SITE CHARACTERIZATION WORK PLAN
164 JOHN STREET
(NYSDEC SPILL NO. 2104180)

CONSOLIDATED EDISON CO. OF NEW YORK, INC.
31-01 20th Avenue
Long Island City, New York 11105

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164 John Street

Site Characterization Work Plan

Prepared for
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TABLE OF CONTENTS

TABLES

FIGURES

APPENDICES

ABBREVIATIONS

µg/m^3	micrograms per cubic meter
amsl	above mean sea level
AOC	Area of Concern, comprising 760 square feet
bgs	below ground surface
CAMP	Community Air Monitoring Plan
Con Edison	Consolidated Edison Company of New York, Inc.
DER-10	*DER-10: Technical Guidance for Site Investigation and Remediation*
DOT	U.S. Department of Transportation
GPR	ground-penetrating radar
HASP	Health and Safety Plan
HFM	Historic Fill Material
MVA	mercury vapor analyzer
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
PCB	polychlorinated biphenyl
PPE	personal protective equipment
Property	Hudson Avenue East Substation,164 John Street, New York, New York
PURS	Public Utility Regulation Station
PVC	polyvinylchloride
QAPP	Quality Assurance Project Plan
SC	site characterization
SC Work Plan	*Site Characterization Work Plan*
Site	northwest area consisting of 0.2-acre at the Property
SOP	Standard Operating Procedure
USGS	U.S. Geological Survey

1 Introduction

On behalf of Consolidated Edison Company of New York, Inc. (Con Edison), Anchor QEA Engineering, PLLC, has prepared this *Site Characterization Work Plan* (SC Work Plan) for work to be conducted on approximately 760 square feet (Area of Concern; AOC) within a 0.2-acre section (the Site) in the northwest corner of Con Edison's Hudson Avenue East (Property) Substation, located at 164 John Street, New York, New York (**Figures 1-1 and 1-2**). During recent excavation activities in August 2021 to support electrical infrastructure upgrades, a previously undocumented masonry subsurface structure was encountered. Visible elemental mercury was observed on the subsurface structure and in the adjacent soils; as a result, a spill report was filed with the New York State Department of Environmental Conservation (NYSDEC). Spill No. 2104180 was opened on August 2, 2021.

This SC Work Plan was prepared to complete site characterization (SC) following guidelines outlined in the NYSDEC *DER-10: Technical Guidance for Site Investigation and Remediation* (DER-10; NYSDEC 2010). The SC objectives are as follows:

- Delineate mercury-contaminated subsurface structure and associated soils within the AOC.
- Assess groundwater to determine if observed mercury contamination within the AOC is adversely affecting downgradient groundwater characteristics.
- Obtain adequate data to develop a remedial strategy, if necessary, to address the mercury-contaminated materials within the AOC.

1.1 Work Plan Organization

This SC Work Plan is organized as detailed in **Table 1-1**.

Table 1-1
Site Characterization Work Plan Organization

Section	Description
1 – Introduction	Presents SC objectives, current Property conditions, regional geology, and historical Property information.
2 – Site Characterization Strategies	Provides a summary description of the proposed characterization strategies.
3 – Data Usability	Describes methods for performing data usability.
4 – Reporting	Presents an outline of information to be reported following completion of the field program.
5 – Project Schedule	Provides a proposed schedule for the SC Work Plan implementation.

This SC Work Plan is supported with in-text and attached figures and tables as detailed in the table of contents and by the following appendices:

- Appendix A: Quality Assurance Project Plan (QAPP)
- Appendix B: Standard Operating Procedures (SOPs)
- Appendix C: Community Air Monitoring Plan (CAMP)
- Appendix D: Current Site Utility Drawings
- Appendix E: Historical Site Mapping

1.2 Site Characterization Objectives and Strategy

In order to achieve the project objectives outlined above, the SC will entail reviewing historical information, screening of the AOC using non-intrusive methods, and the collection and analysis of soil and groundwater samples during the SC. The sequence of work and tasks that will be performed are summarized in **Figure 1-3**. In brief, the technical strategy described throughout this SC Work Plan relies on the review of information obtained from each step to support the decision-making for the subsequent steps.

Figure 1-3
Site Characterization Strategy

Step 1	**Existing Property Information Review:** Compile and review available Property information to identify regional geology and hydrogeology, existing infrastructure, historical Property development (including change in shoreline features), and manufacturing activities to determine potential mercury sources.
Step 2	**Area Reconnaissance and Mapping:** Perform visual observations of current Site conditions as described in Task 2, including topography, drainage pattern, and aboveground and belowground utilities within the vicinity of prior observations of elemental mercury in the subsurface soils.
Step 3	**Geophysical Survey:** Use ground-penetrating radar (GPR) as described in Task 3 to image the lateral extent (length and width) of the subsurface masonry structure that was uncovered during the previous excavation activities, as well as other historical subsurface structures within the AOC.
Step 4	**Mercury Vapor Survey:** Perform a mercury vapor survey as described in Task 4 to measure the mercury vapor concentrations at ground surface to identify areas of higher concentrations of mercury vapor as compared to adjacent readings within the AOC.
Step 5	**Subsurface Structure Assessment:** Complete hand excavations to locate the subsurface structure(s) that were previously uncovered and observed to contain elemental mercury. As described in Task 5, initial excavations will be based on the results of prior observations regarding the brick structure associated with the elemental mercury, the associated manhole structure known to contain elemental mercury, and the mercury vapor survey results. Following completion, investigation locations will be surveyed and derived wastes handled as described in Sections 2.9 and 2.10, respectively.
Step 6	**Soil and Groundwater Assessment:** Following completion of Step 5, select locations for soil borings near the subsurface structure(s) and in areas where mercury vapor readings at the ground level show a comparatively higher concentration as compared with the adjacent areas based on the results of Step 4; additional soil borings will be considered based on field observations of the initial three soil borings. Prior to installing the soil borings, utility clearance (hand clearing and GPR) will be performed.

1.3 Property Location and Current Conditions

Step 1

The AOC covers approximately 760 square feet within the Property located at 164 John Street, New York, New York. The Property is located in the northwestern-most corner area of New York City Tax Lot designated as Block 22 Lot 1 near the intersection of Gold Street and John Street in the Vinegar Hill section of Brooklyn and currently owned and operated by Con Edison. The Property is bordered by John Street to the north, Plymouth Street to the south, Hudson Avenue to the east, and Gold Street to the west. The East River is located approximately 600 feet north of the Property. The Site is bordered by sidewalks and public roads on the north by John Street and on the west by Gold Street, and immediately adjacent on the east is the Extra Space Storage Facility, which is a commercial storage facility open to the public, and on the south by the Gold Street Public Utility Regulation Station (PURS) facility (**Figure 1-2**). Adjacent properties are predominately related to Con Edison's operations or are commercial/industrial. The closest residential area is located at the intersection of Plymouth Street and Gold Street, located approximately 400 feet southeast (see **Figure 1-2**).

The AOC currently consists of a blue stone ground surface with electrical distribution equipment (overhead utility lines as well as subsurface lines) installed throughout. The Property is presently undergoing electrical infrastructure upgrades and **Figure 1-2** shows the extent of the AOC within the Site where elemental mercury was detected when conducting activities in support of the upgrades on the property.

Maps of utilities (electric), subsurface structures, and footings are included as **Appendix D** to this SC Work Plan.

1.3.1 Property History

Step 1

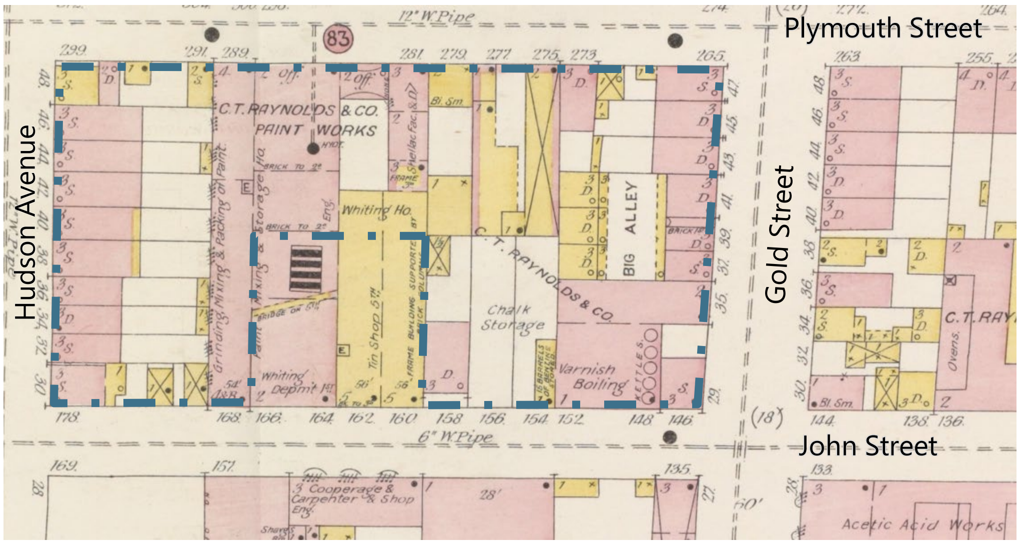
A historical mapping review search was completed for the Property area; several historical topographic and fire insurance maps were reviewed to identify historical activities on the Property. Copies of the historical maps reviewed are included in **Appendix E**. Presented below is a summary of the Property's development history.

The earliest available map reviewed was dated 1766 and indicated that the land area in the vicinity appeared to be agricultural, with a nearby mill dam and marsh areas. The nearest road was named "Road to Flatbush" and appears to align with modern-day Flatbush Avenue. Based on mapping from 1776 and 1777, the area of the Property was considered "high ground" with the original shoreline of the East River located near Marshall Street.

By 1838, the Property was fully subdivided into individual parcels and was bounded by Gold, John, Plymouth, and Jackson streets (Jackson Street appears to be the precursor to Hudson Avenue). The

1855 Perris map indicates several structures on individual lots, including a "Whiting Factory." By 1887, the property appears to be primarily occupied by C.T. Raynolds & Company Paint Works along with dwellings as shown in **Figure 1-4**.

Figure 1-4
1887 Property Configuration



Notes:
1. North is towards the bottom of the page.
2. Source: Sanborn 1887.
3. Dashed blue line represents the approximate limits of the Property.

As shown in **Figure 1-4**, manufacturing activities at the Property apparently included grinding, mixing, and packing of paint, and the manufacture of varnish and shellac. In the vicinity of the AOC, the operations included chalk and benzine storage and varnish boiling. Based on a 1900 catalogue for F.W. Devoe and C.T. Raynolds Company, the properties on Plymouth and John streets were used for the manufacture of lead and zinc paint as well as dry colors (Devoe 1900). By 1907, the majority of the Property was occupied by Devoe & Raynolds Paint Works (Hyde 1907).

The 1933 Sanborn Map shows a change in ownership and operations in the vicinity of the Property. Businesses operating in the vicinity of the AOC include Alexapope Manufacturing Company (fireproof paint), Kent Machine Company, and Sternau & Company Metal Goods (located in the building currently occupied by the Extra Space Storage Facility).

The 1955 Sanborn map indicates that many of the structures formerly located on the Property are no longer present, except the Kent Machine Company (located along Gold Street) and the Sternau & Company Metal Goods building, along with dwellings located on Hudson Street. By 1966, Con Edison acquired Block 22 Lot 1 and redeveloped it into an electrical substation, which based on records and information has not included the use, storage, or release of mercury.

1.4 Geology and Hydrogeology

1.4.1 Regional Geology

Step 1

A U.S. Geological Survey (USGS) Quadrangle Map indicating the location of the Property is included as **Figure 1-1**. As shown in **Figure 1-1**, the area of the Property is relatively flat with gradual sloping towards the East River.

The New York State Surficial Geology Map of New York indicates the Property is underlain by a poorly sorted till likely deposited as glacial outwash during the Pleistocene Epoch (Cadwell 1986). The till has varying amounts of gravel, sand, silt, and clay. Bedrock beneath the Property is classified as Ravenswood Granodiorite (Baskerville 1990) and is located approximately 90 feet below grade (Hobbs 1905).

Review of the historical mapping (**Appendix E**) indicates that the original East River shoreline was located along Marshall Street (one block west and north of John Street in the vicinity of the Property). The earliest available topographic map (by the USGS) is dated 1889, which indicated that pre-1900 the ground surface elevation in the vicinity of the Property (near the intersection of Plymouth Street and Gold Street) was 20 feet above mean sea level (amsl). Recent topographic surveys indicate this area has had some filling, with ground surface elevations reported at 25 feet amsl. A copy of the USGS historical mapping is included in **Appendix E**.

1.4.2 Property Geology and Hydrogeology

In 2019, Con Edison performed an investigation of their Gold Street PURS located at 43 Gold Street, Brooklyn, New York, which is located in the southwest corner of the Property (near the intersection of Gold Street and Plymouth Street). During this investigation, five soil borings were installed using rotosonic and hollow-stem auger drilling methods. Based on a review of these soil borings, the following subsurface conditions were encountered:

- 0 to 0.5 foot below ground surface (bgs): Concrete
- 0.5 to 28 feet bgs: Historic fill material (HFM)—this material consisted of a mixture of sand, gravel, cobbles, brick fragments, and concrete
- 25 to 30 feet bgs: Brown sand with fine to medium grain size, little subangular gravel, and trace amounts of clay

Based on the available PURS investigation soil boring data, the southwest area of the Property appears to have had extensive filling since its initial development in the early 1800s. HFMs were documented in soil borings installed at depths of up to 20 feet bgs.

Review of groundwater elevation data collected along Gold Street (Con Edison 2019) indicates that groundwater flows towards the north/northwest, towards the East River and is located approximately 20 feet bgs. Localized groundwater flow patterns may be impacted by a subsurface low permeability barrier wall installed to a depth of approximately 30 feet bgs around a former tank farm located immediately northeast of the Property (across John Street) and associated with Con Edison's former Hudson Avenue Steam Station.[1]

[1] Information regarding the low permeability barrier wall was provided verbally to Anchor QEA by Con Edison on August 31, 2021.

2 Site Characterization Strategies

To collect the information and data necessary to delineate the extent of mercury impacts in the subsurface of the AOC, a combination of non-intrusive and intrusive sampling methods will be performed during the investigation tasks listed in **Table 2-1**. The investigation tasks generally align with the SC strategies described in Section 1.

Table 2-1
Site Characterization Tasks

Site Characterization Strategy Step	Investigation Task	Status
Step 1	Task 1: Existing Site Information Review	COMPLETED
Step 2	Task 2: Area Reconnaissance and Mapping	ONGOING
Step 3	Task 3: Geophysical Survey	COMPLETED
Step 4	Task 4: Mercury Vapor Survey	COMPLETED
Step 5	Task 5: Subsurface Structure Assessment	PENDING
Step 6	Task 6: Utility Clearance	PENDING
	Task 7: Subsurface Soil Investigation	PENDING
	Task 8: Groundwater Assessment	PENDING

The investigation activities will be performed by Anchor QEA on behalf of Con Edison in sequential order, starting with Task 2 Area Reconnaissance and Mapping. The data gathered from each of the tasks will be used to support decision-making in the subsequent tasks as described in the following sections. The current status of each of the SC tasks, based on the strategy presented in Section 1, is noted in **Table 2-1**.

As further detailed below, Tasks 3 and 4 will use field screening tools to identify potential subsurface structures and areas most likely to present mercury contamination. The use of field screening tools will allow for a dynamic SC where data are collected and reviewed in real time. Review of the field screening results will guide the selection or possible re-alignment of intrusive sampling locations. Air monitoring will be performed during the intrusive SC activities as described in the site-specific Health and Safety Plan (HASP) and CAMP.

Investigation Tasks 1, 2, and a portion of 3 have already been completed and a summary of the activities performed along with the results are included in the sections below.

2.1 Task 1: Existing Site Information Review (Completed)

As an initial step in preparing this work plan, a search of historical maps of the Property and surrounding areas was completed. During this task, several historical topographic and fire insurance maps were identified and reviewed. Information obtained from the maps was used to identify historical uses of the Property, as summarized in Sections 1.3 and 1.4 of this SC Work Plan.

2.2 Task 2: Area Reconnaissance and Mapping (Ongoing)

This task consists of observations of Property topography, drainage patterns, and documentation of aboveground and belowground utilities within the AOC footprint. **Figure 2-1** presents the results of this task as of February 2022. Future activities to be performed under this work task include the following:

- Reviewing existing utility plates (provided by Con Edison) to determine the presence of subsurface utilities within the AOC footprint
- Documenting observations by the field team during investigation activities
- Updating property mapping as needed to reflect current conditions

Suspect areas identified during the area reconnaissance and mapping phase were also screened as part of the geophysical and mercury vapor surveys and are described in the following subsections.

2.3 Task 3: Geophysical Survey (Completed)

A geophysical survey was performed to assess subsurface conditions using radar pulses. **Figure 2-1** shows the survey area where ground-penetrating radar (GPR) was used. The objective of the GPR survey was to attempt to image the lateral extent (length and width) of the subsurface masonry structure that was uncovered during previous excavation activities (and appeared to be the source of the free/elemental mercury), as well as other historical subsurface structures within the AOC.

The GPR survey over the survey area shown in **Figure 2-1** was completed on November 4, 2021. The GPR survey was completed over all accessible portions of the AOC, and two GPR anomalies were identified at shallow depths between 1 and 4 feet below grade. Neither of the anomalies are near the approximate locations of the previously identified subsurface structure. The GPR anomalies were used in combination with the results of the mercury vapor survey (Task 4) as shown in **Figure 2-1** to identify areas for test pitting or soil boring.

2.4 Task 4: Mercury Vapor Survey (Completed)

The objective of the mercury vapor survey was to identify localized areas within the AOC with higher concentrations of mercury vapor as compared to adjacent readings. This information was then used to target areas for intrusive investigation (test pits and or soil borings).

The mercury vapor survey was completed in October 2021 and was conducted over the area depicted in **Figure 2-1**. The mercury vapor survey was conducted using a VM-3000 mercury vapor analyzer (MVA; VM-3000). The VM-3000 collected mercury vapor readings every 2 to 3 seconds from the zone immediately above the ground surface (approximately 1 to 4 inches above the ground surface) as the instrument traversed the survey area along transects spaced approximately 1 foot apart. The readings were recorded on a data logger within the instrument and then transmitted to an Anchor QEA server for processing.

