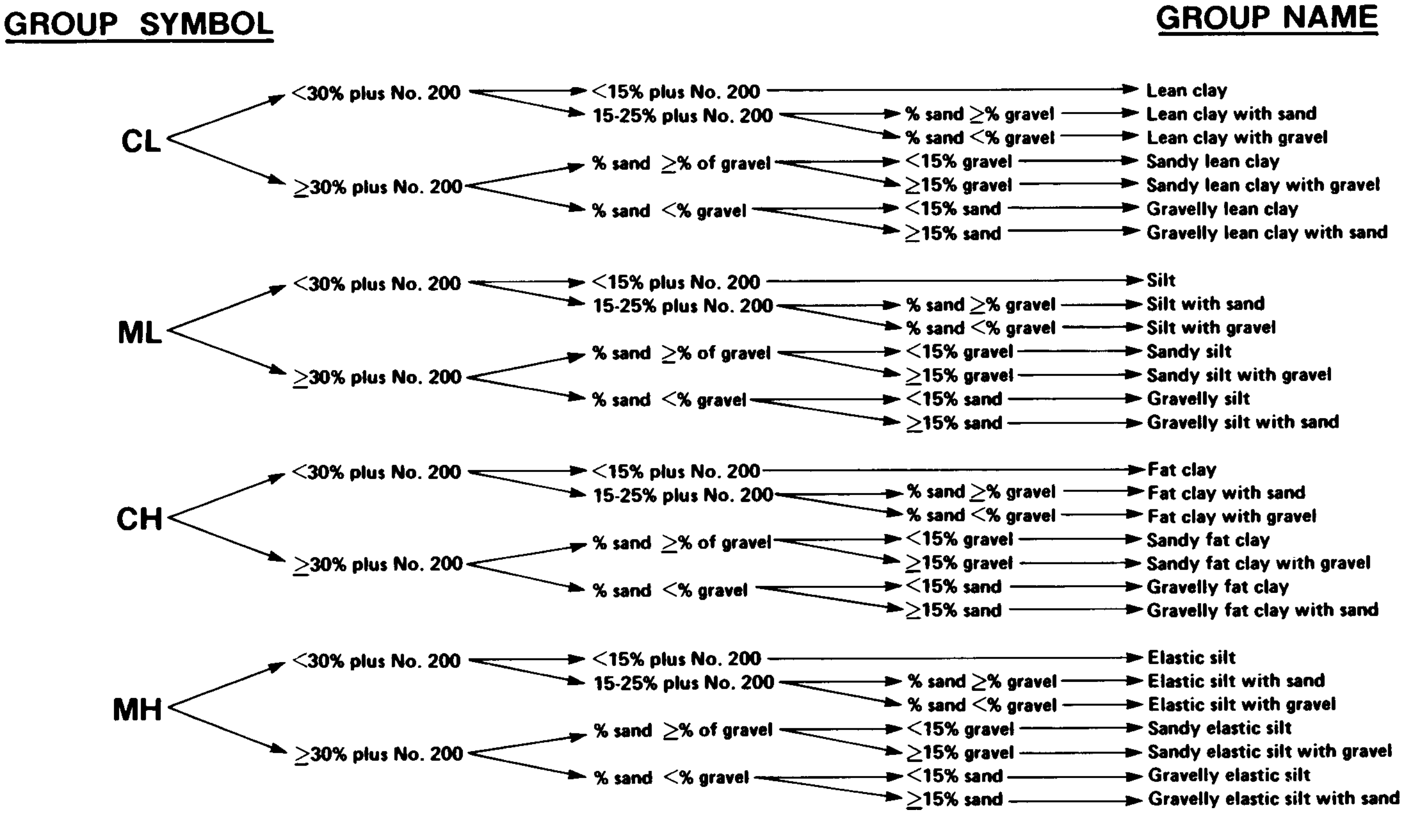
6.2 *Useful Auxiliary Apparatus*:

6.2.1 *Small Test Tube and Stopper* (or jar with a lid).

6.2.2 *Small Hand Lens*.

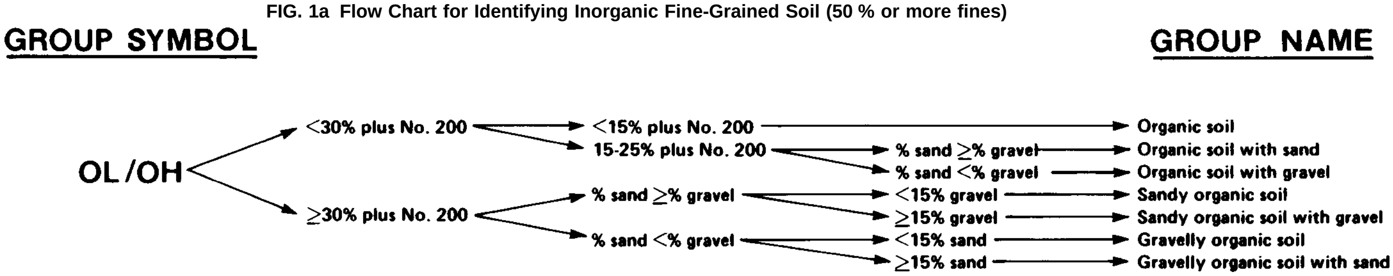
7. Reagents

7.1 *Purity of Water*—Unless otherwise indicated, references to water shall be understood to mean water from a city water



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)

supply or natural source, including non-potable water.

7.2 *Hydrochloric Acid*—A small bottle of dilute hydrochloric acid, HCl, one part HCl (10 *N*) to three parts water (This reagent is optional for use with this practice). See Section 8.

8. Safety Precautions

8.1 When preparing the dilute HCl solution of one part concentrated hydrochloric acid (10 *N*) to three parts of distilled water, slowly add acid into water following necessary safety precautions. Handle with caution and store safely. If solution comes into contact with the skin, rinse thoroughly with water.

8.2 **Caution**—Do not add water to acid.

9. Sampling

9.1 The sample shall be considered to be representative of the stratum from which it was obtained by an appropriate, accepted, or standard procedure.

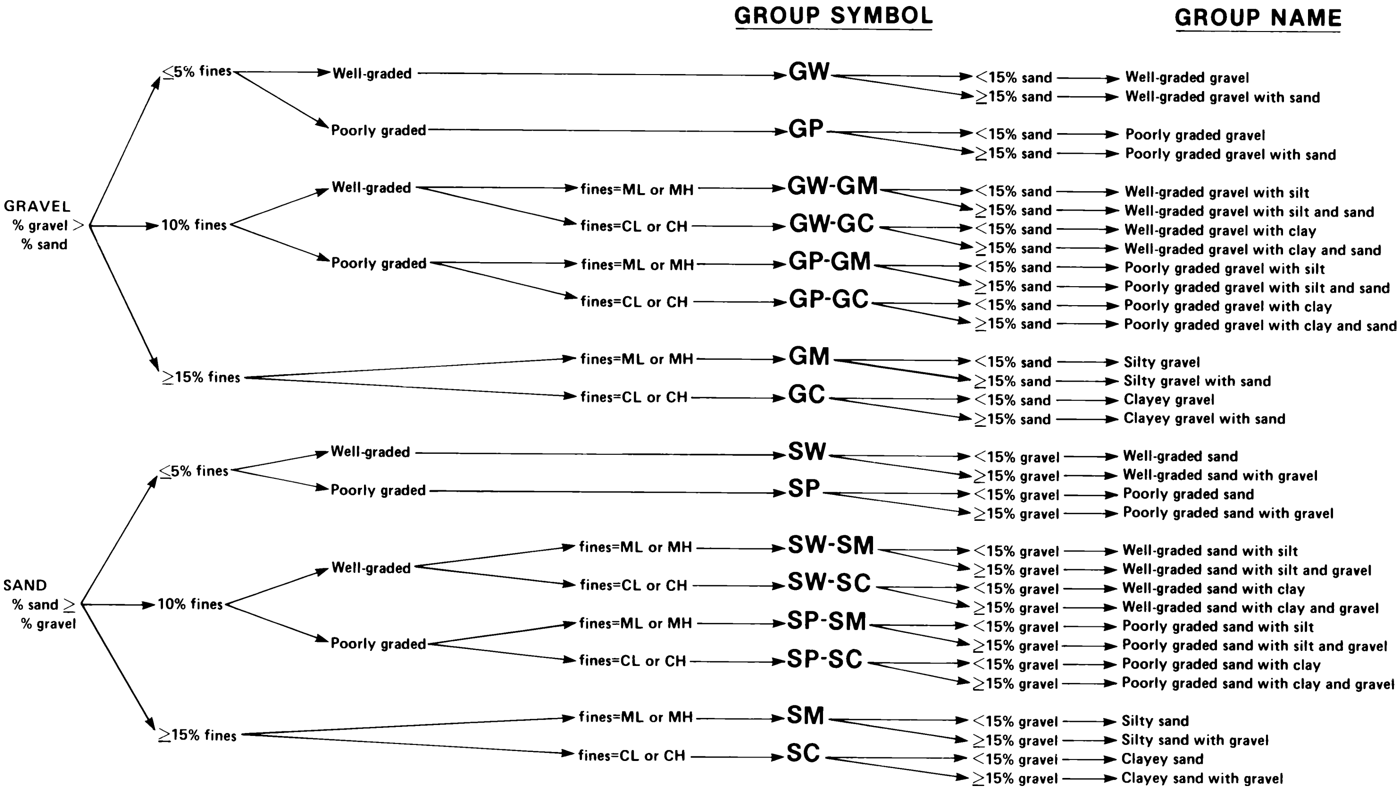
NOTE 6—Preferably, the sampling procedure should be identified as having been conducted in accordance with Practices D 1452, D 1587, or D 2113, or Test Method D 1586.

9.2 The sample shall be carefully identified as to origin.

NOTE 7—Remarks as to the origin may take the form of a boring number and sample number in conjunction with a job number, a geologic stratum, a pedologic horizon or a location description with respect to a permanent monument, a grid system or a station number and offset with respect to a stated centerline and a depth or elevation.

9.3 For accurate description and identification, the minimum amount of the specimen to be examined shall be in accordance with the following schedule:

Maximum Particle Size, Sieve Opening	Minimum Specimen Size, Dry Weight
4.75 mm (No. 4)	100 g (0.25 lb)
9.5 mm (3⁄8 in.)	200 g (0.5 lb)
19.0 mm (3⁄4 in.)	1.0 kg (2.2 lb)
38.1 mm (11⁄2 in.)	8.0 kg (18 lb)
75.0 mm (3 in.)	60.0 kg (132 lb)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)

NOTE 8—If random isolated particles are encountered that are significantly larger than the particles in the soil matrix, the soil matrix can be accurately described and identified in accordance with the preceeding schedule.