The mercury vapor concentrations measured during the mercury vapor survey are summarized graphically in **Figure 2-1** along with the GPR anomalies identified during Task 3. In brief, the detected mercury concentrations in vapor are shown in **Figure 2-1** as discrete "dots," which are colored to reflect a relative scale of concentration range. Specifically, the areas containing blue dots represent mercury vapor readings that are consistent with ambient air. The areas containing yellow, pink, and purple colors represent measurements with higher mercury vapor concentrations (as compared to the areas with blue dots). In general, the yellow, pink, and purple colors were used to identify areas within the AOC that may warrant investigation and served in part to select the proposed intrusive sampling locations.

As indicated in **Figure 2-1**, mercury vapor was either not detected or detected at low concentrations across the southern portion of the AOC and along the eastern and western borders. Within the central and northern portion of the AOC, relatively high mercury vapor readings were detected (as compared to readings in adjacent areas). These areas are in the immediate vicinity of the location where the elemental mercury and associated masonry structure were initially identified.

2.5 Task 5: Subsurface Structure Assessment (Pending)

The objective of this task is to uncover historical subsurface structures where mercury has previously been identified.

Based on the results of the GPR and MVA surveys shown in **Figure 2-1**, and field observations, five exploratory (hand-dug) test pits will be performed. The exploratory test pits will be installed to uncover the subsurface structures in the vicinity where mercury was initially observed. Exploratory test pits will be dug such that both ends of the substructure are located and the overall dimensions can be determined. Additional exploratory test pits will be considered once the overall length/ dimensions of the uncovered structures are determined.

Figure 2-2 presents the proposed exploratory test pit locations imposed on the results of the geophysical and mercury vapor surveys. Locations HAE-TP-01 through HAE-TP-05 shown in the figure, and listed in **Table 2-2,** indicate where hand excavations will be initially targeted in an effort to identify the subsurface structure as well as assess the potential presence of elemental mercury in the subsurface near Manhole No. 61186. Exploratory test pits HAE-TP-03 and HAE-TP-05, proposed nearest to the Manhole No. 61186 location, will be the first to be excavated. The remaining test pits (HAE-TP-01, HAE-TP-02, and HAE-TP-04) are listed in **Table 2-2** (and shown in **Figure 2-2**) and will be located in the field based upon the profile and alignment of the substructure. Both upgradient and downgradient sides of the structure will be exposed in each of the locations.

As the top of the subsurface structure is encountered, the excavations will proceed to uncover the width of the structure to assess if the structure is a masonry vessel or basin or a former foundation wall, and then follow the assessment strategies described below. An SOP for the exploratory test pit installation is included in **Appendix B**. Mercury vapor management will be performed in accordance with the CAMP and as described below in Section 2.5.2.

2.5.1 Exploratory Test Pit Installation Soil Screening and Management

During the exploratory test pitting operations, excavated soil will be screened for mercury vapors using a Jerome 405 MVA[2] and visible elemental mercury. Soil with visible elemental mercury will be placed in 55-gallon drums separate from soils generated from other investigation locations, as well as soil generated during deeper soil borings, for characterization and disposal. The waste will be managed as described in Section 2.10 (below) and the investigation-derived waste SOP in **Appendix B**. When soils are not actively being managed (whether in a 55-gallon drum or on the polyethylene sheeting), they will be covered with polyethylene sheeting or the drum lid to limit the potential for off-gassing during the SC activities.

2.5.2 Mercury Vapor Management During Exploratory Test Pit Activities

Following documentation of visible mercury (if any) on a subsurface structure or on excavated soils, the area with elemental mercury will be treated with a mercury vapor suppressant to limit the generation of mercury vapors. Excavated soils without visible mercury may be treated with vapor suppressant if the vapor levels represent a potential action level or perimeter level exceedance. If mercury vapors are off-gassing from the exposed subsurface structure such that even with the application of vapor suppressants, action levels (as detailed in the CAMP included in **Appendix C**) are being exceeded, the exposed test pit surfaces will be covered with polyethylene sheeting to contain/further suppress the vapors prior to back filling.

2.5.3 Subsurface Structure Evaluation

As part of the subsurface structure evaluation, the type of structure will be ascertained and the method for investigation of the structure will be dependent upon the structure type as further discussed below.

[2] Other mercury vapor analyzers may be used during the SC and will have a minimum detection limit of 0.5 microgram per cubic meter.

2.5.3.1 Historical Containment Structure

If the structure is determined to be a containment structure constructed to store elemental mercury, the structure configuration will be measured (length and width and depth) and the materials of construction noted. If the structure has a closed top, its construction shall be assessed, and attempts will be made to drill into the top of the structure and create a ¾-inch-diameter hole to provide an access location for performing vapor and accumulated product sampling. Attempts will be made to ascertain the depth and contents of the structure through sample collection using a narrow pipette or other small-diameter sampling device. Alternatively, a micro-push camera may be deployed through the drilled hole to assess the interior conditions and contents of the vessel.

Following completion of the structure assessment, the drilled hole location will be surveyed as described in Section 2.9 below. Following assessment, the drilled hole will be sealed using a plug and or expanding foam.

2.5.3.2 Historical Foundation

If the subsurface structure is determined to be a remnant of a former building foundation, the wall will be exposed in each of the exploratory test pit areas to expose the full depth of the wall. The physical characteristics of the wall, such as composition, thickness, and presence of visible mercury, will be documented. Exploratory test pits will be installed on both sides of the wall to assess the presence of visible mercury. The ends of the wall, as well as any bends or turns uncovered during the SC, will be staked at the ground surface to allow for survey mapping of the structure.

2.6 Task 6: Utility Clearance (Pending)

Utility clearance will be performed in advance of all soil borings. In addition to the review of mapping described under Task 2, Anchor QEA will conduct a focused geophysical survey (e.g., using GPR, electromagnetic and radio frequency induction) to identify and mark subsurface utilities and/or structures, if any, at each soil boring location within the AOC. The drilling contractor will then initiate the notification for a utility mark-out (Code 753, Dig Safely NY) and will implement the utility clearance procedure as detailed in Con Edison's Utility Clearance Process for Intrusive Activities. In addition, the results from the focused geophysical survey will be used in combination with an M-scope survey (performed by Con Edison) to confirm the proposed subsurface investigation locations are not in areas of subsurface utilities. During the utility clearance, the presence of overhead structures in areas where intrusive activities are planned will be observed and documented.

Following completion of the utility clearance, the proposed soil boring locations, which were not previously hand excavated during the exploratory activities outlined above, will be hand cleared within a 1.5-foot by 1.5-foot square area to a depth of at least 5 feet bgs. During hand-clearing activities, mercury vapor monitoring will be conducted and soils will be managed as previously described in Section 2.5.2. Following completion of the hand clearing, the soil boring will either be completed at that location or the location backfilled/abandoned if subsurface utilities or obstructions are encountered in the hand-cleared area. If a hand-cleared location is to be used for a soil boring but cannot be completed on the same day, the pre-cleared location will be secured so that it is readily identifiable at some future date.

If a soil boring is to be completed, a 6-inch-diameter polyvinylchloride (PVC) pipe will be placed in the hand-cleared soil boring location from the base of the excavation to ground surface. The annular space between the PVC pipe and exposed soil wall will be backfilled with clean material brought onto the Site. The interior of the pipe may be filled with clean material. The subsurface soil borings will then be advanced inside the PVC pipe previously installed.

2.7 Task 7: Subsurface Soil Investigation (Pending)

Based on the results of the historical information review and mercury vapor and GPR surveys that were completed as part of Tasks 2, 3, and 4 and pending the results of the exploratory test pits to be completed under Task 5, soil borings are proposed to be installed within the AOC. The soil borings are classified into the following categories:

A. Borings installed adjacent to the structure (to be uncovered as part of the exploratory test pit task) to assess potential downward migrations at the presumed source (HAE-SB-01 through HAE-SB-04)

B. Borings installed to delineate the horizontal and vertical extent of elemental mercury impacts as well as the general characteristics of the soils within and downgradient of the AOC (HAE-SB-05 through HAE-SB-07 and HAE-TMW-01)

Additional information regarding each of the proposed soil boring location types is presented in the following subsections.

2.7.1 Soil Borings Installed Adjacent to the Subsurface Structure

Following completion of the exploratory test pits and foundation wall and subsurface structure assessment (described in Section 2.5), four initial soil boring locations (HAE-SB-01 through HAE-SB-04) adjacent to the structure (i.e., classified as "A" borings, above) will be completed to evaluate the potential for downward migration of mercury into the subsurface soils. Four "A" soil boring locations are planned and at least one soil boring will be located on each side of the structure (i.e., on the upgradient and downgradient sides). In addition, secondary soil boring locations (i.e., classified as "B" borings, above) may be selected to evaluate the potential for lateral and downward migration from the structure. The secondary locations will be selected based on the exploratory test pit observations (i.e., based on the nature and extent of elemental mercury observed in soils during excavation). Four "B" soil boring locations (HAE-SB-05 through HAE-SB-07 and HAE-TMW-01) are listed in **Table 2-2** and general locations are shown in Figure 2-2 with locations upgradient and downgradient of the structure.

The proposed soil boring locations will be marked and installed using direct-push methods as described below. All additional soil boring locations will be completed in consultation with NYSDEC.

2.7.2 Soil Borings Installed to Assess Extent of Impacted Soil in AOC

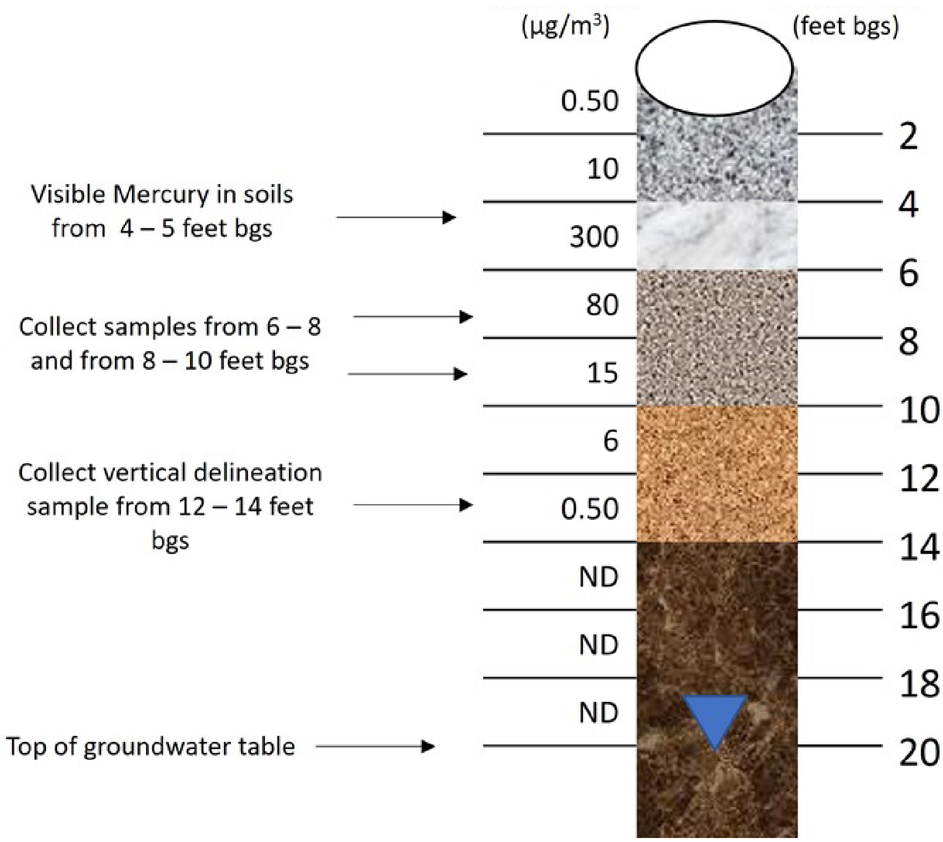
Based on the results of Tasks 2, 3, and 4, three initial soil boring locations (HAE-SB-05 through HAE-SB-07) have been identified for delineation of elemental mercury and to assess overall soil character within the AOC with one additional location (HAE-TMW-01) identified downgradient of the AOC. The proposed boring locations within the AOC target areas where mercury vapor readings at the ground level show a comparatively higher concentration as compared with the adjacent areas. Additional soil borings located upgradient and downgradient from the initial soil borings will also be considered in consultation with NYSDEC based on field observations to further confirm the limits of mercury-impacted soil.

The locations of the three initial soil borings (HAE-SB-05 through HAE-SB-07) in the AOC and one location downgradient (HAE-TMW-01) are shown in **Figure 2-2** and described in **Table 2-2**. Adjustments or proposing additional borings to the soil boring locations may be necessary based upon field conditions especially around test pits in which elemental mercury is detected, analytical results from samples collected during excavation of test pitting, and/or the presence of existing overhead/underground infrastructure. All adjustments or additional locations will be selected in consultation with NYSDEC.

The soil borings will be installed using direct-push drilling methods as detailed in the SOPs included as **Appendix B**. The soil borings will be visually reviewed and screened as the core is opened using an MVA. Soil intervals with visible elemental mercury will be documented and screened with an MVA. Soil borings without visible elemental mercury and with the highest mercury vapor readings will be sampled as will the interval directly below the sampled interval. In addition, the first interval with mercury vapor levels less than the MVA detection limit of 0.5 microgram per cubic meter ($\mu g/m^3$; as measured by a Jerome 405 MVA) will also be sampled to close out the delineation. The borings will be installed to the top of the groundwater table, which is estimated to be approximately 20 feet bgs. If the soil screening results are less than the MVA detection limit (0.5 $\mu g/m^3$ for a Jerome 405 MVA) throughout the soil boring, then no samples will be collected from that soil boring.

Figure 2-3 (below) presents an example of the proposed strategy for collection of soil samples during soil boring advancement.

Figure 2-3
Soil Sample Selection Based on Mercury Vapor Readings



Collected soil samples will be submitted for total mercury analysis as well as total polychlorinated biphenyls (PCBs), volatile and semivolatile organic compounds, and metals. Soil borings will be backfilled with clean material brought onto the Site or grouted in place in accordance with the SOPs included in **Appendix B.**

2.8 Task 8: Groundwater Assessment (Pending)

Based on the results of Tasks 4 to 7, at least one temporary monitoring well will be installed downgradient of the AOC; see **Figure 2-2** for target location. The monitoring well point will be installed using direct-push drilling technology, and filtered and unfiltered groundwater samples will be collected in accordance with the SOPs included in **Appendix B**. In addition, filtered and unfiltered groundwater samples will be collected from existing downgradient monitoring well HW-10 and existing upgradient monitoring well MW-07. The groundwater samples will be submitted for laboratory analysis of total mercury as well as total PCBs, volatile and semivolatile organic compounds, and metals.

2.9 Survey

Once all field activities have been completed, a licensed surveyor will survey the as-built locations for all completed soil borings and installed monitoring wells. Additional features identified during the investigations will also be surveyed (e.g., the extent of the subsurface structure). At each as-built location, the surveyor will record the latitude, longitude, and ground surface elevation in the project datum. For existing monitoring wells, the reference elevation on the well casing will also be surveyed.

2.10 Investigation-Derived Wastes

Investigation-derived liquid waste will be containerized in steel, 55-gallon, U.S. Department of Transportation (DOT)-approved drums. Liquid waste will generally consist of purged groundwater and decontamination water generated while cleaning equipment. All liquid waste drums will be properly sealed and labeled to identify their contents and the source location.

Investigation-derived solid waste will consist of soil generated during test pit excavation and soil boring activities and used personal protective equipment (PPE), such as gloves and plastic bags that have come into contact with potentially contaminated soil or water. The solid waste will be separated into soil and PPE wastes; both will be containerized in steel, 55-gallon, open-top DOT-approved drums. The drums will be properly sealed and labeled to identify their contents.

As drums of soil are generated during these investigations, waste characterization samples will be collected, and all waste will be considered to be mercury contaminated until waste characterization results are returned. In general, soils generated during the investigation will be segregated such that soils with visible mercury or with mercury vapor readings that required application of suppressant will be segregated and characterized separately from all other soils.

Additionally, soil generated from 0 to 5 feet bgs (i.e., shallow soil) will be segregated from soil generated from depths greater than 5 feet bgs, as described below:

- Shallow soils will be generated during manual excavation of exploratory test pits or excavations for utility clearance at soil boring locations.
- Subsurface soils will be generated during advancement of soil borings.
- Shallow and subsurface soils will be tracked by location and location information will be included on drum labels:
  - Shallow soils from more than one location may be combined into a single drum for storage and characterization provided there were no observations of visible mercury or no mercury vapor readings that required application of suppressant. The drum will be labeled to include all investigation locations where soil was generated.
  - Subsurface soils from more than one location may be combined into a single drum for storage and characterization provided there were no observations of visible mercury or

no mercury vapor readings that required application of suppressant. The drum will be labeled to include all investigation locations where soil was generated.

The results of the waste characterization will be used to properly profile and manifest the waste for disposal. Drums of soil without visible mercury or elevated mercury vapor readings that required use of suppressant may be considered for reuse on the Site in consultation with NYSDEC, provided waste characterization results will allow. While awaiting disposal, drums will be stored on the Property within a fenced area. SOP 011: Investigation-Derived Waste (**Appendix B**) provides additional details on management of investigation-derived wastes.

3 Data Usability

Following completion of fieldwork, all field measurements and observations will be tabulated. Analytical results provided by the project laboratory will be submitted for data validation and usability as described in the project QAPP (**Appendix A**). Validated analytical soil results will be compared to the soil criteria identified in 6 New York Codes, Rules and Regulations (NYCRR) Part 375-6 (NYSDEC 2006) and included in a Site Characterization Report to be provided to NYSDEC. The report will follow DER-10 guidance as well as provided as an electronic data submission following the most recent format requirements (NYSDEC 2018).

4 Reporting

Following completion of the SC activities and the receipt of analytical data, a Site Characterization Report will be prepared. The Site Characterization Report will present the following information:

- Description of the Property and Site including the historical background, historical manufacturing operations, and current uses
- Description of the assessment activities
- Visual observations
- Results of the GPR and mercury vapor screening surveys
- Observations recorded during the test pitting and soil boring activities
- Analytical results for the soil and groundwater sampling, along with a comparison to appropriate regulatory standards or other relevant comparison criteria
- Development of figures presenting the sample locations and subsurface structure mapping
- Tabulated analytical results
- Evaluation of the nature and extent of mercury contamination at the AOC
- Recommendations for additional investigation activities, if warranted to further refine the potential extent of mercury contamination, or to develop remedial strategies

5 Project Schedule

Con Edison has performed non-intrusive fieldwork (Steps 3 and 4 of the SC strategy presented in Section 1) and is prepared to initiate the intrusive fieldwork for data collection outlined in this SC Work Plan as soon as possible following receipt of NYSDEC approval and anticipates that it will take up to 8 weeks to complete all fieldwork, associated analytical testing, and data usability review. The schedule in **Table 5-1** is the approximate schedule following submission of the SC Work Plan to NYSDEC with the actual project starting date subject to NYSDEC review and approval of the SC Work Plan, as well as planned shutdowns at the Property (in connection with previously scheduled maintenance work).

Table 5-1
Project Schedule

Work Activity	Date	Duration
SC Work Plan approval by NYSDEC	Projected for February 2022	
MVA and GPR screen	October 15 and November 4, 2021, respectively	2 days
Utility hand dig plus expose limits of structure/wall	February and March 2022 (during scheduled power outage)	5 days
Intrusive work	February and March 2022 (during scheduled power outage)	5 days
Data analysis and reporting	8 weeks	8 weeks
Submit Final Site Characterization Report	3 weeks from receipt of NYSDEC comments	--

6 References

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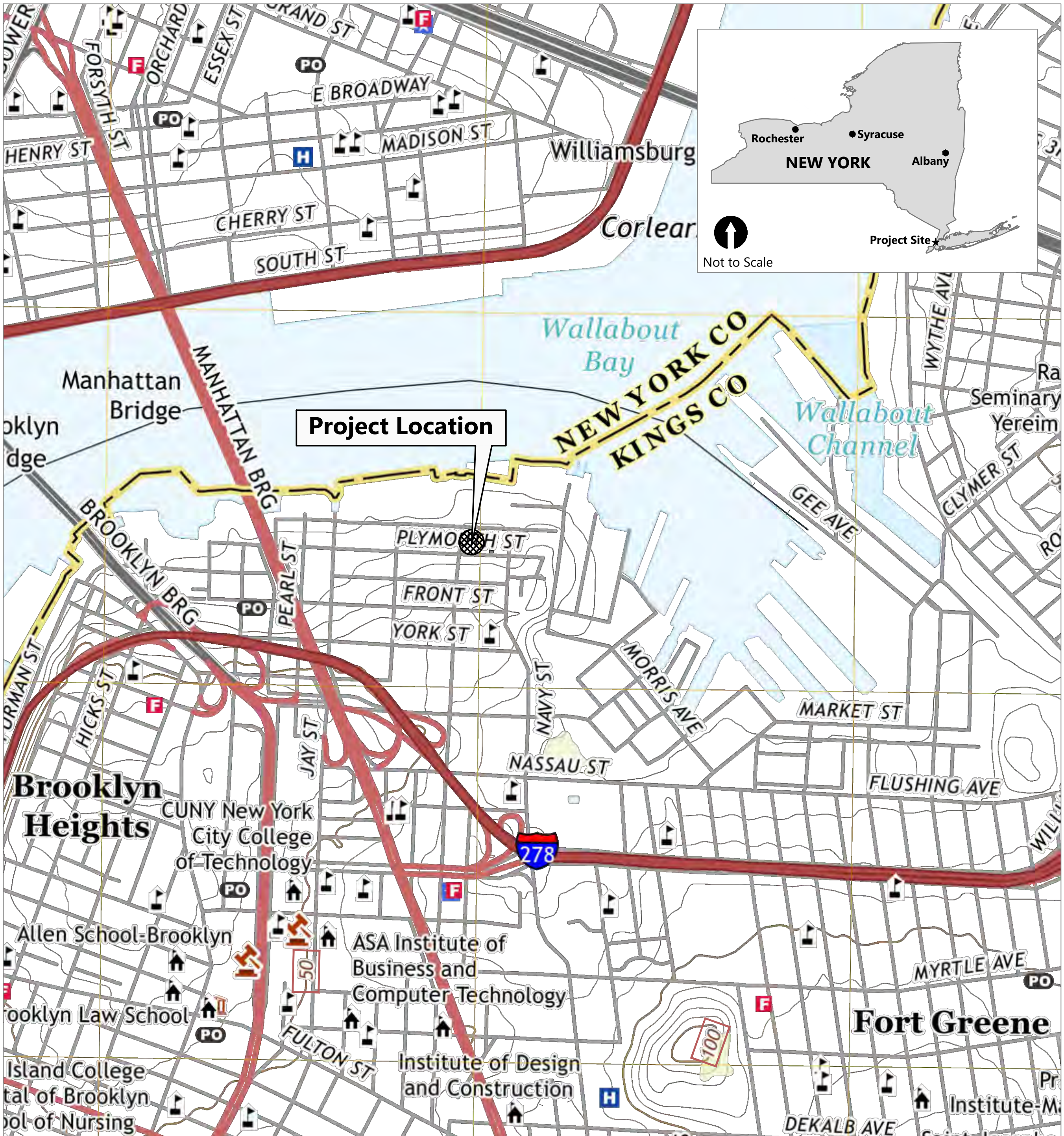
Table (attached)

Table 2-2
Summary of Investigation Locations

Boring Name	Easting[1]	Northing[1]	Justification
HAE-SB-01	989175.6	195829.1	Subsurface soil assessment location
HAE-SB-02	989168.1	195823.9	Subsurface soil assessment location
HAE-SB-03	989171.4	195821.6	Subsurface soil assessment location
HAE-SB-04	989162.8	195815.8	Subsurface soil assessment location
HAE-SB-05	989165.0	195836.0	Subsurface soil assessment for general character location
HAE-SB-06	989180.5	195837.6	Subsurface soil assessment for general character location
HAE-SB-07	989176.7	195817.5	Subsurface soil assessment for general character location
HAE-TMW-01	989171.0	195848.9	Downgradient groundwater sampling location; subsurface soil assessment for general character location
HAE-TP-01	989172.7	195827.2	Subsurface structure and soil investigation location
HAE-TP-02	989169.4	195824.8	Subsurface structure and soil investigation location
HAE-TP-03	989165.2	195820.9	Subsurface structure and soil investigation location
HAE-TP-04	989160.1	195820.2	Subsurface structure and soil investigation location
HAE-TP-05	989167.4	195813.4	Subsurface structure and soil investigation location

Notes:
[1] New York State Plane, Long Island Zone, North American Datum of 1983 (NAD83), U.S. Survey Feet
All locations are considered draft and will be adjusted in the field based upon results of utility clearance and location of subsurface structure.

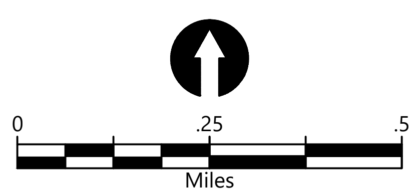
Figures (attached)



SOURCE: USGS Brooklyn Quadrangle, New York, 7.5 Minute Series, 2019
HORIZONTAL DATUM: New York State Plane, Long Island Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: North American Vertical Datum of 1988 (NGVD88)

LEGEND:

100 — Existing Contours (10-Foot Interval)

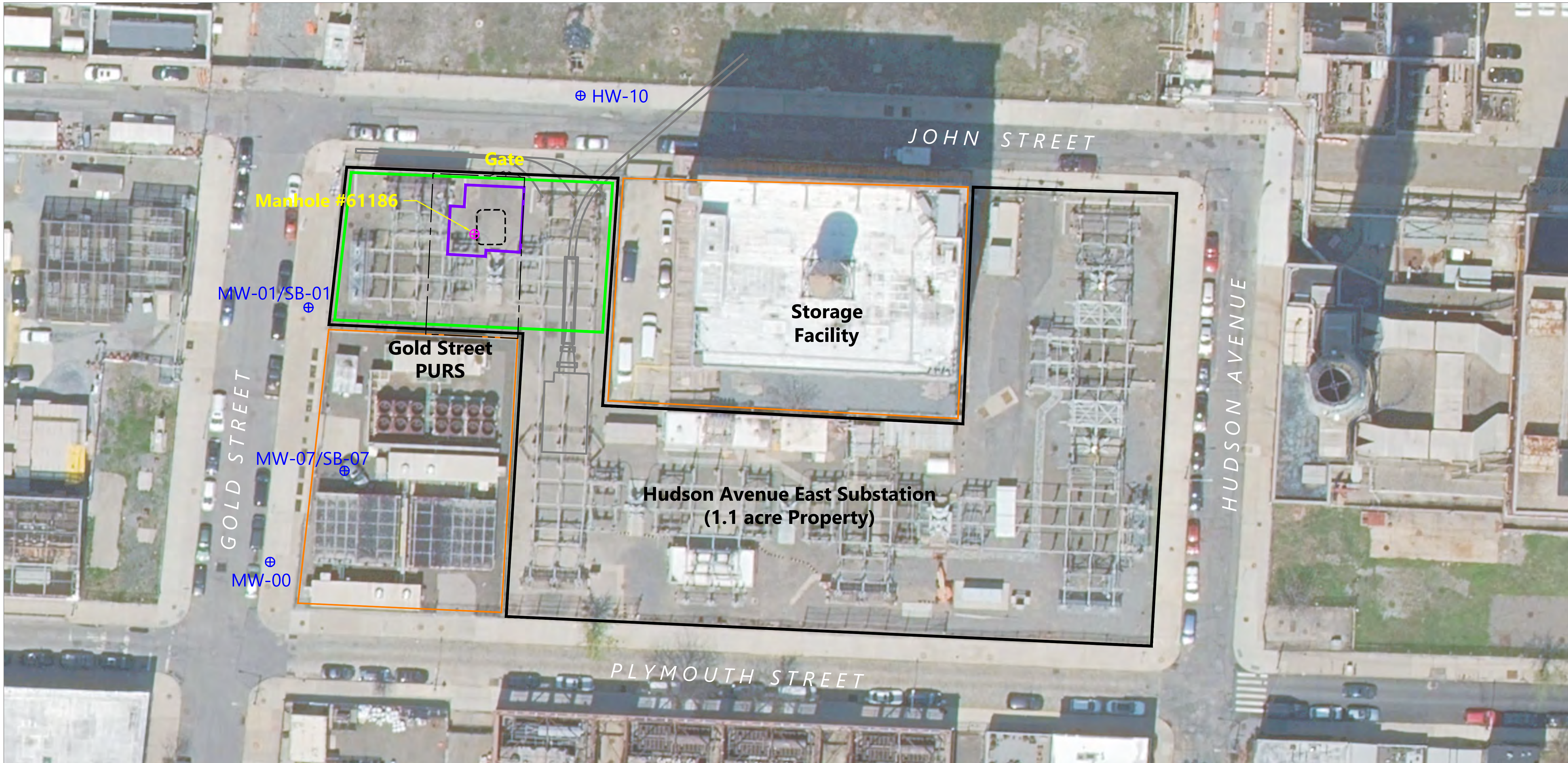


Publish Date: 2022/01/28 11:05 AM | User: psciaba
Filepath: K:\Projects\0921-Con_Edison\194 John Street\0921-RP-025 Site Location Map.dwg Figure 1-1

ANCHOR QEA

Figure 1-1
Site Location Map

Site Characterization Work Plan
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, NY



SOURCE: Subsurface utility locations from Con Edison sketch "Plan of Feeders 38B21, 38B22, and Relocated Feeder 32078", dated July 7, 2021. Aerial by Bing Imagery 2021.
HORIZONTAL DATUM: New York State Plane, Long Island Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: North American Vertical Datum of 1988 (NGVD88)

NOTE: Substructure utilities locations are approximate, contractor to field verify.

LEGEND:

- Mercury Discovery Area
- Existing Groundwater Monitoring Well (Installed by Others)
- Manhole #61866
- Feeders
- Area of Concern (~760 sq ft)
- Mercury Vapor and GPR Survey Area
- Site (~0.2 acre)
- Property (~1.1 acre)

0 40
Feet

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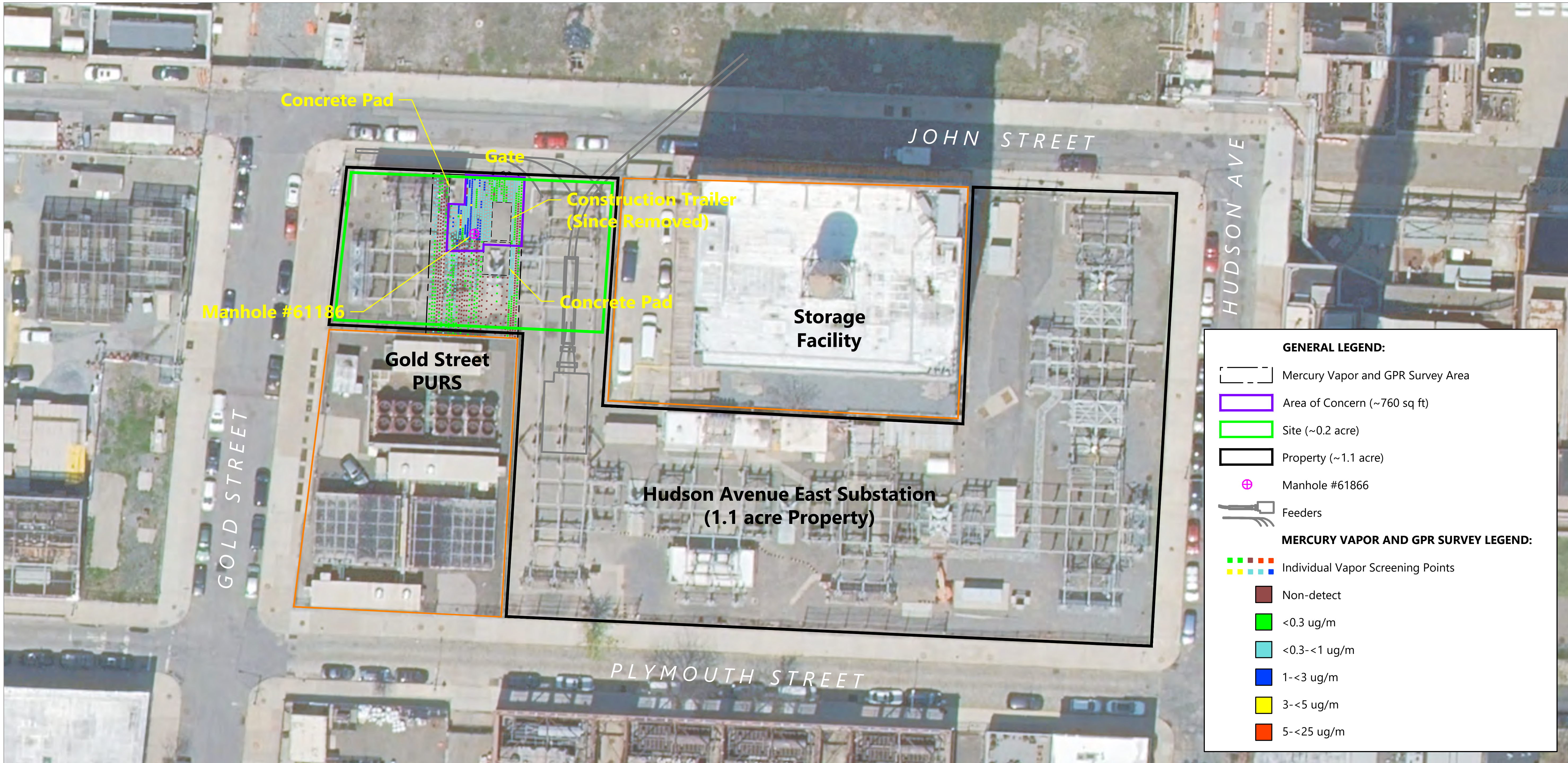
Filepath: K:\Projects\0921-Con_Edison\194 John Street\0921-RP-029 Site Plan - Rev7.dwg Figure 1-2

ANCHOR QEA

Figure 1-2
Site Plan and August 2021 Area of Concern



SOURCE: Subsurface utility locations from Con Edison sketch "Plan of Feeders 38B21, 38B22, and Relocated Feeder 32078", dated July 7, 2021. Aerial by Bing Imagery 2021.
HORIZONTAL DATUM: New York State Plane, Long Island Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: North American Vertical Datum of 1988 (NGVD88)
NOTES:
1. Substructure utilities locations are approximate, contractor to field verify.
2. Investigation locations may be modified based on subsurface conditions encountered, site access or the presence of above grade obstacles, overhead subsurface utilities, or subsurface obstructions.