9.4 If the field sample or specimen being examined is smaller than the minimum recommended amount, the report shall include an appropriate remark.

10. Descriptive Information for Soils

10.1 *Angularity*—Describe the angularity of the sand (coarse sizes only), gravel, cobbles, and boulders, as angular, subangular, subrounded, or rounded in accordance with the criteria in Table 1 and Fig. 3. A range of angularity may be stated, such as: subrounded to rounded.

10.2 *Shape*—Describe the shape of the gravel, cobbles, and boulders as flat, elongated, or flat and elongated if they meet the criteria in Table 2 and Fig. 4. Otherwise, do not mention the shape. Indicate the fraction of the particles that have the shape, such as: one-third of the gravel particles are flat.

TABLE 1 Criteria for Describing Angularity of Coarse-Grained Particles (see Fig. 3)

Description	Criteria
Angular	Particles have sharp edges and relatively plane sides with unpolished surfaces
Subangular	Particles are similar to angular description but have rounded edges
Subrounded	Particles have nearly plane sides but have well-rounded corners and edges
Rounded	Particles have smoothly curved sides and no edges

10.3 *Color*—Describe the color. 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. If the sample contains layers or patches of varying colors, this shall be noted and all representative colors shall be described. The color shall be described for moist samples. If the color represents a dry condition, this shall be stated in the report.

10.4 *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 product, chemical, and the like), it shall be described.

10.5 *Moisture Condition*—Describe the moisture condition as dry, moist, or wet, in accordance with the criteria in Table 3.

10.6 *HCl Reaction*—Describe the reaction with HCl as none, weak, or strong, in accordance with the critera in Table 4. Since calcium carbonate is a common cementing agent, a report of its presence on the basis of the reaction with dilute hydrochloric acid is important.

10.7 *Consistency*—For intact fine-grained soil, describe the consistency as very soft, soft, firm, hard, or very hard, in accordance with the criteria in Table 5. This observation is inappropriate for soils with significant amounts of gravel.

10.8 *Cementation*—Describe the cementation of intact coarse-grained soils as weak, moderate, or strong, in accordance with the criteria in Table 6.

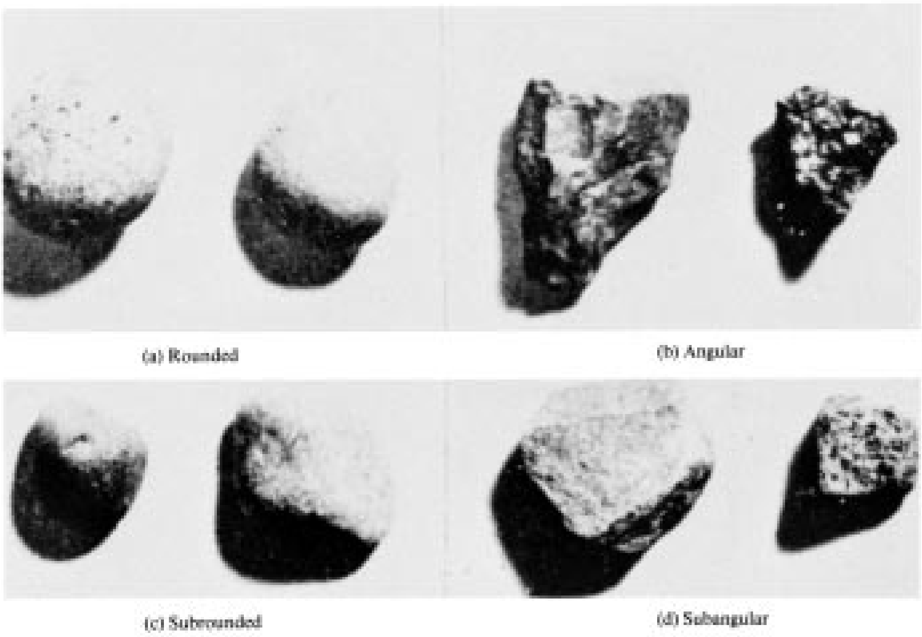


FIG. 3 Typical Angularity of Bulky Grains

TABLE 2 Criteria for Describing Particle Shape (see Fig. 4)

The particle shape shall be described as follows where length, width, and thickness refer to the greatest, intermediate, and least dimensions of a particle, respectively.

Flat	Particles with width/thickness > 3
Elongated	Particles with length/width > 3
Flat and elongated	Particles meet criteria for both flat and elongated

10.9 *Structure*—Describe the structure of intact soils in accordance with the criteria in Table 7.

10.10 *Range of Particle Sizes*—For gravel and sand components, describe the range of particle sizes within each component as defined in 3.1.2 and 3.1.6. For example, about 20 % fine to coarse gravel, about 40 % fine to coarse sand.

10.11 *Maximum Particle Size*—Describe the maximum particle size found in the sample in accordance with the following information:

10.11.1 *Sand Size*—If the maximum particle size is a sand size, describe as fine, medium, or coarse as defined in 3.1.6. For example: maximum particle size, medium sand.

10.11.2 *Gravel Size*—If the maximum particle size is a gravel size, describe the maximum particle size as the smallest sieve opening that the particle will pass. For example, maximum particle size, 1½ in. (will pass a 1½-in. square opening but not a ¾-in. square opening).

10.11.3 *Cobble or Boulder Size*—If the maximum particle size is a cobble or boulder size, describe the maximum dimension of the largest particle. For example: maximum dimension, 18 in. (450 mm).

10.12 *Hardness*—Describe the hardness of coarse sand and larger particles as hard, or state what happens when the particles are hit by a hammer, for example, gravel-size particles fracture with considerable hammer blow, some gravel-size particles crumble with hammer blow. "Hard" means particles do not crack, fracture, or crumble under a hammer blow.

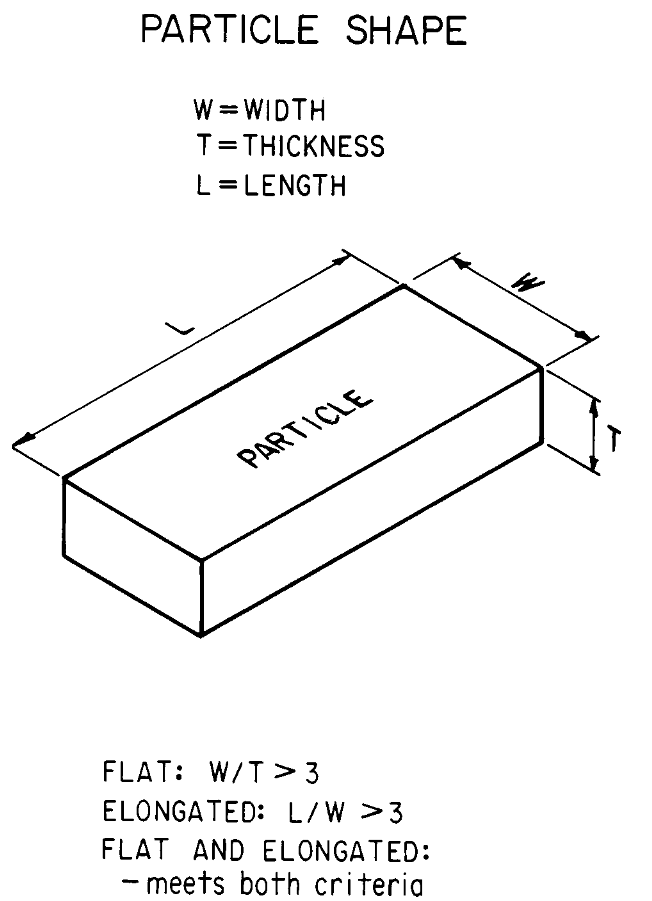


FIG. 4 Criteria for Particle Shape

10.13 Additional comments shall be noted, such as the presence of roots or root holes, difficulty in drilling or augering

TABLE 3 Criteria for Describing Moisture Condition

Description	Criteria
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

TABLE 4 Criteria for Describing the Reaction With HCl

Description	Criteria
None	No visible reaction
Weak	Some reaction, with bubbles forming slowly
Strong	Violent reaction, with bubbles forming immediately

TABLE 5 Criteria for Describing Dilatancy

Description	Criteria
Very soft	Thumb will penetrate soil more than 1 in. (25 mm)
Soft	Thumb will penetrate soil about 1 in. (25 mm)
Firm	Thumb will indent soil about ¼in. (6 mm)
Hard	Thumb will not indent soil but readily indented with thumbnail
Very hard	Thumbnail will not indent soil

TABLE 6 Criteria for Describing Toughness

Description	Criteria
Weak	Crumbles or breaks with handling or little finger pressure
Moderate	Crumbles or breaks with considerable finger pressure
Strong	Will not crumble or break with finger pressure

TABLE 7 Criteria for Describing Dilatancy

Description	Criteria
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick; note thickness
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture 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	Same color and appearance throughout

hole, caving of trench or hole, or the presence of mica.

10.14 A local or commercial name or a geologic interpretation of the soil, or both, may be added if identified as such.

10.15 A classification or identification of the soil in accordance with other classification systems may be added if identified as such.

11. Identification of Peat

11.1 A sample composed primarily of vegetable tissue in various stages of decomposition that has a fibrous to amorphous texture, usually a dark brown to black color, and an organic odor, shall be designated as a highly organic soil and shall be identified as peat, PT, and not subjected to the identification procedures described hereafter.

12. Preparation for Identification

12.1 The soil identification portion of this practice is based on the portion of the soil sample that will pass a 3-in. (75-mm) sieve. The larger than 3-in. (75-mm) particles must be removed, manually, for a loose sample, or mentally, for an intact sample before classifying the soil.

12.2 Estimate and note the percentage of cobbles and the percentage of boulders. Performed visually, these estimates will be on the basis of volume percentage.

NOTE 9—Since the percentages of the particle-size distribution in Test Method D 2487 are by dry weight, and the estimates of percentages for gravel, sand, and fines in this practice are by dry weight, it is recommended that the report state that the percentages of cobbles and boulders are by volume.

12.3 Of the fraction of the soil smaller than 3 in. (75 mm), estimate and note the percentage, by dry weight, of the gravel, sand, and fines (see Appendix X4 for suggested procedures).

NOTE 10—Since the particle-size components appear visually on the basis of volume, considerable experience is required to estimate the percentages on the basis of dry weight. Frequent comparisons with laboratory particle-size analyses should be made.

12.3.1 The percentages shall be estimated to the closest 5 %. The percentages of gravel, sand, and fines must add up to 100 %.

12.3.2 If one of the components is present but not in sufficient quantity to be considered 5 % of the smaller than 3-in. (75-mm) portion, indicate its presence by the term *trace*, for example, trace of fines. A trace is not to be considered in the total of 100 % for the components.