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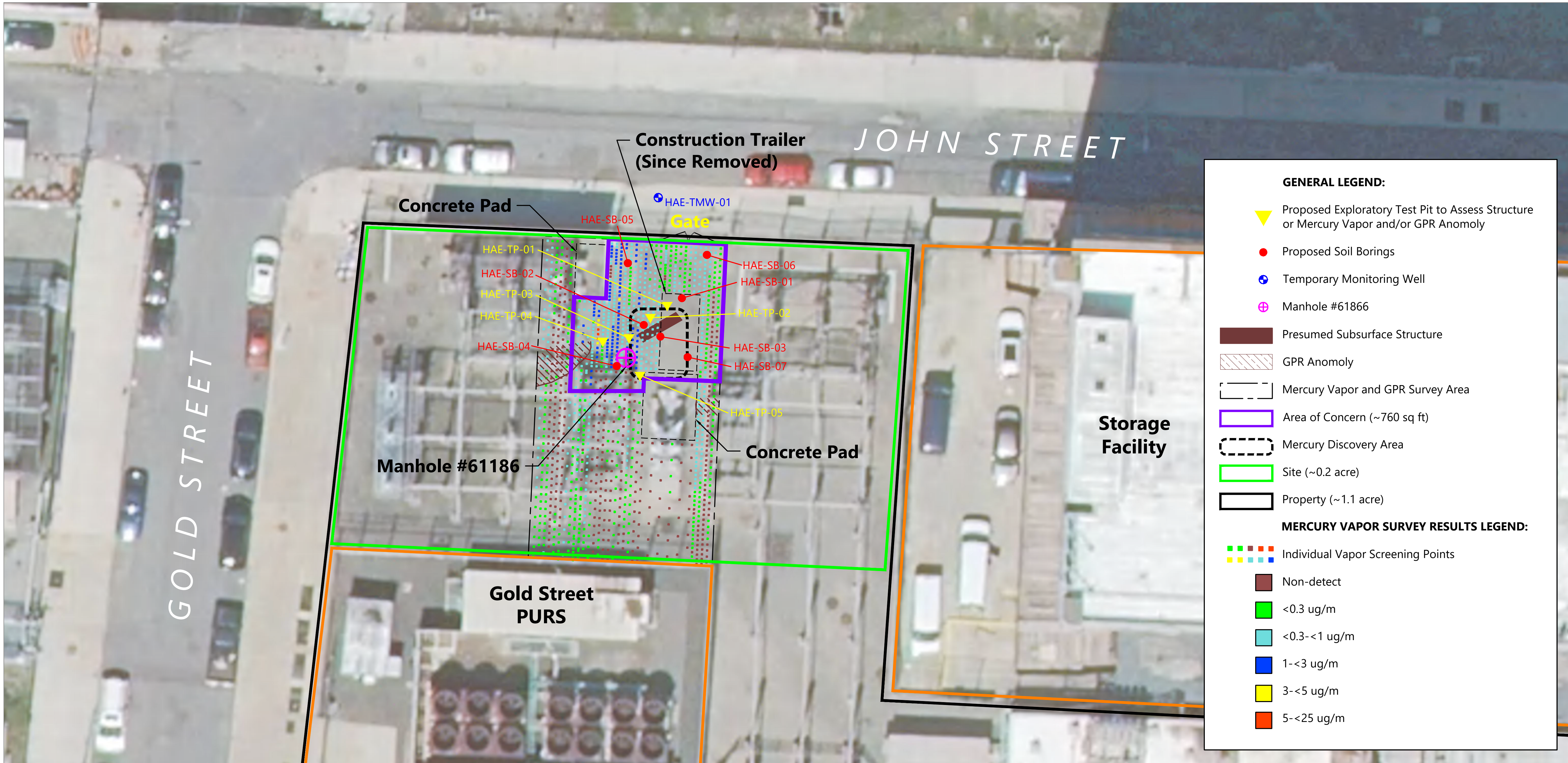
Filepath: K:\Projects\0921-Con_Edison\194 John Street\0921-RP-027 Investigation Area - Rev7.dwg Figure 2-1

ANCHOR QEA

Figure 2-1
MVA Survey Area

Site Characterization Work Plan
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, NY



SOURCE: Subsurface utility locations from Con Edison sketch "Plan of Feeders 38B21, 38B22, and Relocated Feeder 32078", dated July 7, 2021. Aerial by Bing Imagery 2021.
HORIZONTAL DATUM: New York State Plane, Long Island Zone, NAD83, U.S. Survey Feet
VERTICAL DATUM: North American Vertical Datum of 1988 (NGVD88)

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Filepath: K:\Projects\0921-Con_Edison\194 John Street\0921-RP-035 Sample Locations and Survey Results.dwg Figure 2-2

ANCHOR QEA

Figure 2-2
Sample Locations and Survey Results

Site Characterization Work Plan
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, NY

Appendix A
Quality Assurance Project Plan

January 2022
164 John Street

Quality Assurance Project Plan

Prepared for Consolidated Edison Company of New York
31-01 20th Avenue, Building 136, 2nd Floor
Long Island City, New York 11105

January 2022
164 John Street

Quality Assurance Project Plan

Prepared for
Consolidated Edison Co. of New York, Inc.
31-01 20th Avenue, Building 136, 2nd Floor
Long Island City, New York 11105

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

Project Number: E10921-03.01

TABLE OF CONTENTS

TABLES

ABBREVIATIONS

ASTM	ASTM International
CCV	continuing calibration verification
CoC	chain-of-custody
DQO	data quality objective
EPA	U.S. Environmental Protection Agency
FC	Field Coordinator
GC	gas chromatography
HASP	Health and Safety Plan
MD	matrix duplicate
MDL	method detection limit
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NELAP	National Environmental Laboratory Association Program
NIST	National Institute of Standards and Technology
PCB	Polychlorinated biphenyl
PM	Project Manager
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
Site	164 John Street, Brooklyn, New York
SOP	Standard Operating Procedure
SVOC	Semi-volatile organic compound
TAL metals	Target analyte list metals
VOC	Volatile organic compound

1 Introduction

1.1 Purpose

This Quality Assurance Project Plan (QAPP) has been prepared to specify recommended quality assurance (QA) procedures to be followed during site characterization fieldwork performed at Con Edison's Gold Street Public Utility Regulating Station (PURS) located at 164 John Street, Brooklyn, New York (the Site).

1.2 Project Organization

This QAPP has been prepared by Anchor QEA Engineering, PLLC, on behalf of the Consolidated Edison Company of New York, Inc. (Con Edison). Anchor QEA is fully committed to implementing an effective QAPP program. The success of this program is based on the concept that implementation of this program is the responsibility of all project participants. Specific responsibilities have also been assigned to key project personnel for the implementation of this QAPP program.

Margaret Carrillo-Sheridan, PE, will serve as the Project Principal and engineer of record. She will be responsible for the overall technical direction and management of the project. Matthew Cavas, PG, will serve as the Project Manager (PM) responsible for allocation of technical and human resources and schedule management. The PM will provide the overall programmatic guidance to support staff and will verify that all documents, procedures, and project activities meet the objectives contained within this QAPP. The PM will also be responsible for resolving project concerns or conflicts related to technical matters with the Project Principal.

Fabricio Yumiguano will be the Field Coordinator (FC) and will be responsible for day-to-day technical and QA/quality control (QC) oversight for sample collection activities. Mr. Yumiguano will verify that appropriate protocols for sample collection, preservation, and holding times are observed and will submit environmental samples to the designated laboratories for chemical and physical analyses.

Jennifer Marsalla will act as the QA Manager and will provide QA oversight for both the field sampling and laboratory programs, verify that samples are documented appropriately, coordinate with the analytical laboratories, verify data quality, oversee data validation, and supervise project QA coordination and data validation. Ms. Marsalla will work with the Laboratory PM to resolve QC issues as they affect the viability of the project data, and she will work with the assigned data validators to verify that all analytical data are in conformance with the requirements of this QAPP.

Sheng Wang will serve as the Data Manager and will compile field observations and analytical data into a database, review the data for completeness and consistency, append the database with qualifiers assigned by the data validator, and verify that the data obtained are in a format suitable for inclusion in the appropriate databases.

Megan Moeller is the Laboratory PM with Eurofins Lancaster which is National Environmental Laboratory Association Program (NELAP) certified. Ms. Moeller will oversee all laboratory operations associated with the receipt of the environmental samples, chemical/physical analyses, and laboratory report preparation for this project. The Laboratory PM will review all laboratory reports and prepare case narratives describing any anomalies and exceptions that occurred during analyses.

2 Investigation and Sampling Procedures

The scope of investigations presented in this QAPP include the following:

- Subsurface utility locating and surveying
- Subsurface structure and soil investigations and sample collection
- Groundwater investigation, monitoring well installation, and sampling

Investigations will be conducted in accordance with the project Health and Safety Plan (HASP; Appendix C of the Site Characterization Work Plan). Samples will be analyzed according to the U.S. Environmental Protection Agency (EPA) promulgated Standard Method, or ASTM International (ASTM) methods. Regardless of the method used, all preparation and analytical holding times must meet the requirements for that analytical group and as outlined in Table 1. Holding times will be calculated from the sample collection date and time. The method detection limits (MDLs) and method reporting limits (MRLs) for the analytes are laboratory specified for the project based on its most recent MDL studies. Analyte lists for soil and groundwater, and waste characterization samples are listed in Tables 2 thru 4.

2.1 Utility Locating and Surveying

Site characterization investigations will be performed on the Site, primarily on paved or gravel surfaces. Prior to any subsurface intrusive work investigation, target locations will be mapped and private and public utilities will be located to identify potential conflicts. When fieldwork has been completed, actual locations completed will be surveyed.

2.1.1 Utility Locating

Prior to any intrusive fieldwork, utility location work will be completed to identify potential obstructions or conflicts with target locations. Site characterization target locations will be marked using white paint or flags using a handheld GPS. These markings will be visible during utility locators for public utilities notified as part of the New York Dig Safe program (811). Responses from the Dig Safe notification will be documented to ensure all public utilities have been marked.

Following public utility marking, a private utility location subcontractor will mobilize to the Site to complete a geophysical survey for additional buried utilities. Tools such as ground penetrating radar, magnetometer, and pipe and cable locators will be used. The firm will focus on the proposed locations and investigate to “clear” a 5-foot radius around each proposed subsurface investigation location, allowing for adjustments by the drilling firm in the field to ensure the drill is advanced in an area clear of subsurface utilities. Additional details are provided in the project Standard Operating Procedures (SOPs) included in Appendix D to the Site Characterization Work Plan.

2.1.2 Surveying

Locating and mapping the investigation locations in the field prior to the start of intrusive activities will be completed using GPS methods. GPS survey tools are a standard means to identify target locations that may later be adjusted for various reasons. Minimum procedures for data acquisition, analysis, and QA to establish survey/positioning of field investigation locations will include the following:

- Proposed location coordinates will be determined in the field using GPS equipment accurate to ± 1 meter at a minimum.
- Changes in location will be reviewed with the FC and PM prior to any move/adjustment.
- Coordinates for proposed investigation locations will be identified prior to mobilization and reviewed with Con Edison and the New York State Department of Environmental Conservation (NYSDEC).
- All elevation data recorded will be in North American Vertical Datum of 1988 (NAVD88) and all horizontal coordinates will be relative to North American Datum of 1983 (NAD83), State Plane New York West.

Following completion of all site characterization fieldwork, a licensed New York surveyor will mobilize to the Site to collect position and elevation data for all investigation locations. A licensed surveyor will be used because a higher degree of horizontal and vertical control is needed for final, as-built locations. Standard land-based survey techniques will be used and minimum procedures for data acquisition will include the following:

- All elevation data recorded will be in NAVD88, and all horizontal coordinates will be relative to NAD83, State Plane New York West.
- The survey is to be performed at a horizontal accuracy of less than 1 foot.

2.2 Investigations and Sample Collection

The following sections describe procedures to be followed in the field for soil investigations and soil and groundwater sample collection as applicable.

2.2.1 Sampling Equipment

The following is a general list of equipment that may be necessary for soil investigations and soil and groundwater sample collection:

- Appropriate sample bottles (kept closed and in the laboratory-shipped coolers until the samples are collected) provided by the laboratory
- Chain-of-custody (CoC), labels, tags, seals, and record forms
- Logbook, field sampling records, and indelible ink markers

- Laboratory-grade decontamination detergents (such as Alconox or Liquinox), reagent-grade solvents,
- Deionized organic-free water to be used for decontaminating equipment between sampling stations and generation of equipment blanks
- Squirt bottles
- Ruler and measuring tape
- Garbage bags and plastic sheeting
- Paper towels and/or wipes
- Direct-push drill rig and associated equipment
- Buckets, wash basins, and scrub brushes to be used for decontaminating equipment
- Steam cleaner or hot water wash and containment pad
- Groundwater sample pump
- Dedicated tubing and 0.45-micron capsule filter (as needed)
- Digital camera or camera and film to document sampling procedures and sample locations
- White board to include in photographs to label samples/photographs
- Shipping labels and forms
- Knife
- Packing/shipping material to prevent damage to sample bottles during shipping
- Strapping, clear plastic, and duct tape
- Re-sealable plastic bags
- Ice
- Portable field instruments, including photoionization detector and GPS

Other sampling materials and equipment may be utilized as warranted by field conditions encountered at time of sampling. Appropriate health and safety equipment and personal protective equipment, per the HASP (Appendix C of the Site Characterization Work Plan), will be used.

2.2.2 Equipment Decontamination

Between investigation locations and prior to sample collection, all non-dedicated/non-disposable equipment (i.e., drill rods, sample barrel, bowls, groundwater samplers, and field measurement equipment that contacts soil and/or groundwater) will be washed with potable water and a laboratory-grade, phosphate-free, detergent (such as Alconox). Equipment will be given a final rinse of distilled or de-ionized water. Larger equipment (e.g., drill-rig, drilling rods and sample core barrel) may be decontaminated with a hot-water wash. Decontamination may take place at the sampling location as long as all liquids are contained in pails, buckets, 55-gallon drums, or similar containers. Equipment impacted by nonaqueous phase liquid may be cleaned with a cleanser such as CitraSolv. Between rinses, equipment will be placed on polyethylene sheeting or aluminum foil. At no time will decontaminated equipment be placed directly on the ground. Equipment will be wrapped in polyethylene plastic or aluminum foil and stored. Waste materials generated during sampling activities will be disposed of as required.

2.2.3 Field Records

Field logbooks and entries will be maintained by field staff to provide a daily record of significant events, observations, and measurements during the field investigation. All entries will be signed and dated at the bottom of each page.

Information pertinent to the field investigation and/or sampling activities will be recorded in the logbooks. The logbooks will be bound with consecutively numbered pages. Entries in the logbook will include, at a minimum, the following information:

- Name and title of author, date and time of entry, and physical/environmental/weather conditions during field activity
- Purpose of sampling activity
- Location of sampling activity
- Name of field contact
- Name of field crew members
- Name and organization of any site visitors
- Sample media (e.g., soil)
- Sample collection method
- Number and volume of sample(s) collected
- Description of sampling point(s)
- Sample location coordinates
- Date and time of sample collection
- Sample identification number(s)
- Field observations
- Any field measurements made (e.g., water level elevation)
- References for all maps and photographs of the sampling site(s)
- Information pertaining to sample documentation, such as dates and method of sample shipments, CoC record numbers, and overnight shipping air bill number

All original data recorded in field logbooks, sample tags, and CoC records will be written with waterproof ink. None of these accountable, serialized documents will be destroyed.

If an error is made on an accountable document assigned to one individual, that individual will make all corrections simply by crossing a single line through the error, placing the initials of the individual making the correction and date next to the crossed-out information, and entering the correct information. The erroneous information will not be erased. All field personnel will be instructed as to the proper field logging techniques for maintaining the integrity of the documentation.

2.2.4 General Sample Collection and Processing Procedures

Soil and groundwater samples will be collected as outlined in the Site Characterization Work Plan and following procedures described in the SOPs included in Appendix D of the Site Characterization Work Plan.

Subsurface soil sample collection will be conducted following these general procedures:

- At the identified investigation location, advance the soil core barrel to the identified depth below grade. Soil will be recovered within disposable acetate liners. Alternatively, for samples collected via test pitting, collect a grab sample from the test pit side wall (if less than 4 feet deep), or collect a grab sample from the excavator bucket (when filled with soil from the target sample depth)
- Take care to collect the sample the center of the recovered soil, avoiding soils which were touching the acetate liner.
- Photograph and visually characterize the recovered soil.
- Place collected soil into a clean stainless steel bowl and homogenize.
- Place the soil sample into laboratory-provided sample containers.

At a minimum, the following will be recorded in the field logbook:

- Site
- Station identification
- Date and time
- Initials of sampling personnel
- Drilling contractor company's name
- Time associated with sample collection
- Amount of soil recovered
- Sample collection methods
- Sample location coordinates
- Photograph of the sample including a white board listing the following: site name, date, sample identification, and time of sample
- Soil description

Groundwater samples will be collected from monitoring wells installed as part of the site characterization fieldwork. Each of the monitoring wells will be sampled once follow low-flow or low-stress sampling procedures. In addition, a water quality sonde within a flow-through cell will be used to measure water quality parameters prior to sample collected.

At a minimum, the following information will be record in the field logbook:

- Site
- Monitoring well identification
- Date and time
- Initials of sampling personnel
- Time associated with sample collection

2.2.5 Field Quality Assurance/Quality Control Samples

Equipment blanks will be generated at a minimum frequency of one per collection event for all project analytes when using non-dedicated sampling equipment. An equipment blank is a way to measure contamination attributed by the sample collection equipment. Contaminant-free water is poured over sampling equipment and then collected for analyses. The presence of measurable concentrations of contaminants in an equipment blank indicates the potential for cross-contamination. The equipment blanks will be numbered sequentially and appended with the date. Equipment blanks will be analyzed for VOC, SVOC, TAL metals, and PCBs.

To determine the reproducibility and homogeneity of samples, field duplicates will be collected. The frequency of collection of these samples is 1 per up to 20 field samples per matrix. Duplicate samples will be assigned a unique sample number that correlates with the source sample number. The duplicate sample number and sample number for the source sample will be recorded in the field logbook.

MS/matrix spike (MSD)/matrix spike duplicate will be requested at a frequency of 1 set per 20 field samples as required by the method. Sufficient additional sample mass or volume to conduct these QC analyses will be collected for each designated sample, as necessary. An MSD sample may be analyzed for in lieu of a duplicate.

3 Sample Handling Procedures/Sample Custody

Sample custody procedures will be followed to verify that samples are always in the custody of a responsible person and to provide a record of those responsible for the samples. CoC begins at the time of preparation for the field activity, and the procedures apply to field sampling activities, sample shipping, laboratory analytical procedures, and data reporting. Samples are considered to be in one’s custody if they are in the custodian’s possession or view, in a secured location (under lock) with restricted access, or in a container that is secured with official seals such that the sample cannot be reached without breaking the seals.

3.1 Sample Custody and Shipping Requirements

CoC procedures will be followed for all samples throughout the collection, handling, and analysis process. The principal document used to track possession and transfer of samples is the CoC form. Each sample identification will be listed on an electronic or hand-written CoC form the day it is collected. All data entries will be made using indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank lines and spaces on the CoC form will be lined-out, dated, and initialed by the individual maintaining custody.

A CoC form will accompany each shipment of samples to the analytical laboratories. Each person who has custody of the samples will verify that the samples are not left unattended unless properly secured. Copies of all CoC forms will be retained in the project files.

All samples will be shipped, couriered, or hand delivered to the analytical laboratory in a timely manner so holding times are not compromised. Samples collected on a Friday may be held until the following Monday for shipment, provided that this does not jeopardize any hold time requirements. Specific sample shipping procedures are as follows:

- Each cooler or container with the samples for analyses will be hand delivered the day of sample collection, couriered, or shipped via overnight delivery to the appropriate analytical laboratory. In the event that Saturday delivery is required, the FC will contact the analytical laboratory before 3 p.m. on Friday to verify that the laboratory is aware of the number of containers shipped and the airbill tracking numbers for those containers.
- Coolant ice will be sealed in separate plastic bags and placed in the shipping containers.
- Individual samples will be placed in a sealable plastic bag, packed to prevent breakage, and transported in a sealed ice chest or other suitable container.
- Glass jars will be separated in the shipping container by shock-absorbent material (e.g., bubble wrap) to prevent breakage.

- If the samples are transferred using a commercial shipping company, the following procedures will be followed:
  - The shipping containers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the container, and consultant's office name and address) to enable positive identification.
  - The shipping waybill number will be documented on all CoC forms accompanying the samples.
  - CoC forms will be enclosed in a plastic bag and placed inside the cooler.
  - A minimum of two signed and dated CoC seals will be placed on adjacent sides of each cooler prior to shipping.
  - Each cooler will be wrapped securely with strapping tape, labeled "Glass – Fragile" and "This End Up," and clearly labeled with the laboratory's shipping address and the consultant's return address.

Upon transfer of sample possession to the analytical laboratory, the person transferring custody of the sample container will sign the CoC form. Upon receipt of samples at the laboratory, the person receiving the sample will sign the CoC form. The shipping container seals will be broken (if applicable), and the receiver will record the condition of the samples on a sample receipt form. CoC forms will be used internally in the laboratory to track sample handling and final disposition.

4 Quality Assurance/Quality Control

Field and laboratory activities will be conducted in such a manner that the results meet specified quality objectives and are fully defensible. Guidance for QA/QC is derived from the protocols developed for EPA SW-846, the EPA Contract Laboratory Programs (EPA 2020a and 2020b), and the cited methods.

4.1 Field Quality Control

Anchor QEA personnel will identify and label samples in a consistent manner to verify that field samples are traceable. Labels should be used in conjunction with the CoCs and this QAPP to provide all information necessary for the laboratory to conduct required analyses properly. QA samples will be collected in the field to verify project data quality objectives (DQOs) are met. Samples will be placed in appropriate containers and preserved for shipment to the laboratory in accordance with the requirements presented in Table 1.

4.1.1 Field Quality Assurance Sampling

Field QA procedures will consist of following procedures for acceptable practices for sample collection and handling. This also includes periodic and routine equipment inspection.

Field QA samples will be collected along with the environmental samples. Field QA samples are useful in identifying possible problems resulting from sample collection or sample processing in the field. The collection of QA samples includes equipment rinsate blanks, trip blanks, and field duplicates. Equipment blanks will be collected at a frequency of one per collection method per event. Trip blanks will be prepared by the laboratory and sent with the sample containers for water and soil analyses. Trip blanks are 40-mL VOA vial containing VOC-free water and they accompany sample bottles into the field and collected samples back to the laboratory. If target analytes are detected in the equipment or trip blank at levels above the reporting limits (RLs), blank results will be compared to the sample results, and results within five times the concentration of the blank may be qualified. Field duplicates will be collected at a frequency of one per sampling event or 1 in 20 sample locations processed per matrix (whichever is more frequent), provided sufficient sample mass/volume can be collected.

QA samples will also include the collection of additional sample mass or volume as required to verify that the laboratory has sufficient sample mass or volume to run the matrix-specified analytical QA/QC (MS/MSD) samples for analyses as specified in Table 5. Additional sample mass or volume to meet this requirement will be collected at a frequency of one per matrix per sampling event or 1 in 20 samples processed, whichever is more frequent. The samples designated for MS/MSD analyses should be clearly marked on the CoC.

All field QA samples will be documented on the field forms and verified by the QA Manager or designee.

4.1.2 Sample Containers

Sample containers and preservatives will be provided by the laboratory. The laboratory will maintain documentation certifying the cleanliness of bottles and the purity of preservatives provided. Container requirements are listed in Table 1.

4.1.3 Sample Identification and Labels

Each sample collected as part of this investigation will be given a unique identification. With this type of identification, no two samples will have the same label. Labels or tags that include the sample number will be attached to each sample container.

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. If the label is not waterproof, it will be covered with clear packing tape to render it waterproof. The following information will be recorded on the container label at the time of collection:

- Project name
- Sample identification
- Date and time of sample collection
- Preservative type (if applicable)
- Analysis to be performed

4.2 Data Quality Objectives and Criteria

The QA objective for the project is to develop and implement procedures that will provide data of known, documented quality. Field and laboratory quality QA/QC requirements ensure that acceptable levels of data quality will be maintained throughout the sampling and analysis program. The criteria commonly used to specify QA goals include precision, accuracy, representativeness, comparability, completeness, and sensitivity. These criteria are described in more detail in the following sections and project quantitative goals are listed in Table 6.

4.2.1 Precision

Precision is the ability of an analytical method or instrument to reproduce its own measurement. It is a measure of the variability, or random error, in sampling, sample handling, and laboratory analyses. ASTM recognizes two levels of precision (ASTM 2002):

1. Repeatability: the random error associated with measurements made by a single test operator on identical aliquots of test material in a given laboratory with the same apparatus under constant operating conditions
2. Reproducibility: the random error associated with measurements made by different test operators in different laboratories using the same method but different equipment to analyze identical samples of test material

In the laboratory, "within-batch" precision is measured using duplicate sample or QC analyses and is expressed as the relative percent difference (RPD) between the measurements. The "batch-to-batch" precision is determined from the variance observed in the analyses of standard solutions or laboratory control samples from multiple analytical batches.

Field precision will be evaluated by the collection of field duplicates for chemistry samples at a frequency of 1 in 20 samples. Field chemistry duplicate precision will be screened against an RPD of 50%. However, no data will be qualified based solely on field homogenization duplicate precision.

Precision measurements can be affected by the nearness of a chemical concentration to the MDL, where the percent error (expressed as RPD) increases. The equation used to express precision is as follows:

$$RPD = \frac{(C_1 - C_2) x\ 100\%}{(C_1 + C_2)/2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of the two observed values
C_2	=	smaller of the two observed values

4.2.2 Accuracy

Accuracy is a measure of the closeness of an individual measurement (or an average of multiple measurements) to the true or expected value. Accuracy is determined by calculating the value of results from analyses of laboratory control samples, standard reference materials, and standard solutions. In addition, MS samples are also measured, which indicate the accuracy or bias in the actual sample matrix. Accuracy is expressed as percent recovery of the measured value, relative to the true or expected value. If a measurement process produces results that are not the true or expected values, the process is said to be biased. Bias is the systematic error either inherent in a method of analysis (e.g., extraction efficiencies) or caused by an artifact of the measurement system (e.g., contamination). Analytical laboratories utilize several QC measures to eliminate analytical bias, including systematic analysis of method blanks, laboratory control samples, and independent calibration verification standards. Because bias can be positive or negative, and because several types of bias can occur simultaneously, only the net (or total) bias can be evaluated in a measurement.

Laboratory accuracy will be evaluated using quantitative laboratory control sample, MS, surrogate spike, and calibration standard recoveries compared with method-specified performance criteria or criteria listed in Table 6. Accuracy can be expressed as a concentration compared to the true or reference value or as a percent recovery in those analyses where reference materials are not available and spiked samples are analyzed. The equation used to express accuracy is as follows:

$$\%R = 100\% \; x \; (S - U)/Csa$$

where:

$\%R$	=	percent recovery
S	=	measured concentration in the spiked aliquot
U	=	measured concentration in the unspiked aliquot
Csa	=	actual concentration of spike added

Field accuracy will be controlled by adherence to sample collection procedures outlined in this QAPP.

4.2.3 Representativeness

Representativeness expresses the degree to which data accurately and precisely represent an environmental condition.

4.2.4 Comparability

Comparability expresses the confidence with which one dataset can be evaluated in relation to another dataset. For this program, comparability of data will be established through the use of standard analytical methodologies and reporting formats and through common traceable calibration standards and reference materials.

4.2.5 Completeness

Completeness is a measure of the amount of data that are determined to be valid in proportion to the amount of data collected. Completeness will be calculated as follows:

$$C = \frac{(Number\ of\ acceptable\ data\ points)\ x\ 100}{Total\ number\ of\ data\ points}$$

The DQO for completeness for all components of this project is 95%. Data that have been qualified as estimated because the QC criteria were not met will be considered valid for the purpose of assessing completeness. Data that have been rejected will not be considered valid for the purpose of assessing completeness.

4.2.6 Sensitivity

Sensitivity is a measure of analytical detection and RLs. In general, the lowest technologically achievable MDLs and RLs will be targeted for this project.

The MDL is defined as the minimum concentration at which a given target analyte can be measured and reported with 99% confidence that the analyte concentration is greater than zero. Laboratory RLs are defined as the lowest level that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions. Laboratory MDLs and RLs will be used to evaluate the method sensitivity and/or applicability prior to the acceptance of a method for this program.

The sample-specific MDLs and RLs will be reported by the laboratory and will take into account any factors relating to the sample analysis that might decrease or increase these limits (e.g., dilution factor, percent moisture, and analytical mass/volume). In the event that MDLs and RLs are elevated due to matrix interferences and subsequent dilutions or reductions in sample aliquots, the data will be evaluated by Anchor QEA and the laboratory to determine if an alternative course of action is required or possible. If this situation cannot be resolved readily (i.e., detection limits less than criteria are achieved), NYSDEC will be contacted to discuss an acceptable resolution. The sample-specific RL will be the value provided in the project database.

4.3 Laboratory Quality Control

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, matrix replicates, MSs, surrogate spikes (for organic analyses), and method blanks. A summary of the DQOs is provided in Table 6. QA/QC sample analytical frequencies are provided in Table 5.

The analyst will review the results of the QC samples from each sample group immediately after a sample group has been analyzed. The QC sample results will then be evaluated to determine if control limits have been exceeded. If control limits are exceeded in the sample group, the QA Manager will be contacted immediately, and corrective action (e.g., method modifications followed by reprocessing the affected samples) will be initiated prior to processing a subsequent group of samples.

4.3.1 Laboratory Instrument Calibration and Frequency

An initial calibration will be performed on each laboratory instrument to be used prior to the start of the project, after each major interruption to the analytical instrument, and when any ongoing calibration does not meet method control criteria. Calibration verification will be analyzed following each initial calibration and will meet method criteria prior to analyses of samples. Continuing calibration verifications (CCVs) will be analyzed at method-required frequencies to track instrument performance. The frequency of CCVs varies with method. For gas chromatography (GC)/mass spectrometer method (VOCs), one CCV will be analyzed every 12 hours. For inorganic methods that utilize instrumentation, 1 will be analyzed for every 10 samples analyzed and at the end of each run. If the continuing calibration is out of control, the analysis will be terminated until the source of the control failure is eliminated or reduced to meet control specifications, which may include analyzing a new initial calibration. Any project samples analyzed while the instrument calibration was out of control will be re-analyzed.

Instrument blanks or continuing calibration blanks provide information on the stability of the baseline established. Continuing calibration blanks will be analyzed immediately prior to or immediately following a CCV at the instrument for each type of applicable analysis.

4.3.2 Laboratory Duplicates/Replicates

Analytical duplicates provide information on the precision of the analysis and are useful in assessing potential sample heterogeneity and matrix effects. Analytical duplicates and replicates are subsamples of the original sample that are prepared and analyzed as a separate sample.

4.3.3 Matrix Spikes and Matrix Spike Duplicates

Analyses of MS samples provide information on the extraction efficiency of the method on the sample matrix, as well as any interferences introduced by the sample matrix. By analyzing MS samples in duplicate, information on the precision of the method is also provided.

4.3.4 Method Blanks

Method blanks are prepared and analyzed in the same manner as project samples to assess possible laboratory contamination at all stages of sample preparation and analysis. The method blank for all analyses must be less than the MRL of any single target analyte. If a laboratory method blank exceeds this criterion for any analyte, and the concentration of the analyte in any of the samples is less than five times the concentration found in the blank (ten times for common contaminants), analyses must stop and the source of contamination must be eliminated or reduced. Affected samples should be re-prepared and re-analyzed, if possible.

4.3.5 Laboratory Control Samples

Laboratory control samples are analyzed to assess possible laboratory bias at all stages of sample preparation and analyses. The laboratory control sample is a matrix-dependent spiked sample prepared at the time of sample extraction along with the preparation of the sample, MS, and method blank. The laboratory control sample will provide information on the precision of the analytical process and, when analyzed in duplicate, will provide accuracy information as well.

4.3.6 Laboratory Deliverables

Data packages will be checked for completeness immediately upon receipt from the laboratory to verify that data and QA/QC information requested are present. The analytical laboratory will be required, where applicable, to report the following:

- **Project Narrative**. This summary, in the form of a cover letter, will include a discussion of any problems encountered during analyses. This summary should include (but not be limited to) QA/QC, sample shipment, sample storage, and analytical difficulties. Any problems encountered, actual or perceived, and their resolutions will be documented in as much detail as appropriate.
- **CoC Records**. Legible copies of the CoC forms will be provided as part of the data package. This documentation will include the time of receipt and condition of the samples received by the laboratory. Additional internal tracking of sample custody by the laboratory will also be documented on a sample receipt form. The form must include sample shipping container temperatures measured at the time of sample receipt.
- **Sample Results**. The data package will summarize the results for each sample analyzed. The summary will include the following information when applicable:
  - Field sample identification code and the corresponding laboratory identification code
  - Sample matrix
  - Date of sample preparation/extraction
  - Date and time of analysis
  - Mass and/or volume used for preparation and analysis

- Final dilution or concentration factors for the sample
  - Identification of the instrument used for analysis
  - MDLs and MRLs accounting for sample-specific factors (e.g., dilution and total solids)
  - Analytical results with reporting units identified
  - Data qualifiers and their definitions
  - An electronic data deliverable with data in a format specified in advance by Anchor QEA
- **QA/QC Summaries**. These sections will contain the results of the laboratory QA/QC procedures. Each QA/QC sample analysis will be documented with the same information required for the sample results. No recovery or blank corrections will be made by the laboratory. The required summaries are as follows (additional information may be requested):
  - **Instrument Performance Checks**. Injection times and percent relative ion abundances will be reported and compared to method criteria. Associated samples and analysis times will also be reported.
  - **Calibration Blank Analysis**. The calibration blank analysis associated with establishing the analytical curve the concentration of all target analytes identified in these blanks will be reported.
  - **Calibration Data Summary**. These summaries will report the concentrations of the initial calibration and continuing calibration standards and the date and time of analyses. The response factor, percent relative standard deviation, percent drift/difference, percent recovery, and retention time for each analyte will be listed, as appropriate. Calibration results for standards will be documented to indicate instrument sensitivity.
  - **Laboratory fortified blank analysis**. For mercury analyses, a laboratory fortified method blank >10x the MDL, but less than the midpoint concentration of the calibration.
  - **Method Blank Analysis**. The method blank analysis associated with each sample and the concentration of all target analytes identified in these blanks will be reported.
  - **MS Recovery**. MS recovery data for all applicable analyses will be reported. The names and concentrations of compounds added, percent recoveries, and range of acceptable recoveries will be listed. The percent recoveries and RPD values for MSD analyses will be reported.
  - **Laboratory Control Sample**. Laboratory control sample recovery data will be reported. The names and concentrations of compounds added, percent recoveries, and range of acceptable recoveries will be included. The percent recoveries and RPD values for laboratory control sample duplicate analyses will be included.
- **Original Data**. Legible copies of the original data generated by the laboratory will include the following information:

- Sample extraction, preparation, and cleanup logs including methods used
- Instrument analysis logs for all instruments used on days of calibration and sample analyses
- Calculation worksheets as applicable
- Ion chromatograms for all samples, standards, blanks, calibrations, spikes, replicates, and reference materials as applicable
- Copies of full scan chromatograms and quantitation reports for GC/mass spectrometer analyses of samples, standards, blanks, calibrations, spikes, replicates, and reference materials
- Enhanced spectra of detected compounds with associated best-match spectra for each sample

4.4 Instrument/Equipment Testing, Inspection, and Maintenance Requirements

This section describes procedures for testing, inspection, and maintenance of field and laboratory equipment.

4.4.1 Field Instruments/Equipment

In accordance with the QA program, Anchor QEA will maintain an inventory of field instruments and equipment. The frequency and types of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The Anchor QEA FC will be responsible for the preparation, documentation, and implementation of the preventive maintenance program. The equipment maintenance information will be documented in the instrument's calibration log. The frequency of maintenance is dependent on the type and stability of the equipment, methods used, intended use of the equipment, and manufacturer's recommendations. Detailed information regarding the calibration and frequency of equipment calibration is provided in each specific manufacturer's instruction manuals.

All maintenance records will be verified prior to each sampling event. The FC will be responsible for verifying that required maintenance has been performed prior to using the equipment in the field. For this project, maintenance inspections will include the following activities:

- The drilling subcontractor will be responsible for confirming proper operation of the drilling equipment daily. This verification may consist of internal diagnostics on field screening instruments as well as function of direct-push drilling equipment.
- The licensed surveyor will be responsible for confirming proper operation of all survey equipment utilized to locate actual sampling locations both horizontally and vertically. This

verification may consist of internal diagnostics on instruments or visiting a location with known coordinates.

Any problems will be noted in the field logbook and corrected prior to continuing sampling operations.

4.4.2 Laboratory Instruments/Equipment

In accordance with the QA program, the laboratory will maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturer's recommendations and/or previous experience with the equipment.

The laboratory preventative maintenance program, as detailed in the laboratory QA Plan, is organized to maintain proper instrument and equipment performance and to prevent instrument and equipment failure during use. The program considers instrumentation, equipment, and parts that are subject to wear; deterioration or other changes in operational characteristics; the availability of spare parts; and the frequency at which maintenance is required. Any equipment that has been overloaded, has been mishandled, gives suspect results, or has been determined to be defective will be taken out of service, tagged with the discrepancy noted, and stored in a designated area until the equipment has been repaired. After repair, the equipment will be tested to verify that it is in proper operational condition. The client will be promptly notified in writing if defective equipment casts doubt on the validity of analytical data. The client will also be notified immediately regarding any delays due to instrument malfunctions that could impact holding times.

Laboratories will be responsible for the preparation, documentation, and implementation of the preventative maintenance program. Maintenance records will be checked according to the schedule on an annual basis and recorded by laboratory personnel. The Laboratory QA Manager or designee will be responsible for verifying compliance.

4.4.2.1 Laboratory Instrument/Equipment Calibration

As part of their QC programs, laboratories perform two types of calibrations. A periodic calibration is performed at prescribed intervals (e.g., balances, drying ovens, refrigerators, and thermometers), and operational calibrations are performed daily at a specified frequency or prior to analysis (i.e., initial calibrations) according to method requirements. Calibration procedures and frequency are discussed in the laboratory QA Plan. Calibrations are discussed in the laboratory SOPs for analyses.

The Laboratory QA Manager will be responsible for ensuring that the laboratory instrumentation is calibrated in accordance with specifications. Implementation of the calibration program will be the responsibility of the respective laboratory Group Supervisors. Recognized procedures (EPA, ASTM, or manufacturer's instructions) will be used when available.