13. Preliminary Identification

13.1 The soil is *fine grained* if it contains 50 % or more fines. Follow the procedures for identifying fine-grained soils of Section 14.

13.2 The soil is *coarse grained* if it contains less than 50 % fines. Follow the procedures for identifying coarse-grained soils of Section 15.

14. Procedure for Identifying Fine-Grained Soils

14.1 Select a representative sample of the material for examination. Remove particles larger than the No. 40 sieve (medium sand and larger) until a specimen equivalent to about a handful of material is available. Use this specimen for performing the dry strength, dilatancy, and toughness tests.

14.2 *Dry Strength*:

14.2.1 From the specimen, select enough material to mold into a ball about 1 in. (25 mm) in diameter. Mold the material until it has the consistency of putty, adding water if necessary.

14.2.2 From the molded material, make at least three test specimens. A test specimen shall be a ball of material about ½ in. (12 mm) in diameter. Allow the test specimens to dry in air, or sun, or by artificial means, as long as the temperature does not exceed 60°C.

14.2.3 If the test specimen contains natural dry lumps, those that are about ½ in. (12 mm) in diameter may be used in place of the molded balls.

NOTE 11—The process of molding and drying usually produces higher strengths than are found in natural dry lumps of soil.

14.2.4 Test the strength of the dry balls or lumps by crushing between the fingers. Note the strength as none, low, medium, high, or very high in accorance with the criteria in Table 8. If natural dry lumps are used, do not use the results of any of the lumps that are found to contain particles of coarse sand.

14.2.5 The presence of high-strength water-soluble cementing materials, such as calcium carbonate, may cause exceptionally high dry strengths. The presence of calcium carbonate can usually be detected from the intensity of the reaction with dilute hydrochloric acid (see 10.6).

14.3 *Dilatancy*:

14.3.1 From the specimen, select enough material to mold into a ball about ½ in. (12 mm) in diameter. Mold the material, adding water if necessary, until it has a soft, but not sticky, consistency.

14.3.2 Smooth the soil 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 hand several times. Note the reaction of water appearing on the surface of the soil. Squeeze the sample by closing the hand or pinching the soil between the fingers, and note the reaction as none, slow, or rapid in accordance with the criteria in Table 9. The reaction is the speed with which water appears while shaking, and disappears while squeezing.

14.4 *Toughness*:

14.4.1 Following the completion of the dilatancy test, the test specimen is shaped into an elongated pat and rolled by hand on a smooth surface or between the palms into a thread about ⅛ in. (3 mm) in diameter. (If the sample is too wet to roll easily, it should be spread into a thin layer and allowed to lose some water by evaporation.) Fold the sample threads and reroll repeatedly until the thread crumbles at a diameter of about ⅛ in. The thread will crumble at a diameter of ⅛ in. when the soil is near the plastic limit. Note the pressure required to roll the thread near the plastic limit. Also, note the strength of the thread. After the thread crumbles, the pieces should be lumped together and kneaded until the lump crumbles. Note the toughness of the material during kneading.

14.4.2 Describe the toughness of the thread and lump as low, medium, or high in accordance with the criteria in Table 10.

14.5 *Plasticity*—On the basis of observations made during the toughness test, describe the plasticity of the material in accordance with the criteria given in Table 11.

14.6 Decide whether the soil is an *inorganic* or an *organic* fine-grained soil (see 14.8). If inorganic, follow the steps given in 14.7.

TABLE 8 Criteria for Describing Toughness

Description	Criteria
None	The dry specimen crumbles into powder with mere pressure of handling
Low	The dry specimen crumbles into powder 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. Specimen will break into pieces between thumb and a hard surface
Very high	The dry specimen cannot be broken between the thumb and a hard surface

TABLE 9 Criteria for Describing Dilatancy

Description	Criteria
None	No visible change in the specimen
Slow	Water appears slowly on the surface of the specimen during shaking and does not disappear or disappears slowly upon squeezing
Rapid	Water appears quickly on the surface of the specimen during shaking and disappears quickly upon squeezing

TABLE 10 Criteria for Describing Toughness

Description	Criteria
Low	Only slight pressure is required to roll the thread near the plastic limit. The thread and the lump are weak and soft
Medium	Medium pressure is required to roll the thread to near the plastic limit. The thread and the lump have medium stiffness
High	Considerable pressure is required to roll the thread to near the plastic limit. The thread and the lump have very high stiffness

TABLE 11 Criteria for Describing Plasticity

Description	Criteria
Nonplastic	A ⅛-in. (3-mm) thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit

14.7 *Identification of Inorganic Fine-Grained Soils*:

14.7.1 Identify the soil as a *lean clay*, CL, if the soil has medium to high dry strength, no or slow dilatancy, and medium toughness and plasticity (see Table 12).

14.7.2 Identify the soil as a *fat clay*, CH, if the soil has high to very high dry strength, no dilatancy, and high toughness and plasticity (see Table 12).

14.7.3 Identify the soil as a *silt*, ML, if the soil has no to low dry strength, slow to rapid dilatancy, and low toughness and plasticity, or is nonplastic (see Table 12).

14.7.4 Identify the soil as an *elastic silt*, MH, if the soil has low to medium dry strength, no to slow dilatancy, and low to medium toughness and plasticity (see Table 12).

NOTE 12—These properties are similar to those for a lean clay. However, the silt will dry quickly on the hand and have a smooth, silky feel when dry. Some soils that would classify as MH in accordance with the criteria in Test Method D 2487 are visually difficult to distinguish from lean clays, CL. It may be necessary to perform laboratory testing for proper identification.

TABLE 12 Identification of Inorganic Fine-Grained Soils from Manual Tests

Soil Symbol	Dry Strength	Dilatancy	Toughness
ML	None to low	Slow to rapid	Low or thread cannot be formed
CL	Medium to high	None to slow	Medium
MH	Low to medium	None to slow	Low to medium
CH	High to very high	None	High

14.8 *Identification of Organic Fine-Grained Soils*:

14.8.1 Identify the soil as an *organic soil*, OL/OH, if the soil contains enough organic particles to influence the soil properties. 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 for the toughness test will be spongy.

NOTE 13—In some cases, through practice and experience, it may be possible to further identify the organic soils as organic silts or organic clays, OL or OH. Correlations between the dilatancy, dry strength, toughness tests, and laboratory tests can be made to identify organic soils in certain deposits of similar materials of known geologic origin.

14.9 If the soil is estimated to have 15 to 25 % sand or gravel, or both, the words "with sand" or "with gravel" (whichever is more predominant) shall be added to the group name. For example: "lean clay with sand, CL" or "silt with gravel, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percentage of gravel, use "with sand."

14.10 If the soil is estimated to have 30 % or more sand or gravel, or both, the words "sandy" or "gravelly" shall be added to the group name. Add the word "sandy" if there appears to be more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy lean clay, CL", "gravelly fat clay, CH", or "sandy silt, ML" (see Fig. 1a and Fig. 1b). If the percentage of sand is equal to the percent of gravel, use "sandy."

15. Procedure for Identifying Coarse-Grained Soils

(Contains less than 50 % fines)

15.1 The soil is a *gravel* if the percentage of gravel is estimated to be more than the percentage of sand.

15.2 The soil is a *sand* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

15.3 The soil is a *clean gravel* or *clean sand* if the percentage of fines is estimated to be 5 % or less.

15.3.1 Identify the soil as a *well-graded gravel*, GW, or as a *well-graded sand*, SW, if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes.

15.3.2 Identify the soil as a *poorly graded gravel*, GP, or as a *poorly graded sand*, SP, if it consists predominantly of one size (uniformly graded), or it has a wide range of sizes with some intermediate sizes obviously missing (gap or skip graded).

15.4 The soil is either a *gravel with fines* or a *sand with fines* if the percentage of fines is estimated to be 15 % or more.

15.4.1 Identify the soil as a *clayey gravel*, GC, or a *clayey sand*, SC, if the fines are clayey as determined by the procedures in Section 14.

15.4.2 Identify the soil as a *silty gravel*, GM, or a *silty sand*, SM, if the fines are silty as determined by the procedures in Section 14.

15.5 If the soil is estimated to contain 10 % fines, give the soil a dual identification using two group symbols.

15.5.1 The first group symbol shall correspond to a clean gravel or sand (GW, GP, SW, SP) and the second symbol shall correspond to a gravel or sand with fines (GC, GM, SC, SM).

15.5.2 The group name shall correspond to the first group symbol plus the words "with clay" or "with silt" to indicate the plasticity characteristics of the fines. For example: "well-graded gravel with clay, GW-GC" or "poorly graded sand with silt, SP-SM" (see Fig. 2).

15.6 If the specimen is predominantly sand or gravel but contains an estimated 15 % or more of the other coarse-grained constituent, the words "with gravel" or "with sand" shall be added to the group name. For example: "poorly graded gravel with sand, GP" or "clayey sand with gravel, SC" (see Fig. 2).

15.7 If the field sample contains any cobbles or boulders, or both, the words "with cobbles" or "with cobbles and boulders" shall be added to the group name. For example: "silty gravel with cobbles, GM."

16. Report

16.1 The report shall include the information as to origin, and the items indicated in Table 13.

NOTE 14—*Example: Clayey Gravel with Sand and Cobbles, GC*—About 50 % fine to coarse, subrounded to subangular gravel; about 30 % fine to coarse, subrounded sand; about 20 % fines with medium plasticity, high dry strength, no dilatancy, medium toughness; weak reaction with HCl; original field sample had about 5 % (by volume) subrounded cobbles, maximum dimension, 150 mm.

In-Place Conditions—Firm, homogeneous, dry, brown

Geologic Interpretation—Alluvial fan

NOTE 15—Other examples of soil descriptions and identification are given in Appendix X1 and Appendix X2.

NOTE 16—If desired, the percentages of gravel, sand, and fines may be stated in terms indicating a range of percentages, as follows:

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 %

TABLE 13 Checklist for Description of Soils

1. Group name
2. Group symbol
3. Percent of cobbles or boulders, or both (by volume)
4. Percent of gravel, sand, or fines, or all three (by dry weight)
5. Particle-size range:
   Gravel—fine, coarse
   Sand—fine, medium, coarse
6. Particle angularity: angular, subangular, subrounded, rounded
7. Particle shape: (if appropriate) flat, elongated, flat and elongated
8. Maximum particle size or dimension
9. Hardness of coarse sand and larger particles
10. Plasticity of fines: nonplastic, low, medium, high
11. Dry strength: none, low, medium, high, very high
12. Dilatancy: none, slow, rapid
13. Toughness: low, medium, high
14. Color (in moist condition)
15. Odor (mention only if organic or unusual)
16. Moisture: dry, moist, wet
17. Reaction with HCl: none, weak, strong

For intact samples:

18. Consistency (fine-grained soils only): very soft, soft, firm, hard, very hard
19. Structure: stratified, laminated, fissured, slickensided, lensed, homogeneous
20. Cementation: weak, moderate, strong
21. Local name
22. Geologic interpretation
23. Additional comments: presence of roots or root holes, presence of mica, gypsum, etc., surface coatings on coarse-grained particles, caving or sloughing of auger hole or trench sides, difficulty in augering or excavating, etc.

16.2 If, in the soil description, the soil is identified using a classification group symbol and name as described in Test Method D 2487, it must be distinctly and clearly stated in log forms, summary tables, reports, and the like, that the symbol and name are based on visual-manual procedures.

17. Precision and Bias

17.1 This practice provides qualitative information only, therefore, a precision and bias statement is not applicable.

18. Keywords

18.1 classification; clay; gravel; organic soils; sand; silt; soil classification; soil description; visual classification

APPENDIXES

(Nonmandatory Information)

X1. EXAMPLES OF VISUAL SOIL DESCRIPTIONS

X1.1 The following examples show how the information required in 16.1 can be reported. The information that is included in descriptions should be based on individual circumstances and need.

X1.1.1 *Well-Graded Gravel with Sand (GW)*—About 75 % fine to coarse, hard, subangular gravel; about 25 % fine to coarse, hard, subangular sand; trace of fines; maximum size, 75 mm, brown, dry; no reaction with HCl.

X1.1.2 *Silty Sand with Gravel (SM)*—About 60 % predominantly fine sand; about 25 % silty fines with low plasticity, low dry strength, rapid dilatancy, and low toughness; about 15 % fine, hard, subrounded gravel, a few gravel-size particles fractured with hammer blow; maximum size, 25 mm; no reaction with HCl (Note—Field sample size smaller than recommended).

In-Place Conditions—Firm, stratified and contains lenses of silt 1 to 2 in. (25 to 50 mm) thick, moist, brown to gray; in-place density 106 lb/ft^3; in-place moisture 9 %.

X1.1.3 *Organic Soil (OL/OH)*—About 100 % fines with low plasticity, slow dilatancy, low dry strength, and low toughness; wet, dark brown, organic odor; weak reaction with HCl.

X1.1.4 *Silty Sand with Organic Fines (SM)*—About 75 % fine to coarse, hard, subangular reddish sand; about 25 % organic and silty dark brown nonplastic fines with no dry strength and slow dilatancy; wet; maximum size, coarse sand; weak reaction with HCl.

X1.1.5 *Poorly Graded Gravel with Silt, Sand, Cobbles and Boulders (GP-GM)*—About 75 % fine to coarse, hard, subrounded to subangular gravel; about 15 % fine, hard, subrounded to subangular sand; about 10 % silty nonplastic fines; moist, brown; no reaction with HCl; original field sample had about 5 % (by volume) hard, subrounded cobbles and a trace of hard, subrounded boulders, with a maximum dimension of 18 in. (450 mm).

X2. USING THE IDENTIFICATION PROCEDURE AS A DESCRIPTIVE SYSTEM FOR SHALE, CLAYSTONE, SHELLS, SLAG, CRUSHED ROCK, AND THE LIKE

X2.1 The identification procedure may be used as a descriptive system applied to materials that exist in-situ as shale, claystone, sandstone, siltstone, mudstone, etc., but convert to soils after field or laboratory processing (crushing, slaking, and the like).

X2.2 Materials such as shells, crushed rock, slag, and the like, should be identified as such. However, the procedures used in this practice for describing the particle size and plasticity characteristics may be used in the description of the material. If desired, an identification using a group name and symbol according to this practice may be assigned to aid in describing the material.

X2.3 The group symbol(s) and group names should be placed in quotation marks or noted with some type of distinguishing symbol. See examples.

X2.4 Examples of how group names and symbols can be incororated into a descriptive system for materials that are not naturally occurring soils are as follows:

X2.4.1 *Shale Chunks*—Retrieved as 2 to 4-in. (50 to 100-mm) pieces of shale from power auger hole, dry, brown, no reaction with HCl. After slaking in water for 24 h, material identified as "Sandy Lean Clay (CL)"; about 60 % fines with medium plasticity, high dry strength, no dilatancy, and medium toughness; about 35 % fine to medium, hard sand; about 5 % gravel-size pieces of shale.

X2.4.2 *Crushed Sandstone*—Product of commercial crushing operation; "Poorly Graded Sand with Silt (SP-SM)"; about 90 % fine to medium sand; about 10 % nonplastic fines; dry, reddish-brown, strong reaction with HCl.

X2.4.3 *Broken Shells*—About 60 % gravel-size broken shells; about 30 % sand and sand-size shell pieces; about 10 % fines; "Poorly Graded Gravel with Sand (GP)."

X2.4.4 *Crushed Rock*—Processed from gravel and cobbles in Pit No. 7; "Poorly Graded Gravel (GP)"; about 90 % fine, hard, angular gravel-size particles; about 10 % coarse, hard, angular sand-size particles; dry, tan; no reaction with HCl.

X3. SUGGESTED PROCEDURE FOR USING A BORDERLINE SYMBOL FOR SOILS WITH TWO POSSIBLE IDENTIFICATIONS.

X3.1 Since this practice is based on estimates of particle size distribution and plasticity characteristics, it may be difficult to clearly identify the soil as belonging to one category. To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example: SC/CL or CL/CH.

X3.1.1 A borderline symbol may be used when the percentage of fines is estimated to be between 45 and 55 %. One symbol should be for a coarse-grained soil with fines and the other for a fine-grained soil. For example: GM/ML or CL/SC.

X3.1.2 A borderline symbol may be used when the percentage of sand and the percentage of gravel are estimated to be about the same. For example: GP/SP, SC/GC, GM/SM. It is practically impossible to have a soil that would have a borderline symbol of GW/SW.

X3.1.3 A borderline symbol may be used when the soil could be either well graded or poorly graded. For example: GW/GP, SW/SP.

X3.1.4 A borderline symbol may be used when the soil could either be a silt or a clay. For example: CL/ML, CH/MH, SC/SM.

X3.1.5 A borderline symbol may be used when a fine-grained soil has properties that indicate that it is at the boundary between a soil of low compressibility and a soil of high compressibility. For example: CL/CH, MH/ML.

X3.2 The order of the borderline symbols should reflect similarity to surrounding or adjacent soils. For example: soils in a borrow area have been identified as CH. One sample is considered to have a borderline symbol of CL and CH. To show similarity, the borderline symbol should be CH/CL.

X3.3 The group name for a soil with a borderline symbol should be the group name for the first symbol, except for:

CL/CH lean to fat clay
ML/CL clayey silt
CL/ML silty clay

X3.4 The use of a borderline symbol should not be used indiscriminately. Every effort shall be made to first place the soil into a single group.

X4. SUGGESTED PROCEDURES FOR ESTIMATING THE PERCENTAGES OF GRAVEL, SAND, AND FINES IN A SOIL SAMPLE

X4.1 *Jar Method*—The relative percentage of coarse- and fine-grained material may be estimated by thoroughly shaking a mixture of soil and water in a test tube or jar, and then allowing the mixture to settle. The coarse particles will fall to the bottom and successively finer particles will be deposited with increasing time; the sand sizes will fall out of suspension in 20 to 30 s. The relative proportions can be estimated from the relative volume of each size separate. This method should be correlated to particle-size laboratory determinations.

X4.2 *Visual Method*—Mentally visualize the gravel size particles placed in a sack (or other container) or sacks. Then, do the same with the sand size particles and the fines. Then, mentally compare the number of sacks to estimate the percentage of plus No. 4 sieve size and minus No. 4 sieve size present. The percentages of sand and fines in the minus sieve size No. 4 material can then be estimated from the wash test (X4.3).

X4.3 *Wash Test (for relative percentages of sand and fines)*—Select and moisten enough minus No. 4 sieve size material to form a 1-in (25-mm) cube of soil. Cut the cube in half, set one-half to the side, and place the other half in a small dish. Wash and decant the fines out of the material in the dish until the wash water is clear and then compare the two samples and estimate the percentage of sand and fines. Remember that the percentage is based on weight, not volume. However, the volume comparison will provide a reasonable indication of grain size percentages.

X4.3.1 While washing, it may be necessary to break down lumps of fines with the finger to get the correct percentages.

X5. ABBREVIATED SOIL CLASSIFICATION SYMBOLS

X5.1 In some cases, because of lack of space, an abbreviated system may be useful to indicate the soil classification symbol and name. Examples of such cases would be graphical logs, databases, tables, etc.

X5.2 This abbreviated system is not a substitute for the full name and descriptive information but can be used in supplementary presentations when the complete description is referenced.

X5.3 The abbreviated system should consist of the soil classification symbol based on this standard with appropriate lower case letter prefixes and suffixes as:

Prefix: Suffix:

s = sandy	s = with sand
g = gravelly	g = with gravel
	c = with cobbles
	b = with boulders

X5.4 The soil classification symbol is to be enclosed in parenthesis. Some examples would be:

Group Symbol and Full Name	Abbreviated
CL, Sandy lean clay	s(CL)
SP-SM, Poorly graded sand with silt and gravel	(SP-SM)g
GP, poorly graded gravel with sand, cobbles, and boulders	(GP)scb
ML, gravelly silt with sand and cobbles	g(ML)sc

SUMMARY OF CHANGES

In accordance with Committee D18 policy, this section identifies the location of changes to this standard since the last edition (1993$^{\epsilon 1}$) that may impact the use of this standard.

(1) Added Practice D 3740 to Section 2.

(2) Added Note 5 under 5.7 and renumbered subsequent notes.