Physical standards (i.e., weights or certified thermometers) will be traceable to nationally recognized standards such as the National Institute of Standards and Technology (NIST). Chemical reference standards will be NIST standard reference materials or vendor-certified materials traceable to these standards.

The calibration requirements for each method and respective corrective actions will be accessible, either in the laboratory SOPs or in the laboratory's QA Plan for each instrument or analytical method in use. All calibrations will be preserved on electronic media.

4.5 Inspection/Acceptance of Supplies and Consumables

Inspection and acceptance of field supplies, including laboratory-prepared sampling bottles, will be performed by the FC. All primary chemical standards and standard solutions used for this project, either in the field or laboratory, will be traceable to documented, reliable commercial sources. Standards will be validated to determine their accuracy by comparison with an independent standard. Any impurities found in the standard will be documented.

4.6 Data Management

Field data sheets will be checked for completeness and accuracy by the FC prior to delivery to the Data Manager. Data generated in the field will be documented in electronic or hard copy format and provided to the Data Manager, who is responsible for the data entry into the database. All manually entered data will be verified by a second party. Field documentation will be filed in the main project file after data entry and verification are complete.

Laboratory data will be provided to the Data Manager in Anchor QEA's custom EQuIS electronic format. Laboratory data that are electronically provided and loaded into the database will undergo a check against the laboratory hard copy data. Data will be validated or reviewed manually, and qualifiers, if assigned, will be entered manually. The accuracy of all manually entered data will be verified by a second party. Data tables and reports will be exported from EQuIS to Microsoft Excel tables.

5 Data Reduction, Validation, and Usability

Once data are received from the laboratory, a number of QC procedures will be followed to provide an accurate evaluation of the data quality. Specific procedures will be followed to assess data precision, accuracy, and completeness.

5.1 Compliance Assessments

Laboratory and field performance audits consist of on-site reviews of QA systems and equipment for sampling, calibration, and measurement. Laboratory audits will not be conducted as part of this study; however, all laboratory audit reports will be made available to the project QA Manager upon request. The laboratory is required to have written procedures addressing internal QA/QC. These procedures have been submitted, and the project QA Manager will review them to verify compliance with this QAPP. The laboratory must verify that personnel engaged in analytical tasks have appropriate training. The laboratory will provide written details of any and all method modifications planned prior to project commencement.

5.2 Response and Corrective Actions

The following sections identify the responsibilities of key project team members and actions to be taken in the event of an error, problem, or non-conformance to protocols identified in this document.

5.2.1 Field Activities

The FC will be responsible for correcting equipment malfunctions during the field sampling effort. The project QA Manager will be responsible for resolving situations identified by the FC that may result in non-compliance with this QAPP. All corrective measures will be immediately documented in the field logbook.

5.2.2 Laboratory

The laboratory is required to comply with its SOPs. The Laboratory PM will be responsible for ensuring that appropriate corrective actions are initiated as required for conformance with this QAPP. All laboratory personnel will be responsible for reporting problems that may compromise the quality of the data.

The Laboratory PM will be notified if any QC sample exceeds the project-specified control limits. The analyst will identify and correct the anomaly before continuing with the sample analysis. If the laboratory internal corrective action does not resolve the non-conformance, the Laboratory PM will notify the QA Manager. A narrative describing the anomaly, the steps taken to identify and correct the anomaly, and the treatment of the relevant sample batch (i.e., recalculation, re-analysis, and re-extraction) will be submitted with the data package in the form of a cover letter.

5.3 Data Review, Validation, and Verification

During the validation process, analytical data will be evaluated for project, method, and laboratory QC compliance, and their validity and applicability for program purposes will be determined. Based on the findings of the validation process, data validation qualifiers may be assigned. The validated project data, including qualifiers, will be entered into the project database, thus enabling this information to be retained or retrieved as needed.

5.4 Validation and Verification Methods

Data validation includes the following: signed entries by the field and laboratory technicians on field data sheets and laboratory datasheets, respectively; review for completeness and accuracy by the FC and Laboratory Manager; review by the QA Manager for outliers and omissions; and the use of QC criteria to accept or reject specific data. All data will be entered into the EQuIS database and a raw data file printed or exported. A second data manager or designee will perform a cursory verification of the database raw data file. If errors are found, further verification will be performed to verify that all data are accurate. Any errors found will be corrected in the database.

All laboratory data will be reviewed and verified to determine whether DQOs have been met and that appropriate corrective actions have been taken, when necessary. The project QA Manager or designee will be responsible for the final review of data generated from analyses of samples.

The first level of review will take place in the laboratory as the data are generated. The Laboratory Department Manager or designee will be responsible for ensuring that the data generated meet minimum QA/QC requirements and that the instruments were operating under acceptable conditions during generation of data. DQOs will also be assessed at this point by comparing the results of QC measurements with pre-established criteria as a measure of data acceptability.

The analysts and/or Laboratory Department Manager will prepare a preliminary QC checklist for each parameter and for each sample delivery group (SDG) as soon as analysis of an SDG has been completed. Any deviations from the DQOs on the checklist will be brought to the attention of the Laboratory Manager to determine whether corrective action is needed and to determine the impact on the reporting schedule.

Data packages will be checked for completeness immediately upon receipt from the laboratory to verify that data and QA/QC information requested are present. Data validation will be conducted by a reviewer using current National Functional Guideline documents (EPA 2020a and 2020b) as guidance by considering the following information, as applicable per method and level of validation:

- CoC documentation and sample receipt condition
- Holding times
- Instrument performance checks
- Initial calibrations
- Continuing calibrations
- Method blanks
- Surrogate recoveries
- Internal standard recoveries
- Detection limits
- RLs
- Laboratory control samples
- MS/MSD samples
- Field and laboratory duplicates
- Equipment blanks
- Standard reference material results
- Raw data review

The data will be validated in accordance with the project-specific DQOs described above, analytical method criteria, and the laboratory's internal performance standards based on its SOPs. Validated data will be exported from the EQuIS database in New York State Department of Environmental Conservation's Electronic Data Warehouse Standards or as otherwise directed by the Division of Environmental Remediation. A Data Usability Summary Report will be submitted describing the results of the validation and including an evaluation of the analytical data to determine whether or not the data meet the site/project-specific criteria for data quality and use.

6 Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-QC performance that can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective action proposed and implemented should be documented in QA reports to management. Corrective action should be implemented only after the approval of the PM and the QA Manager. If immediate corrective action is required, approvals secured by telephone should be documented.

For non-compliance problems, a formal corrective action program will be determined and implemented at the time that the problem is identified. The person who identifies the problem is responsible for notifying the PM and QA Manager. Implementation of corrective action will be confirmed in writing through the same channels.

Non-conformance with the established QC procedures in the QAPP will be identified and corrected in accordance with the QAPP. The FC, QA Manager, or their designees will issue a non-conformance report describing non-conformance action depending on if the non-conformance is related to the field or laboratory activities.

6.1 Field Corrective Action

Corrective action in the field may be required when the sample network is changed (e.g., more or fewer samples, or sampling locations other than those identified in the Field Sampling Plan or QAPP), or when sampling procedures and/or field analytical procedures require modification due to unexpected conditions. The need for corrective action and recommendations will be communicated to the PM, who will approve the corrective action and verify that the corrective action has been implemented. Corrective actions will be implemented and documented in a bound field logbook. No Anchor QEA personnel will initiate corrective action without prior communication of findings through proper channels.

If corrective action taken will result in fewer samples collected, fewer parameters analyzed, alternate sampling locations, or other changes that might result in non-attainment of QA objectives, then the PM must be advised of the proposed corrective action and must concur with its implementation.

6.2 Corrective Action During Data Quality Review and Data Assessment

The need for corrective action may be identified during data quality review or data assessment. Potential types of corrective action may include resampling by the field team or repreparation and/or re-analyses of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team, and whether the data to be collected are necessary to meet the required DQOs. If a corrective action situation is identified, the PM and QA Manager will recommend the implementation of corrective action. The QA Manager will implement and document the approved corrective action.

6.3 Quality Assurance Reports to Management

QA reports to management will only be required if corrective action has been initiated during any phase of this project. The content of the QA report will include a summary of the issue requiring the corrective action, action performed, and results of the follow-up inspection. The impact on any data will also be summarized. QA results will be reported in the Phase II report.

7 References

ASTM (ASTM International), 2002. *Standard Practices for Use of the Term Precision and Bias in ASTM Test Methods*. 177-90a.

EPA (U.S. Environmental Protection Agency), 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response. USEPA 540-R-08-005. January 2009.

EPA, 2020a. National Functional Guidelines for Superfund Organic Methods Data Review. Office of Superfund Remediation and Technology Innovation. EPA-540-R-20-005. November 2020.

EPA, 2020b. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review*. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. EPA-540-R-2017-001. November 2020.

Tables

Table 1
Sample Sizes, Containers, and Hold Times

Parameter	Sample Size	Container Size and Type	Preservative	Maximum Holding Time
Soil Samples				
Total solids	50 g	4-oz WM-G	Cool/0–6°C	None established
			Freeze -18°C	None established
Mercury	25 g	4-oz WM-G	Cool/0–6°C	28 days
VOCs	10 g	3 x 40 mL VOA vial	Methanol or sodium bisulfate	14 days
	50 g	4-oz WM-G	Cool/0–6°C; no headspace	
SVOCs	100 g	4-oz WM-G, amber	Cool/0–6°C	14 days to extraction
			Freeze -18°C	1 year to extraction
			Cool/0–6°C	40 days to analysis
Metals	50 g	4-oz WM-G	Cool/0–6°C	6 months; 28 days for mercury
			Freeze -18°C	180 days (except mercury)
PCBs	30 g	4-oz WM-G, amber	Cool/0–6°C, Freeze -18°C	None established
Groundwater Samples				
VOCs	120 mL	3 x 40-mL VOA vials	Cool/0–6°C; HCl to pH <2, store in the dark.	14 days to analysis
SVOCs	250 mL	2 x 250-mL amber glass with HDPE-lined lid	Cool/0–6°C; store in the dark	7 days to extraction
				40 days to analysis
Metals	250 mL	250-mL HDPE	Cool/0–6°C; field filter dissolved samples or within 24 hours; HNO_3 to pH <2	180 days (except mercury)
PCBs	250 mL	2 x 250-mL amber glass	Cool/0–6°C	None established
Investigation Derived Waste				
TCLP VOCs	100 g	2-oz wide-mouth glass with Teflon lined septa cap, no headspace	Cool/0–6°C	14 days to extraction, 40 days to analysis
	40 mL	3 x 40-mL septum-sealed VOA vials	Cool/0–6°C, HCl to pH<2	
TCLP SVOCs	100 g	8-oz WM-G	Cool/0–6°C	14 days to extraction, 40 days to analysis
	250 mL	2 x 250-mL amber glass with HDPE-lined lid	Cool/0–6°C	
TCLP Metals	50 g	4-oz WM-G	Cool/0–6°C	180 days and 28 days for mercury to TCLP extraction/analysis
	250 mL	250-mL HDPE	Cool/0–6°C, HNO3 to pH < 2	

Notes:
g: gram
WM-G: wide-mouth glass
HCl: hydrochloric acid
HDPE: high density polyethylene
HNO_3: nitric acid
mL: milliliter
oz: ounce
'--: not applicable
TCLP: toxicity characteristic leaching procedure

Table 2
Analyte List, Methods, and Reporting and Detection Limits for Soils and Groundwaters

Parameter	Analytical Method	Cleanup Levels [1,2]	Reporting Limit	Method Detection Limit
Conventional Parameters (%)				
Total solids	SM 2540G	--	0.1	0.1
TCL Volatile Organic Compounds (µg/kg)				
Methylene chloride	EPA 8260	--	10	0.816
1,1-Dichloroethane	EPA 8260	--	1.5	0.2952
Chloroform	EPA 8260	--	1.5	0.3246
Carbon tetrachloride	EPA 8260	--	1	0.2112
1,2-Dichloropropane	EPA 8260	--	3.5	0.255
Dibromochloromethane	EPA 8260	--	1	0.3078
1,1,2-Trichloroethane	EPA 8260	--	1.5	0.393
Tetrachloroethene	EPA 8260	--	1	0.3062
Chlorobenzene	EPA 8260	--	1	0.1862
Trichlorofluoromethane	EPA 8260	--	5	0.3914
1,2-Dichloroethane	EPA 8260	--	1	0.2274
1,1,1-Trichloroethane	EPA 8260	--	1	0.2698
Bromodichloromethane	EPA 8260	--	1	0.3848
trans-1,3-Dichloropropene	EPA 8260	--	1	0.3006
cis-1,3-Dichloropropene	EPA 8260	--	1	0.2672
1,1-Dichloropropene	EPA 8260	--	5	0.4556
Bromoform	EPA 8260	--	4	0.4954
1,1,2,2-Tetrachloroethane	EPA 8260	--	1	0.2402
Benzene	EPA 8260	60	1	0.2972
Toluene	EPA 8260	700	1.5	0.2416
Ethylbenzene	EPA 8260	1,000	1	0.2214
Chloromethane	EPA 8260	--	5	0.7832
Bromomethane	EPA 8260	--	2	0.6478
Vinyl chloride	EPA 8260	--	2	0.7534
Chloroethane	EPA 8260	--	2	0.4384
1,1-Dichloroethene	EPA 8260	--	1	0.2598
trans-1,2-Dichloroethene	EPA 8260	--	1.5	0.3916
Trichloroethene	EPA 8260	--	1	0.224
1,2-Dichlorobenzene	EPA 8260	--	5	0.3642
1,3-Dichlorobenzene	EPA 8260	--	5	0.3996
1,4-Dichlorobenzene	EPA 8260	--	5	0.4198
Methyl tert butyl ether	EPA 8260	930	2	0.487

Table 2
Analyte List, Methods, and Reporting and Detection Limits for Soils and Groundwaters

Parameter	Analytical Method	Cleanup Levels [1,2]	Reporting Limit	Method Detection Limit
p/m-Xylene	EPA 8260	--	2	0.43
o-Xylene	EPA 8260	--	2	0.4174
Total xylene	calculated	260	--	--
cis-1,2-Dichloroethene	EPA 8260	--	1	0.3014
Dibromomethane	EPA 8260	--	10	0.4348
Styrene	EPA 8260	--	2	0.726
Dichlorodifluoromethane	EPA 8260	--	10	0.3888
Acetone	EPA 8260	--	10	3.235
Carbon disulfide	EPA 8260	--	10	0.3754
2-Butanone	EPA 8260	--	10	3.8772
Vinyl acetate	EPA 8260	--	10	0.751
4-Methyl-2-pentanone	EPA 8260	--	10	0.8164
1,2,3-Trichloropropane	EPA 8260	--	10	0.387
2-Hexanone	EPA 8260	--	10	0.3964
Bromochloromethane	EPA 8260	--	5	0.3022
2,2-Dichloropropane	EPA 8260	--	5	0.795
1,2-Dibromoethane	EPA 8260	--	4	0.4088
1,3-Dichloropropane	EPA 8260	--	5	0.5656
1,1,1,2-Tetrachloroethane	EPA 8260	--	1	0.3284
Bromobenzene	EPA 8260	--	5	0.2202
n-Butylbenzene	EPA 8260	12,000	1	0.3144
sec-Butylbenzene	EPA 8260	11,000	1	0.2756
tert-Butylbenzene	EPA 8260	5,900	5	0.6032
o-Chlorotoluene	EPA 8260	--	5	0.313
p-Chlorotoluene	EPA 8260	--	5	0.3608
1,2-Dibromo-3-chloropropane	EPA 8260	--	5	0.8366
Hexachlorobutadiene	EPA 8260	--	5	0.4582
Isopropylbenzene	EPA 8260	2,300	1	0.177
p-Isopropyltoluene	EPA 8260	10,000	1	0.2732
Naphthalene	EPA 8260	12,000	5	0.7696
Acrylonitrile	EPA 8260	--	10	0.3756
n-Propylbenzene	EPA 8260	3,900	1	0.284
1,2,3-Trichlorobenzene	EPA 8260	--	5	0.4034
1,2,4-Trichlorobenzene	EPA 8260	--	5	0.7898
1,3,5-Trimethylbenzene	EPA 8260	8,400	5	0.6016
1,2,4-Trimethylbenzene	EPA 8260	3,600	5	0.573
1,4-Dioxane	EPA 8260	--	100	17.4

Table 2

Analyte List, Methods, and Reporting and Detection Limits for Soils and Groundwaters

Parameter	Analytical Method	Cleanup Levels [1,2]	Reporting Limit	Method Detection Limit
1,4-Diethylbenzene	EPA 8260	--	4	0.2
4-Ethyltoluene	EPA 8260	--	4	0.097
1,2,4,5-Tetramethylbenzene	EPA 8260	--	4	0.181
Ethyl ether	EPA 8260	--	5	0.3798
trans-1,4-Dichloro-2-butene	EPA 8260	--	5	1.478
TCL Semivolatile Organic Compounds (µg/kg)				
Phenol	EPA 8270D	--	33	3.2
Bis(2-chloroethyl)ether	EPA 8270D	--	33	6.1
2-Chlorophenol	EPA 8270D	--	33	2.2
1,3-Dichlorobenzene	EPA 8270D	--	33	6.8
1,4-Dichlorobenzene	EPA 8270D	--	33	6.9
Benzyl Alcohol	EPA 8270D	--	67	22
1,2-Dichlorobenzene	EPA 8270D	--	33	7.3
2-Methylphenol	EPA 8270D	--	33	2.9
Bis(2-chloroisopropyl)ether	EPA 8270D	--	33	5.6
Acetophenone	EPA 8270D	--	33	4.2
4-Methylphenol	EPA 8270D	--	33	4.4
N-Nitroso-di-n-propylamine	EPA 8270D	--	33	5.7
Hexachloroethane	EPA 8270D	--	33	5.6
Nitrobenzene	EPA 8270D	--	33	3.5
Isophorone	EPA 8270D	--	33	3.7
2-Nitrophenol	EPA 8270D	--	33	3.6
2,4-Dimethylphenol	EPA 8270D	--	33	5.5
Bis(2-chloroethoxy)methane	EPA 8270D	--	33	3.4
2,4-Dichlorophenol	EPA 8270D	--	33	3.6
1,2,4-Trichlorobenzene	EPA 8270D	--	33	2.1
Naphthalene	EPA 8270D	--	33	2.2
4-Chloroaniline	EPA 8270D	--	33	3.0
Hexachlorobutadiene	EPA 8270D	--	33	6.5
P-Chloro-M-Cresol	EPA 8270D	--	33	4.8
2-Methylnaphthalene	EPA 8270D	--	33	2.6
Hexachlorocyclopentadiene	EPA 8270D	--	200	37
2,4,6-Trichlorophenol	EPA 8270D	--	33	3.0
2,4,5-Trichlorophenol	EPA 8270D	--	33	4.0
2-Chloronaphthalene	EPA 8270D	--	33	2.3
2-Nitroaniline	EPA 8270D	--	33	5.4
Dimethylphthalate	EPA 8270D	--	33	2.6