ATTACHMENT B
SOIL/SEDIMENT CLASSIFICATION FIELD GUIDE

ANCHOR QEA

SOIL/SEDIMENT CLASSIFICATION FIELD GUIDE

SOIL/SEDIMENT DESCRIPTION COMPONENTS: USCS name (USCS symbol): density/consistency, moisture, color, list gravel/silt/sand by %; additional remarks

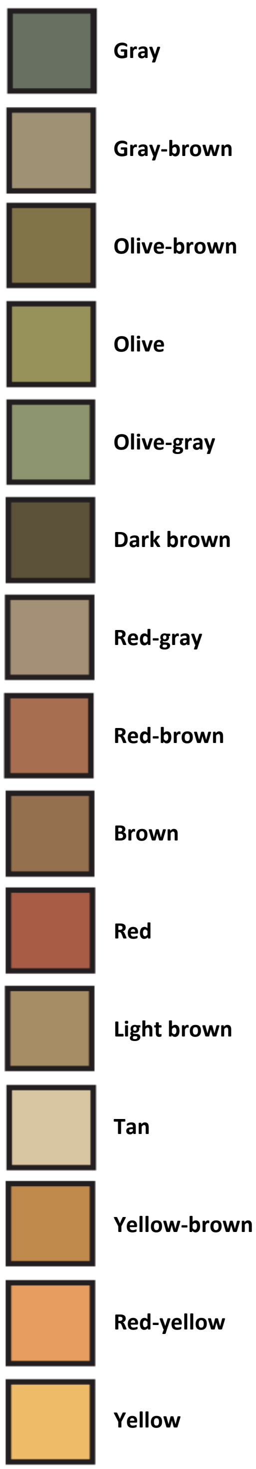
Example: SILTY SAND (SM): soft, wet, dark brown, 85% fine sand, 15% non-plastic fines, trace seashell fragments, strong H2S odor from 0 to 1.5 ft

Density of Coarse-grained (Cohesionless) Soils

Density	*Standard Penetration (N; blows/foot)*
Very Loose	0 to 4
Loose	4 to 10
Medium Dense	10 to 30
Dense	30 to 50
Very Dense	More than 50

Consistency of Fine-grained (Cohesive) Soils

Consistency	*Standard Penetration (N; blows/foot)*	*Unconfined Compressive Strength (tsf)*	*Manual Penetration Test*
Very Soft	0 to 2	<0.25	Thumb will penetrate soil more than 1 inch
Soft	2 to 4	0.25 to 0.5	Thumb will penetrate soil about 1 inch
Medium Stiff	4 to 8	0.5 to 1	Molded by moderate to firm finger pressure
Stiff	8 to 15	1 to 2	Readily indented by thumb, difficult to penetrate
Very Stiff	15 to 30	2 to 4	Readily indented by thumbnail
Hard	More than 30	>4	Indented with difficulty by thumbnail



Moisture Content

Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp, but no visible water
Wet	Visible, free water

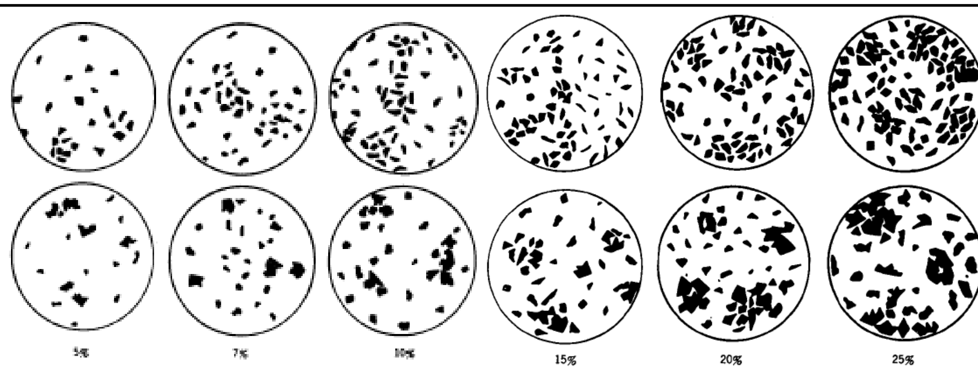
Particle Shape/Angularity

Description	*Criteria*
Rounded	Near-spherical or oval
Sub-rounded	Primarily rounded corners and edges
Sub-angular	Slightly rounded corners and edges
Angular	Sharp corners and edges

Grain Size

Soil Component		*Anthropogenic Component*	*Size Range (U.S. Standard Sieve)*	*Approximate Size*
Boulders		Blocks	>12 inches	larger than basketball
Cobbles		Pieces	3 to 12 inches	fist to basketball
Gravel	Coarse	Fragments	3/4 to 3 inches	thumb to fist
	Fine		#4 to 3/4 inches	pea to thumb
Sand	Coarse	Particles	#10 to #4	rock salt to pea
	Medium		#40 to #10	sugar to rock salt
	Fine		#200 to #40	flour to sugar
Fine Grained	Silt	Specks	Pass #200	finer than flour
	Clay			

Charts for Estimating Percentages (After Compton, 1962)



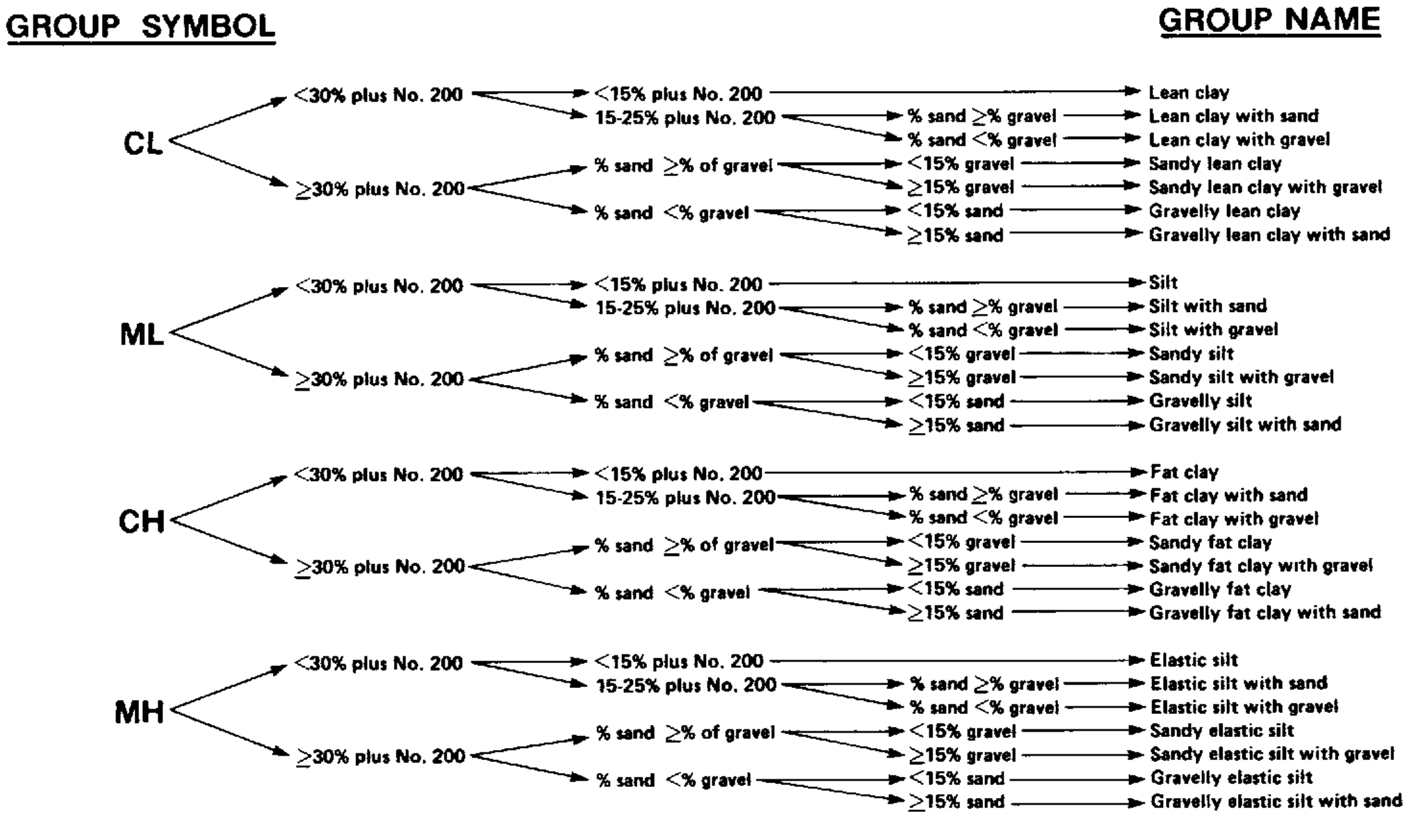
Index of Plasticity

Description	*Criteria*
Non-plastic	A 1/8 inch (3 mm) thread cannot be rolled at any water content. Has definite structure but can easily be separated or crumbled. Is readily rinsed off sampling equipment. Breaks easily when pieces are dried.
Low Plasticity	A thread can barely be rolled.
Medium Plasticity	A thread is easily rolled. Stays together relatively well when molded (i.e., behaves like Play-Doh). Can be washed off sampling equipment easily. Requires some effort to break when pieces are dried.
High Plasticity	A threat is easily rolled, and can be rerolled several times. Can be easily molded and stays together very well, but takes effort to rinse off of sampling equipment. Difficult to break when pieces are dried.

Criteria for Describing Soil Structure

Decomposed	Visible signs of breakdown, applicable to organic matter and rock.
Homogeneous	Same color and appearance throughout.
Interbedded	Alternating soil layers of different composition.
Lens	A very thin cohesive layer, less than .5-inch thick.
Layer	A general term for material lying essentially parallel to the surfaces against which it was formed (.5-inch to 12-inch thick).
Varved	A cyclic sedimentary couplet consisting of a coarser and a finer layer, representing variation in depositional energy.
Washed	Material missing in core tube due to loss through the bottom of sampler due to improper closing.

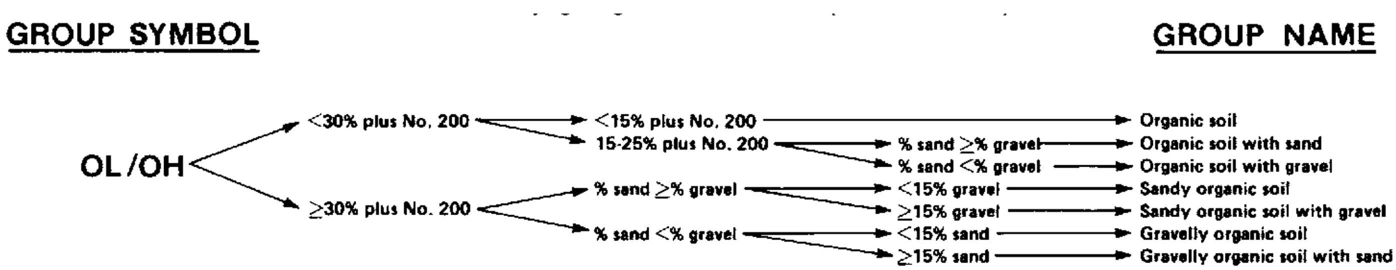
Flow Chart for Identifying Inorganic Fine-Grained Soil (50% or more fines)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1a Flow Chart for Identifying Inorganic Fine-Grained Soil (50 % or more fines)

Flow Chart for Identifying Organic Fine-Grained Soil (50% or more fines)

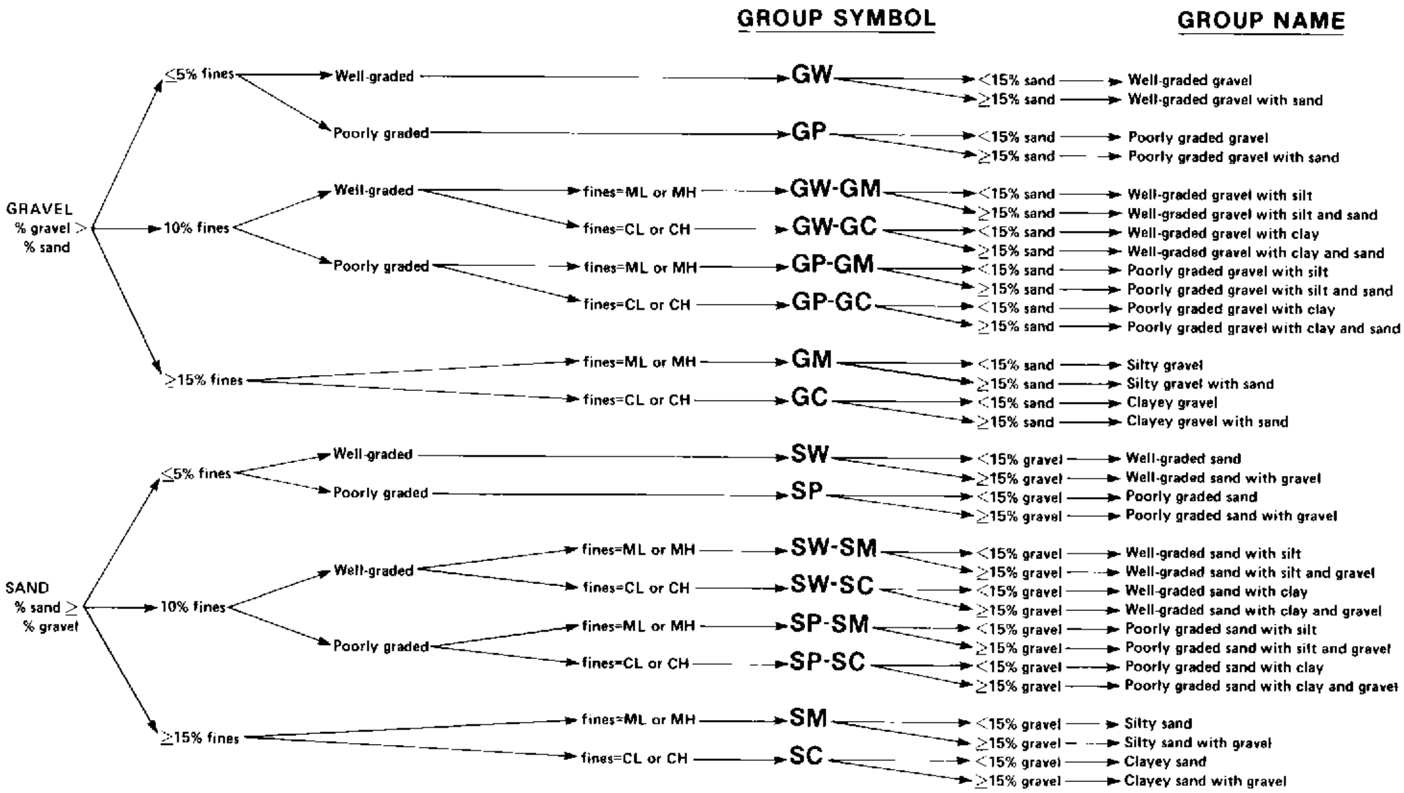


NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 1 b Flow Chart for Identifying Organic Fine-Grained Soil (50 % or more fines)

SOIL/SEDIMENT CLASSIFICATION FIELD GUIDE

Flow Chart for Identifying Coarse-Grained Soils (less than 50% fines)



NOTE 1—Percentages are based on estimating amounts of fines, sand, and gravel to the nearest 5 %.

FIG. 2 Flow Chart for Identifying Coarse-Grained Soils (less than 50 % fines)

⚠ **NOTE: The following terminology is optional, and should be used with caution. Consult the Anchor QEA Project Manager prior to field use. Use caution when describing odors, sheens, and non-aqueous phase liquid (NAPL) to avoid exposure to potentially hazardous chemicals. Do not sniff the sample or bring it close to your face. If unexpected contamination is encountered, stop work, clear personnel from the area, and contact the Anchor QEA Project Manager for further instruction.**

Criteria for Describing Odors

Relative Intensity	***Odor Types***
Trace (faint)	Petroleum-like (e.g., diesel, No. 2 fuel oil, kerosene, or gasoline)
	Hydrogen sulfide-like (H_2S-like)
Moderate (obvious)	Organic-like (e.g., septage)
	Solvent-like (e.g., alcohol)
Strong (overwhelming)	Tar-like (e.g., hot asphalt or roofing tar)

Criteria for Describing Sheens

Relative Intensity	***Sheen Color***		***Description Components***
Trace, <25% of surface covered **Moderate,** 25 to 75% of surface covered **Heavy,** >75% of surface covered	Rainbow	Multicolored	1. Intensity 2. Sheen color 3. Sheen distribution (e.g., continuous, present as .5-inch spots) 4. Depth interval over which sheen is present
	Silver or Metallic	Metallic, silver/gray-colored	**Distinguishing hydrocarbon-sheen from biological sheen:** If disturbed, a hydrocarbon sheen will typically coalesce, where an inorganic sheen will break apart and has a blocky appearance. Distinguish biological sheens if obvious.

Criteria for Describing Nonaqueous Phase Liquid (NAPL) and/or Separate Phase Material (SPM)

Relative Amounts and/or Distribution of NAPL/SPM		***Description Components***
Blebs	Describes the occurrence of discrete droplets of separate phase liquid, but for the most part, the sediment matrix does not contain NAPL. Describe the estimated size and number of blebs.	1. Relative amount of NAPL 2. Color 3. Viscosity 4. Distribution of NAPL 5. Density 6. Depth interval over with NAPL is present
Coated	NAPL present as a coating on the sediment grains; may be present in the pore space, but not as a free separate phase liquid. The degree of coating should be described as light, moderate, or heavy.	
Saturated	NAPL is present on the sediment surface and in the pore spaces. NAPL appears as a liquid on the surface of the sample when the sample is disturbed. Depending on viscosity, NAPL may freely drain from the sample.	

ATTACHMENT C
NYSDEC *FIELD DESCRIPTIONS OF SAMPLES FOR FORMER MANUFACTURED GAS PLANT (MGP) SITES*

Field Descriptions of Samples for
Former Manufactured Gas Plant (MGP) Sites

SOIL SAMPLE DESCRIPTIONS

It is important that descriptive qualifiers are consistently used to characterize degree and nature of contaminant impacts and visual-manual soil classification. The following presents some examples of descriptive qualifiers.

SOIL LOGGING

• All soils are to be logged using the **Unified Soil Classification** (ASTM D 2488 field descriptions)

• **PID or FID** used to screen all soil samples (Jar Headspace method) – maximum readings should be recorded and included on the logs. The PID/FID should be calibrated daily at a minimum

• **Moisture terms** are: Dry, Moist, and Wet

• **Color terms** - use geotechnical color charts - colors may be combined: e.g. red-brown. Color terms should be used to describe the "natural color" of the sample as opposed to staining caused by contamination (see below)

• **Log of each sample interval** should be prepared as follows:

[Coarse Grained Example] NARROWLY GRADED SAND (SP); mostly fine sand; <5% fines; red-brown, moist, environmental/depositional/geologic descriptions.

[Fine Grained Example] SANDY SILT (ML); heterogeneous till structure, nonplastic, ~30% fine to coarse, subangular sand; ~10% subangular fine gravel, max. size ~ 10 mm; brown; environmental/depositional/geologic descriptions.

• **Representativeness –** Soil logs should include particular notes if the field representative believes that there is a possibility that the soil sample being described is not representative of the interval sampled.

• **Intervals for Description –** if using a 2' (split spoon) or 4' (Macro-core) long sampler – the field description should not necessarily be for the entire sample interval. It is important to look for, identify, and describe small-scale units and changes within each sample interval.

DESCRIPTION OF CONTAMINANTS

Visible Contamination Descriptors

• **Sheen** - iridescent petroleum-like sheen. Not to be used to describe a "bacterial sheen", which can be distinguished by its tendency to break up on the water surface at angles, whereas a petroleum sheen will be continuous and will not break up. A field test for sheen is to put a soil sample in a jar of water and shake the sample (jar shake test) , then observe the presence/absence of sheen on the surface of the water in the jar.

• **Stained** - used w/ color (i.e. black or brown stained) to indicate that the soil matrix is stained a color other than the natural (unimpacted) color of the soil.

• **Coated** - soil grains are coated with tar/free product – there is not sufficient free-phase material present to saturate the pore spaces. The degree of coating should be described as light, moderate, or heavy.

• **Blebs** - observed discrete sphericals of tar/free product - but for the most part the soil matrix was not visibly contaminated or saturated. Typically this is residual product. The estimated size and number of blebs should be reported.

• **Saturated** - the entirety of the pore space for a sample is saturated with the tar/free product. Care should be taken to ensure that you're not observing water saturating the pore spaces if you use this term. Depending on viscosity, tar/free-phase saturated materials may freely drain from a soil sample.

• **Oil** - Used to characterize free and/or residual product that exhibits a distinct fuel oil or diesel fuel like odor; distinctly different from MGP-related odors/impacts.

• **Tar** - Used to describe free and/or residual product that exhibits a distinct "coal tar" type odor (e.g. naphthalene-like odor). Colors of product can be brown, black, reddish-brown, or gold.

• **Solid Tar** - Used to describe product that is solid or semi-solid phase. The magnitude of the observed solid tar should be described (e.g. discrete granules or a solid layer).

• **Purifier Material** - Purifier material is commonly brown/rust or blue/green wood chips or granular material. It is typically associated with a distinctive sulfur-like odor. Other colors may be present.

Olfactory Descriptors

• Use terms such as " tar-like odor" or "naphthalene-like odor" or "fuel oil-like odor" that provide a qualitative description (opinion) as to the possible source of the odor.

• Use modifiers such as strong, moderate, faint to indicate intensity of the observed odor.

DNAPL/LNAPL

- A jar shake test should be performed to identify and determine whether observed tar/free phase product is either denser or lighter than water. In addition, MGP residues can include both light and dense phases - this test can help determine if both light and dense phase materials are present at a particular location.

Viscosity of Free-Phase Product – If free-phase product/tar is present a qualitative description of viscosity should be made. Use descriptors such as:

- Highly viscous (e.g. taffy-like)
- Viscous (e.g. No. 6 fuel oil or bunker crude like)
- Low viscosity (e.g. No. 2 fuel oil like)

GROUNDWATER SAMPLING OBSERVATIONS

- Any observations of sheen, blebs, free-phase product/tar, staining or coating of the sampling equipment, odor, etc. that made during sampling of groundwater are to be included in the groundwater sample collection log.