Table 2

Analyte List, Methods, and Reporting and Detection Limits for Soils and Groundwaters

Parameter	Analytical Method	Cleanup Levels [1,2]	Reporting Limit	Method Detection Limit
Acenaphthylene	EPA 8270D	100,000	33	2.9
2,6-Dinitrotoluene	EPA 8270D	--	33	8.6
3-Nitroaniline	EPA 8270D	--	67	3.5
Acenaphthene	EPA 8270D	20,000	33	3.3
2,4-Dinitrophenol	EPA 8270D	--	200	57
4-Nitrophenol	EPA 8270D	--	553	183
Dibenzofuran	EPA 8270D	--	33	2.5
2,4-Dinitrotoluene	EPA 8270D	--	33	2.3
Diethylphthalate	EPA 8270D	--	33	3.4
4-Chlorophenyl phenyl ether	EPA 8270D	--	33	3.2
Fluorene	EPA 8270D	--	33	2.5
4-Nitroaniline	EPA 8270D	--	200	4.5
4,6-Dinitro-2-Methylphenol	EPA 8270D	--	200	64
NitrosoDiPhenylAmine(NDPA)/DPA	EPA 8270D	--	33	2.3
4-Bromophenyl phenyl ether	EPA 8270D	--	33	3.1
Hexachlorobenzene	EPA 8270D	--	33	3.2
Pentachlorophenol	EPA 8270D	--	200	60
Phenanthrene	EPA 8270D	100,000	33	2.1
Anthracene	EPA 8270D	100,000	33	1.7
Di-n-butylphthalate	EPA 8270D	--	33	3.2
Fluoranthene	EPA 8270D	100,000	33	2.9
Pyrene	EPA 8270D	100,000	33	2.8
Butylbenzylphthalate	EPA 8270D	--	33	6.7
3,3'-Dichlorobenzidine	EPA 8270D	--	67	5.7
Benz(a)anthracene	EPA 8270D	1,000	33	1.9
Chrysene	EPA 8270D	1,000	33	2.3
Bis(2-Ethylhexyl)phthalate	EPA 8270D	--	33	8.7
Di-n-octylphthalate	EPA 8270D	--	67	14
Benzo(b)fluoranthene	EPA 8270D	1,000	33	2.9
Benzo(k)fluoranthene	EPA 8270D	800	33	2.5
Benzo(a)pyrene	EPA 8270D	1,000	33	2.4
Indeno(1,2,3-cd)Pyrene	EPA 8270D	500	33	2.7
Dibenz(a,h)anthracene	EPA 8270D	330	33	3.5
Benzo(ghi)perylene	EPA 8270D	100,000	33	2.6
Aniline	EPA 8270D	--	33	5.0
Carbazole	EPA 8270D	--	33	2.1
Benzidine	EPA 8270D	--	933	216

Table 2

Analyte List, Methods, and Reporting and Detection Limits for Soils and Groundwaters

Parameter	Analytical Method	Cleanup Levels [1,2]	Reporting Limit	Method Detection Limit
n-Nitrosodimethylamine	EPA 8270D	--	33	8.4
Biphenyl	EPA 8270D	--	33	3.5
Benzoic Acid	EPA 8270D	--	2000	423
1,2,4,5-Tetrachlorobenzene	EPA 8270D	--	33	3.2
Atrazine	EPA 8270D	--	33	2.9
Azobenzene	EPA 8270D	--	33	2.5
Benzaldehyde	EPA 8270D	--	33	8.4
Caprolactam	EPA 8270D	--	67	4.9
Pyridine	EPA 8270D	--	133	5.9
Metals (mg/kg)				
Aluminum	EPA 6020B	--	10	1.480
Antimony	EPA 6020B	--	0.16	0.014
Arsenic	EPA 6020B	--	0.05	0.007
Barium	EPA 6020B	--	0.3	0.021
Beryllium	EPA 6020B	--	0.03	0.009
Cadmium	EPA 6020B	--	0.02	0.003
Calcium	EPA 6020B	--	50	6.080
Chromium	EPA 6020B	--	0.2	0.047
Cobalt	EPA 6020B	--	0.05	0.005
Copper	EPA 6020B	--	0.2	0.019
Iron	EPA 6020B	--	20	2.060
Lead	EPA 6020B	--	0.06	0.015
Magnesium	EPA 6020B	--	10	1.232
Manganese	EPA 6020B	--	0.2	0.044
Mercury	EPA 7474	--	0.0125	0.002
Nickel	EPA 6020B	--	0.1	0.027
Potassium	EPA 6020B	--	10	1.588
Selenium	EPA 6020B	--	0.2	0.076
Silver	EPA 6020B	--	0.05	0.005
Sodium	EPA 6020B	--	15	1.172

Table 2
Analyte List, Methods, and Reporting and Detection Limits for Soils and Groundwaters

Parameter	Analytical Method	Cleanup Levels [1,2]	Reporting Limit	Method Detection Limit
Thallium	EPA 6020B	--	0.02	0.005
Vanadium	EPA 6020B	--	0.1	0.038
Zinc	EPA 6020B	--	1	0.260

Notes:
[1]NYSDEC (New York State Department of Environmental Conservation), 2010. *CP-51: Soil Cleanup Guidance.* October 21, 2010.
[2] New York State Groundwater Effluent Limitations, Class GA (NYDEC 1998)
NYSDEC (New York State Department of Environmental Conservation), 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations. Class GA. Division of Water Technical and Operational Guidance Series (1.1.1). June 1998.
--: not applicable
EPA: U.S. Environmental Protection Agency
mg/L: milligrams per liter
mg/kg: milligrams per kilogram
SM: Standard Method

Table 3
Groundwater Analyte List, Methods, and Reporting and Detection Limits

Parameter	Analytical Method	Groundwater Screening Levels[1]	Reporting Limit	Method Detection Limit
TCL Volatile Organic Compounds (µg/L)				
Methylene chloride	EPA 8260	5	3.0	0.289
1,1-Dichloroethane	EPA 8260	5	0.75	0.21
Chloroform	EPA 8260	7	0.75	0.162
Carbon tetrachloride	EPA 8260	0.4	0.5	0.134
1,2-Dichloropropane	EPA 8260	1	1.75	0.133
Dibromochloromethane	EPA 8260	50	0.5	0.149
1,1,2-Trichloroethane	EPA 8260	1	0.75	0.144
Tetrachloroethene	EPA 8260	0.7	0.5	0.181
Chlorobenzene	EPA 8260	5	0.5	0.178
Trichlorofluoromethane	EPA 8260	5	2.5	0.161
1,2-Dichloroethane	EPA 8260	0.6	0.5	0.132
1,1,1-Trichloroethane	EPA 8260	5	0.5	0.158
Bromodichloromethane	EPA 8260	50	0.5	0.192
trans-1,3-Dichloropropene	EPA 8260	0.4	0.5	0.164
cis-1,3-Dichloropropene	EPA 8260	0.4	0.5	0.144
1,3-Dichloropropene, Total	EPA 8260	0.4	0.5	0.144
1,1-Dichloropropene	EPA 8260	5	2.5	0.173
Bromoform	EPA 8260	50	2.0	0.248
1,1,2,2-Tetrachloroethane	EPA 8260	0.2	0.5	0.144
Benzene	EPA 8260	1	0.5	0.159
Toluene	EPA 8260	5	0.75	0.161
Ethylbenzene	EPA 8260	5	0.5	0.168
Chloromethane	EPA 8260	5	2.5	0.176
Bromomethane	EPA 8260	5	1.0	0.256
Vinyl chloride	EPA 8260	0.3	1.0	0.0699
Chloroethane	EPA 8260	5	1.0	0.134
1,1-Dichloroethene	EPA 8260	0.7	0.5	0.142
trans-1,2-Dichloroethene	EPA 8260	5	0.75	0.163
1,2-Dichloroethene (total)	EPA 8260	--	0.5	0.163
Trichloroethene	EPA 8260	5	0.5	0.175
1,2-Dichlorobenzene	EPA 8260	3	2.5	0.184
1,3-Dichlorobenzene	EPA 8260	3	2.5	0.186
1,4-Dichlorobenzene	EPA 8260	3	2.5	0.187
Methyl tert butyl ether	EPA 8260	10	1.0	0.2
p/m-Xylene	EPA 8260	5	1.0	0.3
o-Xylene	EPA 8260	5	1.0	0.3
Xylene (Total)	EPA 8260	5	1.0	0.3
cis-1,2-Dichloroethene	EPA 8260	5	0.5	0.187
Dibromomethane	EPA 8260	5	5.0	0.363
1,4-Dichlorobutane	EPA 8260	--	5.0	0.464

Table 3

Groundwater Analyte List, Methods, and Reporting and Detection Limits

Parameter	Analytical Method	Groundwater Screening Levels[1]	Reporting Limit	Method Detection Limit
1,2,3-Trichloropropane	EPA 8260	0.04	5.0	0.176
Styrene	EPA 8260	5	1.0	0.359
Dichlorodifluoromethane	EPA 8260	5	5.0	0.245
Acetone	EPA 8260	50	5.0	1.46
Carbon disulfide	EPA 8260	60	5.0	0.299
2-Butanone	EPA 8260	50	5.0	1.94
Vinyl acetate	EPA 8260	--	5.0	0.311
4-Methyl-2-pentanone	EPA 8260	--	5.0	0.416
2-Hexanone	EPA 8260	50	5.0	0.515
Ethyl methacrylate	EPA 8260	3	5.0	0.606
Acrylonitrile	EPA 8260	5	5.0	0.43
Bromochloromethane	EPA 8260	5	2.5	0.138
Tetrahydrofuran	EPA 8260	50	5.0	0.525
2,2-Dichloropropane	EPA 8260	5	2.5	0.204
1,2-Dibromoethane	EPA 8260	0.0006	2.0	0.193
1,3-Dichloropropane	EPA 8260	5	2.5	0.212
1,1,1,2-Tetrachloroethane	EPA 8260	5	0.5	0.164
Bromobenzene	EPA 8260	5	2.5	0.152
n-Butylbenzene	EPA 8260	5	0.5	0.192
sec-Butylbenzene	EPA 8260	5	0.5	0.181
tert-Butylbenzene	EPA 8260	5	2.5	0.185
o-Chlorotoluene	EPA 8260	5	2.5	0.17
p-Chlorotoluene	EPA 8260	5	2.5	0.185
1,2-Dibromo-3-chloropropane	EPA 8260	0.04	2.5	0.327
Hexachlorobutadiene	EPA 8260	0.5	0.5	0.217
Isopropylbenzene	EPA 8260	5	0.5	0.187
p-Isopropyltoluene	EPA 8260	5	0.5	0.188
Naphthalene	EPA 8260	10	2.5	0.216
n-Propylbenzene	EPA 8260	5	0.5	0.173
1,2,3-Trichlorobenzene	EPA 8260	5	2.5	0.234
1,2,4-Trichlorobenzene	EPA 8260	5	2.5	0.22
1,3,5-Trimethylbenzene	EPA 8260	5	2.5	0.174
1,3,5-Trichlorobenzene	EPA 8260	5	2	0.127
1,2,4-Trimethylbenzene	EPA 8260	5	2.5	0.191
trans-1,4-Dichloro-2-butene	EPA 8260	5	2.5	0.173
Ethyl ether	EPA 8260	--	2.5	0.15
Methyl Acetate	EPA 8260	--	10	0.234
Ethyl Acetate	EPA 8260	--	10	0.716
Isopropyl Ether	EPA 8260	--	2.0	0.425
Cyclohexane	EPA 8260	--	10	0.271
Ethyl-Tert-Butyl-Ether	EPA 8260	--	2.0	0.179

Table 3
Groundwater Analyte List, Methods, and Reporting and Detection Limits

Parameter	Analytical Method	Groundwater Screening Levels[1]	Reporting Limit	Method Detection Limit
Tertiary-Amyl Methyl Ether	EPA 8260	--	2.0	0.278
1,4-Dioxane	EPA 8260	--	250	41.1
1,1,2-Trichloro-1,2,2-Trifluoroethane	EPA 8260	5	10	0.148
Methyl cyclohexane	EPA 8260	--	10	0.396
1,4-Diethylbenzene	EPA 8260	--	2.0	0.392
4-Ethyltoluene	EPA 8260	--	2.0	0.34
1,2,4,5-Tetramethylbenzene	EPA 8260	5	2.0	0.542
TCL Semivolatile Organic Compounds (μg/L)				
Bis(2-chloroethyl)ether	EPA 8270D	0.03	0.5	0.0929
Phenol	EPA 8270D	2	0.5	0.0512
2-Chlorophenol	EPA 8270D	--	0.5	0.0912
1,3-Dichlorobenzene	EPA 8270D	3	0.5	0.0783
1,4-Dichlorobenzene	EPA 8270D	3	0.5	0.0828
1,2-Dichlorobenzene	EPA 8270D	3	0.5	0.0680
Bis(2-chloroisopropyl)ether	EPA 8270D	5	0.5	0.1080
2-Methylphenol	EPA 8270D	--	0.5	0.1040
Hexachloroethane	EPA 8270D	5	0.5	0.1020
N-Nitroso-di-n-propylamine	EPA 8270D	--	0.5	0.1230
4-Methylphenol	EPA 8270D	--	0.5	0.1130
Nitrobenzene	EPA 8270D	0.4	0.5	0.1020
Isophorone	EPA 8270D	50	0.5	0.1260
2-Nitrophenol	EPA 8270D	--	0.5	0.1150
2,4-Dimethylphenol	EPA 8270D	50	2.0	0.2410
Bis(2-chloroethoxy)methane	EPA 8270D	5	0.5	0.0854
2,4-Dichlorophenol	EPA 8270D	5	0.5	0.0996
1,2,4-Trichlorobenzene	EPA 8270D	5	0.5	0.0961
Naphthalene	EPA 8270D	10	0.5	0.0876
4-Chloroaniline	EPA 8270D	5	0.5	0.1280
Hexachlorobutadiene	EPA 8270D	0.5	0.5	0.0855
P-Chloro-M-Cresol	EPA 8270D	--	0.5	0.1030
2-Methylnaphthalene	EPA 8270D	--	0.5	0.0911
1,2,4,5-Tetrachlorobenzene	EPA 8270D	5	0.5	0.0797
Hexachlorocyclopentadiene	EPA 8270D	5	0.5	0.1530
Pentachloronitrobenzene	EPA 8270D	ND	0.5	0.1690
2,4,6-Trichlorophenol	EPA 8270D	--	0.5	0.1520
2,4,5-Trichlorophenol	EPA 8270D	--	0.5	0.0913
2-Chloronaphthalene	EPA 8270D	10	0.5	0.0899
2-Nitroaniline	EPA 8270D	5	0.5	0.1380
Acenaphthylene	EPA 8270D	--	0.5	0.1120
Dimethylphthalate	EPA 8270D	50	0.5	0.1170
2,6-Dinitrotoluene	EPA 8270D	0.07	0.5	0.1680

Table 3
Groundwater Analyte List, Methods, and Reporting and Detection Limits

Parameter	Analytical Method	Groundwater Screening Levels[1]	Reporting Limit	Method Detection Limit
Acenaphthene	EPA 8270D	20	0.5	0.0955
3-Nitroaniline	EPA 8270D	5	0.5	0.1110
2,4-Dinitrophenol	EPA 8270D	10	5.0	0.7280
Dibenzofuran	EPA 8270D	--	0.5	0.0910
2,4-Dinitrotoluene	EPA 8270D	5	0.5	0.1630
4-Nitrophenol	EPA 8270D	--	2.5	0.5900
2,3,4,6-Tetrachlorophenol	EPA 8270D	--	0.5	0.1430
Fluorene	EPA 8270D	50	0.5	0.1040
4-Chlorophenyl phenyl ether	EPA 8270D	--	0.5	0.0792
Diethylphthalate	EPA 8270D	50	0.5	0.1800
Azobenzene	EPA 8270D	5	0.5	0.1280
4-Nitroaniline	EPA 8270D	5	0.5	0.1120
4,6-Dinitro-2-Methylphenol	EPA 8270D	--	2.0	0.5100
NitrosoDiPhenylAmine(NDPA)/DPA	EPA 8270D	50	0.5	0.0720
4-Bromophenyl phenyl ether	EPA 8270D	--	0.5	0.0997
Hexachlorobenzene	EPA 8270D	0.04	0.5	0.1220
Pentachlorophenol	EPA 8270D	2	2.0	0.4300
Phenanthrene	EPA 8270D	50	0.5	0.1110
Anthracene	EPA 8270D	50	0.5	0.1370
Carbazole	EPA 8270D	--	0.5	0.1430
Di-n-butylphthalate	EPA 8270D	50	0.5	0.0996
Fluoranthene	EPA 8270D	50	0.5	0.1560
Pyrene	EPA 8270D	50	0.5	0.1700
Butylbenzylphthalate	EPA 8270D	50	0.5	0.0848
3,3'-Dichlorobenzidine	EPA 8270D	5	0.5	0.1930
Benz(a)anthracene	EPA 8270D	0.002	0.5	0.1840
Chrysene	EPA 8270D	0.002	0.5	0.1420
Bis(2-Ethylhexyl)phthalate	EPA 8270D	5	0.5	0.0809
Di-n-octylphthalate	EPA 8270D	50	1.0	0.0786
Benzo(b)fluoranthene	EPA 8270D	0.002	0.5	0.0655
Benzo(k)fluoranthene	EPA 8270D	0.002	0.5	0.1610
Benzo(a)pyrene	EPA 8270D	0.002	0.5	0.0602
Indeno(1,2,3-cd)Pyrene	EPA 8270D	0.002	0.5	0.0896
Dibenz(a,h)anthracene	EPA 8270D	--	0.5	0.0641
Benzo(ghi)perylene	EPA 8270D	--	0.5	0.1090
Aniline	EPA 8270D	5	1.0	0.1270
Acetophenone	EPA 8270D	--	1.0	0.2070
Atrazine	EPA 8270D	7.5	0.5	0.1600
Benzaldehyde	EPA 8270D	--	2.0	0.1190
Benzidine	EPA 8270D	5	20.0	0.4640
Caprolactam	EPA 8270D	--	2.0	0.1230