Standard Colors for Reporting MGP Impacts

	RGB Color	Auto Cad Index
TAR SATURATED	255,0,0	10
COATED MATERIAL, LENSES	255,0,255	210
HARDENED TAR	129,64,0	34
BLEBS, GLOBS, SHEEN	255,191,0	40
STAINING, ODOR	255,255,0	50
PETROLEUM IMPACTS SATURATION & SHEENS	0,191,255	140
PETROLEUM IMPACTS STAINING & ODORS	170,234,255	141
PURIFIER WASTE AND ODOR	0,0,255	170
NO OBSERVED IMPACTS	0,165,0	92

Attachment 2
Sediment and Soil Core Processing Log

Sediment Core Processing Log

ANCHOR QEA

Job:	Station ID:
Job No.	Date/Time:
No. of Sections:	Core Logged By:
Drive Length:	Attempt #:
Recovery:	Type of Core ☐ Mudmole ☐ Vibracore ☐ Diver Core
% Recovery:	Diameter of Core (inches)
Notes:	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed

Recovered Length (cm)	Size % Gravel	Size % Sand	Size % Fines	**Classification and Remarks** (Density, Moisture, Color, Minor Constituent, MAJOR Constituent, with Additional Constituents, Sheen, Odor)	Recovered Length (cm)	PID	Sample	Summary Sketch

Attachment 5
Standard Operating Procedure 004 – Diffusion-Based Aqueous-Phase Sampling Using Porous Ceramic Samplers

Standard Operating Procedure Acknowledgement Form

Project Number: 210644-01.01 Project Name: Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Scope and Application

The purpose of this Standard Operating Procedure (SOP) is to describe the use of porous ceramic samplers to collect water samples in sediment. Porous ceramics can be used to collect water samples by diffusion or pumping; they provide the unique capability of excluding non-aqueous phase liquid (NAPL) from aqueous-phase samples. The presence of NAPL can complicate traditional water sampling and cause laboratory-reported concentrations to be biased high—above true dissolved concentrations of NAPL chemical components.

Hydrophilic porous ceramic acts as a capillary barrier to NAPL but allows water samples to be collected in the saturated zone (in sub-aqueous sediment or below the water table in upland settings) by diffusion through the porous barrier. Laboratory test results indicate that volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) in water inside a porous ceramic sampler equilibrate with surrounding water in a period of approximately 20 to 30 days. Entry pressure tests confirm that the sampler pore sizes exclude non-wetting NAPLs under reasonably expected field conditions (Gefell et al. 2018).

To apply this sampling method, a cylindrical, porous ceramic cup is pre-wetted with deionized (DI) water, filled with DI water, and capped with a water-tight seal to produce a porous "ceramic sampler". The ceramic sampler is placed in the zone where aqueous concentrations are to be measured. This will be accomplished with the use of divers to bury the samplers in sediment in the river bottom. Following an equilibration period of 30 days, the ceramic sampler will be retrieved, the water-tight cap will be removed, and the water will be poured into laboratory-supplied sample containers.

Expected procedures for sample collection are outlined in this SOP. Substantive deviations from the procedures detailed in this SOP, if any, will be recorded in the Daily Log or field book, on a Field Deviation Form, and reported to the field lead or project manager.

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021a). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel.

Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and the *Supplemental Investigation Work Plan to Support Remedy Selection* (Work Plan; Anchor QEA 2021b). In addition, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- **Sampler Preparation**
  - Appropriate personal protective equipment (PPE) (for this step, nitrile gloves and safety glasses)
  - Porous ceramic cups (Soilmoisture Equipment Corp., Item ID: 0652X18-B0.5M2, 1.51-inch outer diameter (OD) by 7.5 inches long, 1/2 bar, or equivalent—the specified item has an internal volume of approximately 115 milliliters)
  - Cap assembly parts
  - 1.5-inch-diameter rubber pipe cap with stainless steel hose clamps covered with polytetrafluoroethylene (PTFE) coated fiberglass tape
  - 1.650-inch (43-mm) diameter PTFE disc liner Methanol (High Performance Liquid Chromatography [HPLC]-grade) in spray bottle
  - Water (HPLC-grade)
  - DI water in spray bottle
  - Wide-mouth glass, plastic, or metal container for water bath and temporary sample storage
  - Aluminum foil
  - Containers for waste materials and or decontamination rinsate
- **Deployment**
  - Appropriate field PPE
  - Assembled porous ceramic samplers with caps
  - Shovel or trowel
  - Item to mark location for retrieval
  - Sample bottles, sample preservation supplies
  - Aluminum foil
  - Engineer’s rule or tape (optional)
- **Retrieval and Sample Collection**
  - Appropriate field PPE
  - Clean disposable paper towels or Kimwipes
  - Methanol (HPLC-grade) in a spray bottle
  - Water (HPLC-grade) in a spray bottle
  - PPE
  - Sample bottles with labels and chain-of-custody (COC) forms

- Cooler
- Ice

Pre-Deployment Preparation (Typically Conducted in Laboratory Setting)

1. Wear nitrile gloves.
2. Rinse a clean container (glass, plastic, or metal) using methanol and HPLC-grade water.
3. Fill the rinsed container with sufficient HPLC-grade water to fully submerge the ceramic cups in water.

4. Fill a new, clean, dry, porous ceramic cup with HPLC-grade water, and hold until water visibly drips out of the outside surface of the ceramic cup, signifying the pores are filling with water.
5. Completely submerge the porous ceramic cup in the HPLC water bath for at least 30 minutes to fully wet the ceramic surfaces with water. During this wetting period, gently "tap" the ceramic porous cup against the bottom or sides of the container to help displace any air bubbles from the ceramic pores.
6. Rinse the cap components using methanol and HPLC-grade water and place on a clean surface (e.g., aluminum foil), plastic, or glass container as shown below.

7. Place the PTFE disc liner in the rubber pipe cap to assemble the cap, as shown below.

8. Remove a ceramic cup from the HPLC water bath and complete the following as quickly as practicable so that the ceramic cup, when assembled, is as full of HPLC water as possible.
   a. If necessary, top off with HPLC-grade water to completely fill the ceramic cup.
   b. Holding the full ceramic cup vertical, place the cap in the ceramic cup without headspace.
   c. Push the cap onto the ceramic cup to make sure that there is no gap between the ceramic cup and the cap assembly.
   d. Tighten the hose clamp firmly to create a water-tight seal (as shown in photo below). The ceramic sampler is now fully assembled.
   e. Gently tug on the cap to ensure it is securely fastened. If necessary, quickly re-seat the cap and further tighten the hose clamp.
   f. Place the capped ceramic sampler back in the HPLC-grade water bath, and keep completely submerged until deployment in sediment.

Deployment

1. A dive plan describing the operations to be performed and safety protocols will be filed and approved prior to deployment and retrieval operations.

2. Using a GPS uploaded with pre-determined sets of coordinates for each sampling location, navigate the sampling vessel to within 10 feet of a sampling location.
3. Anchor or spud the vessel in place.
4. Deploy a separate anchor or weight with a buoy line attached to allow the diver to follow the line down to the sampling location.
5. Remove a ceramic sampler from the water bath.
6. Quickly verify that the hose clamp on the cap is properly tightened, and test the snugness of fit by gently pulling the cap to ensure the cap is tightly seated in the ceramic cup.
7. Hand the ceramic sampler (or group of samplers, if more than one will be deployed to obtain one porewater sample from one location) to a diver in the water. Diver should immediately lower the ceramic sampler(s) below the water level, and follow the buoy line down to the sampling location at the river bottom.
8. Using a shovel or trowel, the diver will dig a horizontal trough-shaped pit into the sediment deep enough to allow the sampler(s) to be deployed in a horizontal position. Typical deployment depth for surface sediment porewater samples is 3 to 6 inches below mudline. Place the ceramic sampler(s) in the pit and bury it (them) with surficial sediment from the same location, and using the original, excavated sediment if possible. The divers will take care deploying the ceramic tubes, as they are somewhat fragile.
9. Leave a visual marker at the location to aid in locating the samplers and facilitate their retrieval.

Retrieval and Sample Collection

1. Prepare the glassware in advance so the bottles are ready to fill right after the samplers are retrieved from a given sampling station.
2. At least 30 days after ceramic sampler deployment, locate the visual marker and retrieve the samplers. The divers need to note whether any of the ceramic sampler tubes are exposed above mudline. [If so, the water from those samplers will need to be kept separate from the water collected from the "buried" samplers. The sample bottles containing water from any "exposed" samplers should be clearly labelled "exposed to surface water". The water in those bottles will not be analyzed unless determined necessary, and the project manager and senior technical advisor(s) will discuss those decisions on a case-by-case basis.] If any ceramic sampler is partially or entirely exposed above mudline, the diver should note how much of it is exposed and describe it in detail to the field team, and/or photograph it.
3. Wipe off any excess sediment clinging to the ceramic sampler(s) before bringing the ceramic sampler(s) above water level; be careful not to loosen the cap.
4. When each ceramic sampler from a given sampling station is above the surface water, quickly inspect the outside of the sampler for any visible NAPL or iridescent sheen (and photograph the sampler(s) if possible); if any NAPL or sheen is observed, note its occurrence on the field sampling log. Remove any NAPL or sheen by wiping with a clean disposable paper towel or

Kimwipe followed by wiping with methanol-moistened paper towel, DI water spray rinse, and final wipe with clean paper towel or Kimwipe. [This step needs to be performed quickly but carefully—within 1 minute or less—to avoid losing sample volume by water dripping out of porous ceramic sampler.]

5. With the sampler in an upright position (i.e., cap at top of the sampler), loosen the hose clamp, and carefully remove the cap.
6. Carefully pour the water sample from the ceramic sampler into sample bottles. If any sheen is observed on the surface of the water sample, record the observation in the field sampling notes. The sample may be discarded at that point or submitted for analysis at the discretion of the Project Manager.

Waste Management

Wastes generated during ceramic sampler preparation or following ceramic sampler use must be collected, stored, and disposed of in a manner consistent with project-specific waste management practices.

Quality Assurance

Laboratory and field notes and COC forms will be double-checked by staff to verify the information is correct.

Collection of Blanks and Duplicates

Equipment Blank (optional)

An equipment blank can be obtained as follows. Remove an assembled ceramic sampler from the water bath, remove the cap, and pour the water into lab-supplied sample containers for analysis of the same parameters as the primary field samples. Refill the sampler with DI water, recap the sampler, and return it to the water bath for use in sampling. The equipment blank verifies that the ceramic sampler does not contain any target analytes at concentrations that could affect sample data quality.

Field Duplicate (optional)

A field duplicate can be obtained by using another ceramic sampler at the same place, time, and duration as a primary sampler.

Sources of Variation and Bias

Any NAPL attached to the outside of the ceramic porous device after retrieval must not be sampled together with the water sample inside the ceramic porous cup. The section on retrieval and sample collection includes steps to help verify that the sample submitted to the laboratory is a pure aqueous sample with no NAPL or sheen.

References

Anchor QEA (Anchor QEA, LLC), 2021a. *Health and Safety Plan Operable Unit 3 2021 Supplemental Investigations*. Prepared for New York State Electric and Gas Corporation. June 2021.

Anchor QEA, 2021b. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection*. Prepared on behalf of New York State Electric and Gas Corporation. June 2021.

Gefell, M.J., M. Kanematsu, D. Vlassopoulos, and D. Lipson, 2018. "Aqueous-phase sampling with NAPL exclusion using ceramic porous cups." *Groundwater* 56(6):847–851.

Attachment 6
Standard Operating Procedure 005 – Investigation-Derived Waste Handling and Disposal

Standard Operating Procedure Acknowledgement Form

Project Number: 210644-01.01 Project Name: Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

Date	Name (print)	Signature	Company

Scope and Application

This Standard Operating Procedure (SOP) describes the instructions for proper disposal of investigation-derived waste (IDW; i.e., sediment, soil, water, personal protective equipment [PPE], and other potentially contaminated materials) generated during implementation of fieldwork.

Procedures for IDW handling and disposal outlined in this SOP are expected to be followed. Substantive deviations from the procedures detailed in the SOP will be recorded in the Daily Log or field log book, on a Field Deviation Form, and reported to the field lead or project .

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in Section 8.5 of the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021a). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel.

Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP and the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021b). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

Equipment and Supplies

The following is a list of equipment that may be necessary to carry out the activities in this SOP. Additional equipment may be required, depending on field conditions.

- PPE as required by the HASP (Anchor QEA 2021a)
- Garbage bags or drum liners
- 5- to 10-gallon buckets or carboys to be used as satellite waste-collection containers
- Solvent spill kits (as needed)
- Labels and tags for drums and other containers

Waste Disposal Procedures

Materials that are known or suspected to be contaminated with hazardous substances through the actions of sample collection or personnel and equipment decontamination are said to be IDW. In general, IDW will be classified into the following three categories unless otherwise directed:

1. Solid residual waste consisting of sediments, soils, used core tubes, used PPE, and other materials used in the handling, processing, and storage of sediment
2. Liquid wastes, such as waste purge water and decontamination water

3. Spent and residual chemicals (liquids) from decontamination

Each type of material will be handled in a manner described in this SOP.

Solid Waste

Solid residual wastes generated during field activities will consist of two types of materials: sediment/soil and non-sediment/soil solids. Sediment/soil waste will include discarded ponar or core samples and leftover sediment/soil from ponar and core samples not used for sample analyses. Non-sediment/soil wastes will include items such as used core tubes and caps, aluminum foil, and PPE (e.g., gloves, Tyvek® suits, and plastic sheeting). Sediment/soil and non-sediment/soil wastes will be segregated and stored in separate containers pending disposal unless otherwise directed. Loose sediment/soil will be removed from non-sediment/soil waste items prior to disposal, to the extent practical.

Sediment/soil and non-sediment/soil wastes will be segregated and containerized in closed 5-gallon buckets or trash bags, as necessary and appropriate, on the vessel and secured until transferred into the Saranac Street Former Manufactured Gas Plant Site Operable Unit 2 Remedial Construction disposal facility.

Wastewater

Wastewater will be generated during sample processing and decontamination activities. Sediments/soils recovered during this process will be handled as solid waste as previously described. Wastewater will be collected in a large, contaminated-liquid waste tank (e.g., 5-gallon bucket with lid) until the material is brought to the Saranac Street Former Manufactured Gas Plant Site Operable Unit 2 Remedial Construction disposal facility.

Liquid Chemical Waste

Liquid chemical wastes may include spent solvents generated during the decontamination process (refer to SOP 002: Equipment Decontamination). Waste solvents (e.g., ethyl acetate) will be collected in jacketed-glass solvent bottles and labeled with a Class 3 flammable liquid label. Waste containers will be stored in a secure location until picked up by an authorized waste handler.

Investigation-Derived Wasted Management

Generated soil/sediment and non-sediment/soil wastes will be placed in buckets prior to disposal at the Saranac Street Former Manufactured Gas Plant Site Operable Unit 2 Remedial Construction disposal facility.

Quality Assurance/Quality Control

It is the responsibility of the field team leader to periodically check and ensure that IDW handling and disposal procedures are in conformance with those stated in this SOP.

References

Anchor QEA (Anchor QEA, LLC), 2021a. *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations*. Prepared for New York State Electric and Gas Corporation. July 2021.

Anchor QEA, 2021b. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection*. Prepared for New York State Electric and Gas Corporation. July 2021.

Attachment 7
Standard Operating Procedure 006 – Sample Handling, Packaging, and Shipping

1 Standard Operating Procedure Acknowledgement Form

Project No. 210644.01.01 Project Name: Saranac Street Former Manufactured Gas Plant Site Operable Unit 3

My signature below certifies that I have read and understand the procedures specified in this Standard Operating Procedure.

Date	Name (print)	Signature	Company

Scope and Application

This Standard Operating Procedure (SOP) describes procedures for packaging and shipping samples collected as part of the Pre-Design Investigation. Sample packaging and shipping generally involves the placement of individual sample containers into a cooler with packing material and coolant in a manner that isolates the samples to prevent breakage, maintains required temperature, and limits the potential for damage to sample containers when the cooler is transported.

Procedures for sample packaging and shipping outlined in this SOP are expected to be followed. Additional information can be found in the project Quality Assurance Project Plan (QAPP), which is included in the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021a).Deviations from the procedures detailed in the SOP will be described on the Daily Log and recorded on a Field Deviation Form (see Section 5 of Field Sampling Plan).

Health and Safety Warnings

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations* (HASP; Anchor QEA 2021b). The HASP will be followed during all activities conducted by Anchor QEA, LLC personnel.

Personnel Qualifications

Field personnel executing these procedures will have read, must be familiar with, and must comply with the requirements of this SOP, the Field Sampling Plan, and the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021a). Field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection. Boat navigation and positioning will only be performed by field team staff or subcontractors experienced with boat operations and GPS operation.

Equipment and Materials

The following is a list of equipment that may be necessary to carry out the procedures contained in this SOP. Additional equipment may be required, pending field conditions.

- Approved documents including SSP, Field Sampling Plan, and QA/QC Plan
- Ballpoint black ink pens
- Personal protective equipment as required by the SSP
- Inert packing material (e.g., cardboard and bubble wrap)
- Pre-preserved sample containers as specified in the QAPP
- Sample labels
- Insulated coolers

- Custody seals
- Shipping tape
- Re-sealable, zippered clear-plastic bags
- Temperature blanks (if not provided by the laboratory)
- Ice
- Overnight courier airbills or shipping forms
- Clear-plastic sealing tape
- Wax sealant and/or stretch tape for sealing undisturbed core samples

Procedures

Observance of proper holding times and conditions during sample storage and shipment prior to laboratory analysis is critical to obtaining quality data from a sampling effort. Immediately after collection, samples (sediment and soil) should be stored in refrigerators (if available) or ice-filled, insulated coolers with sufficient ice to maintain an ambient temperature of approximately 4°C until received by the analytical laboratory. Specific sample holding times and conditions for specific matrices and analyses are listed in the QAPP in Appendix B of the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021a).

Individual sample containers (or groups of sample containers) should be stored in the coolers and packed in re-sealable, zippered, clear-plastic bags to prevent labels from smearing and falling off. Ice should be placed on top of samples inside the coolers.

Sample Shipping

All samples should be shipped or hand-delivered to the analytical laboratory as soon as possible after completion of sampling to minimize the number of people handling samples and protect sample quality and security. The following guidelines apply to soil and sediment samples that will be shipped by courier to the laboratory:

1. Shipping containers should be in good shape and capable of withstanding rough treatment during shipping.
2. Samples should be packed tightly with dividers (e.g., bubble wrap and cardboard) separating all glass containers and empty space within shipping containers filled so the jars are held securely.
3. Sample coolers should be packed with ice to maintain an ambient sample temperature of approximately 4°C until delivery to the analytical laboratory. Wet ice (no synthetic ice) can be used, and should be packed in a manner that will preclude leaking inside the sample cooler. A temperature blank (supplied by the laboratory) can be placed in the sample cooler along with analytical samples.
4. All coolers must be leak-proof or lined with a leak-proof plastic liner. Leaking coolers will not be delivered by some couriers.

5. A chain-of-custody (COC) form for each shipping container should be filled out completely (see QAPP, Appendix B of the *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection* (Anchor QEA 2021a) for additional information.
6. The original COC form and analysis request should be protected from damage by sealing in a re-sealable, zippered, clear-plastic bag, and taped to the underside of the cover inside the shipping container.
7. A custody seal should be attached to the outside of the shipping container lid so that the shipping container cannot be opened without breaking the seal.
8. Shipping containers carrying glass sample containers should have a “this side up” label to ensure that jars are transported in an upright position, and a “fragile – glass” label should be attached to the top of the container to minimize agitation of the samples. Each cooler will be wrapped securely with packing or strapping tape.
9. Shipping containers should be sent by a carrier that will provide a delivery receipt (such as FedEx) to confirm that the contract laboratory received the samples and to serve as a backup to the COC form.

Undisturbed samples to be analyzed by a geotechnical laboratory will be hand-delivered (i.e., couriered) to the project laboratory as soon as possible after completion of sampling. This will minimize the number of people handling samples and protect sample quality and security. The following guidelines apply to undisturbed sediment and soil samples that will be shipped by courier to the geotechnical laboratory:

1. Once the undisturbed sample has been collected, it will be stored upright and secured to minimize disturbance of the sediment or soil.
2. The undisturbed sample will be sealed with caps on the ends of the collection tube so that there is minimal void space and sediment or soil is not allowed to move during shipment.
3. The ends of the collection tube will be capped and further secured in place with a wax seal or using stretch tape (various types available).
4. The collection tube will be marked to indicate the “top” of the undisturbed sample.
5. During storage, transfer, and shipping, the sample will remain upright and be secured so that the chance for unnecessary movement and disturbance of the sample is minimized.

Quality Assurance/Quality Control

It is the responsibility of the Field Lead to periodically check to ensure that the procedures are in conformance with those stated in this SOP.

References

Anchor QEA, 2021a. *Work Plan of Proposed Supplemental Investigations to Support Remedy Selection.* Prepared for New York State Electric and Gas Corporation. July 2021.

Anchor QEA (Anchor QEA, LLC), 2021b. *Health and Safety Plan – Operable Unit-3 2021 Supplemental Investigations*. Prepared for New York State Electric and Gas Corporation. July 2021.