Table 3
Groundwater Analyte List, Methods, and Reporting and Detection Limits

Parameter	Analytical Method	Groundwater Screening Levels[1]	Reporting Limit	Method Detection Limit
n-Nitrosodimethylamine	EPA 8270D	--	0.5	0.0720
Biphenyl	EPA 8270D	5	0.5	0.1110
Benzyl Alcohol	EPA 8270D	--	0.5	0.1230
Pyridine	EPA 8270D	50	0.5	0.1630
Benzoic Acid	EPA 8270D	--	40.0	3.0100
Total and Dissolved Metals (mg/L)				
Aluminum	EPA 6020B	--	0.01	0.0033
Antimony	EPA 6020B	0.003	0.004	0.0004
Arsenic	EPA 6020B	0.05	0.0005	0.0002
Barium	EPA 6020B	1	0.0005	0.0002
Beryllium	EPA 6020B	0.003	0.0003	0.0001
Cadmium	EPA 6020B	0.005	0.0002	0.0001
Calcium	EPA 6020B	--	0.1	0.0394
Chromium	EPA 6020B	0.05	0.001	0.0002
Cobalt	EPA 6020B	--	0.0005	0.0002
Copper	EPA 6020B	0.2	0.001	0.0004
Iron	EPA 6020B	--	0.050	0.0191
Lead	EPA 6020B	0.05	0.001	0.0003
Magnesium	EPA 6020B	35	0.070	0.0242
Manganese	EPA 6020B	--	0.001	0.0004
Mercury	EPA 7474	0.0007	0.0001	0.000026
Nickel	EPA 6020B	0.1	0.002	0.0006
Potassium	EPA 6020B	--	0.100	0.0309
Selenium	EPA 6020B	0.01	0.005	0.0017
Silver	EPA 6020B	0.05	0.0004	0.0002
Sodium	EPA 6020B	--	0.100	0.0293
Thallium	EPA 6020B	0.0005	0.0005	0.0001
Vanadium	EPA 6020B	--	0.005	0.0016
Zinc	EPA 6020B	2	0.010	0.0034

Table 3
Groundwater Analyte List, Methods, and Reporting and Detection Limits

Notes:
1. New York State Groundwater Effluent Limitations, Class GA (NYDEC 1998)
NYSDEC (New York State Department of Environmental Conservation), 1998. *Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations* . Class GA. Division of Water Technical and Operational Guidance Series (1.1.1). June 1998.
--: not applicable
μg/L: micrograms per liter
CAS RN: Chemical Abstracts Service Registry Number
EPA: U.S. Environmental Protection Agency
mg/L: milligrams per liter
ND: "a non-detectable concentration by the approved analytical methods referenced in section 700.3"
SM: Standard Method
TCL: Target Compound List

Table 4
Waste Characterization Analyte List, Methods, and Reporting and Detection Limits

Parameter	Recommended Analytical Method	MDL[1]	MRL[1]
Conventionals (mg/kg)			
pH (SU)	EPA 9045D	—	—
Ignitablility (°)	EPA 1030	—	—
Corrosivity	EPA 9040C	—	—
Total Solids (%)	SM 2540 G	0.10	0.10
TCLP Metals (mg/L)			
Arsenic	EPA 6020A	0.05	0.10
Barium	EPA 6020A	2.5	5.00
Cadmium	EPA 6020A	0.05	0.10
Chromium	EPA 6020A	0.05	0.10
Lead	EPA 6020A	0.025	0.05
Mercury	EPA 6020A	0.0035	0.007
Selenium	EPA 6020A	0.05	0.10
Silver	EPA 6020A	0.05	0.10
TCLP VOCs (mg/L)			
Benzene	EPA 8260C	0.00625	0.0125
Carbon tetrachloride	EPA 8260C	0.0125	0.025
Chlorobenzene	EPA 8260C	0.0125	0.025
Chloroform	EPA 8260C	0.025	0.05
1,2-Dichloroethane	EPA 8260C	0.0125	0.025
1,1-Dichloroethene	EPA 8260C	0.0125	0.025
1,4-Dichlorobenzene	EPA 8260C	0.0125	0.025
2-Butanone	EPA 8260C	0.25	0.5
Tetrachloroethene	EPA 8260C	0.0125	0.025
Trichloroethene	EPA 8260C	0.0125	0.025
Vinyl chloride	EPA 8260C	0.0125	0.025
TCLP SVOCs (mg/L)			
2,4,5-Trichlorophenol	EPA 8270D	0.0025	0.005
2,4,6-Trichlorophenol	EPA 8270D	0.0025	0.005
2,4-Dinitrotoluene	EPA 8270D	0.001	0.002
2-Methylphenol	EPA 8270D	0.0025	0.005
3- & 4-Methylphenol	EPA 8270D	0.0025	0.005
Hexachlorobenzene	EPA 8270D	0.001	0.002
Hexachlorobutadiene	EPA 8270D	0.0025	0.005
Hexachloroethane	EPA 8270D	0.0025	0.005
Nitrobenzene	EPA 8270D	0.0025	0.005
Pentachlorophenol	EPA 8270D	0.005	0.01
Pyridine	EPA 8270D	0.005	0.01
TCLP PCBs (ug/L)			
Aroclor 1016	EPA 8082A	0.02	0.01
Aroclor 1221	EPA 8082A	0.02	0.01
Aroclor 1232	EPA 8082A	0.02	0.01
Aroclor 1242	EPA 8082A	0.02	0.01
Aroclor 1248	EPA 8082A	0.02	0.01
Aroclor 1254	EPA 8082A	0.02	0.01
Aroclor 1260	EPA 8082A	0.02	0.01

Notes:

1. Actual MDLs and MRLs may vary based on sample aliquot size, moisture content, and required dilution factor.

—: not applicable
µg/kg: micrograms per kilogram
EPA: U.S. Environmental Protection Agency
MDL: method detection limit
mg/kg: milligrams per kilogram
mg/L: milligrams per liter
MRL: method reporting limit
SM: Standard Method
SVOC: semivolatile organic compound
VOC: volatile organic compound
PCBs:
TCLP: toxicity characteristic leaching procedure
PCB: polychlorinated biphenyl

Table 5
Laboratory Quality Control Sample Analysis Summary

Analysis Type	Initial Calibration	Ongoing Calibration	Laboratory Control Samples	Duplicates	Matrix Spikes	Matrix Spike Duplicates	Method Blanks	Surrogate Spikes
Total solids	Daily[1,2]	N/A	N/A	1 per 20 samples	N/A	N/A	N/A	N/A
Mercury	Daily[3]	Every 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A	1 per 20 samples	N/A
Metals	Daily[3]	Every 10 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	N/A	N/A
VOCs, SVOCs, PCBs	As needed[4]	1 per 20 samples	1 per 20 samples	—	N/A	1 per 20 samples	1 per 20 samples	Every sample

Notes:
1. Calibration and certification of drying ovens and weighing scales are conducted bi-annually.
2. Scale should be calibrated with Class 5 weights daily; weights must bracket the weight of sample and weighing vessel.
3. Initial calibration verification and calibration blank must be analyzed at the beginning of each batch.
4. Initial calibrations are considered valid until the ongoing continuing calibration no longer meets method specifications. At that point, a new initial calibration is performed.

N/A: not applicable
SVOC: semivolatile organic compound
VOC: volatile organic compound
PCB: polychlorinated biphenyl

Table 6
Data Quality Objectives

Parameter	Precision[1]	Accuracy[2]	Completeness
Soil Samples			
Total solids	± 20% RPD	N/A	95%
VOCs	± 35% RPD	50–150% R	95%
SVOCs	± 35% RPD	50–150% R	95%
Metals	± 30% RPD	75–125% R	95%
Mercury	± 30% RPD	70 to 130% R	95%
PCBs	± 35% RPD	50 to 150% R	95%
Groundwater Samples			
Total and dissolved mercury	± 20% RPD	80–120% R	95%
Waste Characterization Samples			
SVOCs, VOCs, PCBs	± 35% RPD	50 to 150% R	95%
Metals	± 25% RPD	75 to 125% R	95%

Notes:
1. When the sample concentration is greater than five times the reporting limit.
2. Accuracy goals apply to laboratory control samples and matrix spike samples, as applicable to the analysis.
N/A: not applicable
R: recovery
RPD: relative percent difference
SVOC: semivolatile organic compound
VOC: volatile organic compound
PCB: polychlorinated biphenyl

Appendix B
Standard Operating Procedures

STANDARD OPERATING PROCEDURES

SOP 001 – Field Records
SOP 002 – Ground Penetrating Radar
SOP 003 – Scanning of Surfaces for Mercury Vapors
SOP 004 – Utility Clearance
SOP 005 – Test Pit Excavation
SOP 006 – Subsurface Soil Investigation
SOP 007 – Equipment Decontamination
SOP 008 - Monitoring Well Installation Development
SOP 009 – Low Flow Groundwater Sampling
SOP 010 – Slug Testing
SOP 011 – Investigation Derived Waste
SOP 012 – Mercury Scanning of Decontaminated Equipment
SOP 013 – Sample Custody

ANCHOR QEA

Standard Operating Procedure

Field Records

SOP 001

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the documentation of field activities during implementation of field tasks. Field documentation will consist of field forms, daily logs, photographs, and electronically recorded field measurements.

2. Equipment List

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 including, but not limited to, the following:

- Daily logs
- Field forms and records
- Waterproof pen
- Camera

3. Documentation Procedures

Field team members will keep a daily record of significant events, observations, and measurements on paper field forms. All field activities will be recorded on forms specific to the collection activity and will be maintained by the Field Team Leader. Field notes should be maintained for all field activities (e.g., the collection of samples or the gathering of environmental data). The on-site field representative will record on the daily log forms information pertinent to the field task, including, at a minimum, the following information:

- Project name
- Field personnel on site
- Health and safety discussions
- Soil boring location ID
- Well location number
- Observations made during sample collection, including weather conditions, complications, and other details

- Sampling method and description of activities
- Name, telephone number, and category of site visitors (e.g., Client, Regulatory, Municipal, or General Public).
- Meetings in the field associated with sampling/installation activities

Field notes shall be written in water-resistant paper logbooks or on pre-printed forms, and all field documentation will be made using an indelible, waterproof ink pen. 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.

4. 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.

Attachment

Attachment 1 Daily Log

Attachment 1

Daily Log

Daily Log

ANCHOR QEA

Anchor QEA, LLC
1201 3rd Avenue, Suite 2600
Seattle, WA 98101
Phone 206.287.9130 Fax 206.287.9131

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

Signature:

Geophysical Survey using Ground Penetrating Radar (GPR)

SOP 002

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the identification of subsurface infrastructure using the geophysical survey of ground penetrating radar (GPR). GPR equipment transmits high frequency electromagnetic waves into the ground and detects energy reflected back to the surface. Energy is reflected along subsurface interfaces that possess different electrical properties. Reflections typically occur at lithologic contacts or when the electromagnetic waves encounter subsurface materials having high electrical contrasts, including metal objects such as underground storage tanks (USTs), drums, and utility pipes. These reflections are detected by the antenna and processed into an electrical signal, which can then be used to image the subsurface feature.

Typical objectives of a GPR survey are to image the lateral extent (length and width) of subsurface infrastructure such as concrete, asphalt, metals, pipes, or cables. The results of the survey can be used in combination with information obtained from other preliminary activities to identify areas for test pitting and soil boring.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform GPR surveys. The details within this SOP should be used in conjunction with the project work plan.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

3. Personnel Qualifications

Only qualified personnel will lead geophysical survey activities. Training requirements for direction of these activities include reviewing this SOP, applicable SOPs provided by subcontractor and/or manufacturer, guidance documents, and health and safety training.

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for geophysical data collection.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) as needed.

4. Equipment List

Equipment and materials that will be used for performing a GPR survey may include the following:

- Appropriate personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP; Appendix C)
- Indelible ink pen
- Non-conductive tape measure and stakes or marker flags
- Survey equipment or GPS system
- Geophysical Survey System, Inc. (GSSI) Subsurface Interfacing Radar (SIR) System-2000 radar or equivalent
- One antenna of an appropriate frequency (typically 100 to 500 megahertz) to achieve the survey depth needed, and delineate the subsurface features of interest
- Connecting cables, survey wheel, and 12-volt power source
- Camera
- Whiteboard with erasable markers
- Field logbook

5. Health and Safety Considerations

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project HASP (Appendix C). The HASP will be followed during all activities conducted by Anchor QEA personnel and subcontractors.

The site-specific HASP and GPR subcontractor's HASP will be used to guide the performance of the GPR survey in a safe manner. Job Safety Analyses (JSAs) will be prepared by Anchor QEA and subcontractors.

6. GPR Survey Procedure

Prior to initiating the GPR survey, any known surface or potential subsurface conditions (e.g., utilities, foundation remnants) that may present in the work area should be identified and located to the extent practical.

- Obtain and review plates, drawings, and maps for each subsurface work location, if available.
- Contact the facility and ask if they have any historical information on subsurface utilities in the area of interest. Identify utility lines that would be anticipated to be present based on facility usage (e.g., electric, water, natural gas).
- Conduct mark-outs using the following methods:
  - Code 753 call in (i.e., "811" or "Dig Safely New York") at 800-272-4480 for public utilities.
  - Private Utility Contractor for private property, if applicable.
- Inspect the area for cuts in the asphalt or dips in asphalt surfaces that may represent past work or settlement along a utility line. Identify lamp posts, electrical enclosure boxes, or detached buildings that may contain utility connections other than from the main service connection to the site.

Any identified or suspected utility lines within the area of interest for which reliable mapping is not available should be an area of focus during the GPR survey. In addition, the GPR results can be used to verify the accuracy of available utility and structural information.

The GPR survey procedures are outlined as follows:

1. Identify the traverse location(s) in the field notebook or on a site plan map.
2. Don personal protective equipment as required by the site-specific HASP (Appendix C).
3. Establish a temporary control grid over the designated survey area(s) using conventional surveying methods and/or referenced to the site plan using a baseline established from site features. Lay out the measuring tape along the desired traverse, or mark a reference grid on the ground using the measuring tape.
4. Initial calibration of the GPR system and antenna will be performed by the operator using subsurface soil boring information, if available, and observed response of the GPR's analog signal. Calibration of the system will be completed using the GSSI system setting and adjusting the range and dielectric constant parameters to the approximate subsurface conditions at the site. If available, calibrate the depth (using the dielectric constant) of the GPR over a buried pipe

(or other object) of known depth. Re-calibrate the equipment if the antenna or system settings are changed.

5. Connect the GPR control unit and antenna with appropriate cables, and adjust the instrument gains, if needed, to obtain a satisfactory record throughout the desired survey depth range.
6. Use the survey control grid to determine the GPR survey line location and sequence for collecting the GPR data. Optionally, use a differential GPS system connected to the GPR system to locate the data collected along each survey line.
7. Record GPR data while slowly pulling the antenna(s) along the survey traverse(s). Annotate the record using the antenna's marker switch, at even distance increments (10 feet, or as needed).
8. Make note of any variable surface condition (e.g., terrain changes, surface cover materials, standing water) that could affect data interpretation. Also note any surface expressions of potential buried utilities or structures.
9. Conduct data analysis in accordance with the manufacturer's recommendations RADAN for Windows software, or equivalent and industry practice.

7. Quality Assurance

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

Scanning of Surfaces for Mercury Vapors

SOP 003

Project: 164 John Street

Date: September 2021

1. Purpose

This Standard Operating Procedure (SOP) describes the investigative monitoring requirements for use in identifying mercury impacted areas on the ground surface. This SOP addresses instrumentation, action levels, sampling location, and duration. This SOP is not intended for the screening of decontaminated, non-disposable equipment or waste materials (i.e., demolition debris, excavated soil, subsurface structure debris) generated by the investigation activities.

Procedures for surface scanning outlined in this SOP are expected to be followed. Substantive deviations from the procedures detailed in this SOP will be recorded on the Daily Field Log and communicated to task and project management.

The details within this SOP should be used in conjunction with the project work plan.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the installation procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

3. Summary of Method

Areas suspected of visible elemental mercury contamination shall be treated with caution as to not disturb or track the mercury into uncontaminated areas. Any visible mercury shall be removed using mercury spill kits, vacuumed using mercury vacuums and or or marked prior to scanning so that the area is not inadvertently disturbed during scanning and tracked to other areas on-Site. Visible mercury or areas of higher mercury vapor concentrations found during the mercury scanning activities shall be clearly marked. Regardless of whether or not mercury is visible, protective foot coverings for personnel working within mercury contaminated soils are required to prevent tracking.

Holding the probe or tube of the MVA directly adjacent to (within an inch) off the ground surface, transects of the area shall be scanned. Care should be taken not to drag the probe along the surface so that no particulates are sucked into the machinery. Transects no larger than one-foot intervals ensure that the whole area is well characterized. MVA output should be monitored, and areas of high concentration shall be clearly marked for further field investigation and/or characterization.

Measurements shall be recorded (either by hand or logged by the MVA) at appropriate time or spatial intervals for the development of a concentration map, commonly known as heat map.

4. Personnel Qualifications

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan (Anchor QEA 2021), and the corresponding documents (i.e., HASP, Quality Assurance Project Plan [QAPP, Anchor QEA 2021], etc.). Specialized training is not required for scanning and use of equipment; however, field staff will be supervised by experienced staff.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) as needed.

5. Equipment List

Equipment and materials that will be used by Anchor QEA personnel to carry out the procedures contained in this SOP include

- Mercury Vapor Analyzer (MVA: VM-3000).
- Proper task specific PPE per the HASP (Tyvek boot covers or overalls, respirator with appropriate air-purifying cartridges, nitrile gloves, etc.)
- Utility wagon cart, or equivalent, to move equipment around
- Battery pack for power supply, unless there is a direct electrical source
- Marking supplies (paint, flags, caution tape, or similar)

Standard Operating Procedure

Utility Clearance

SOP 004

Project: 164 John Street

Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for Utility Clearance prior to and in support of the drilling or excavation of fill and unconsolidated soils.

This SOP describes the requirements, process, and documentation procedures necessary to locate and mark utilities before soil boring, test pit excavation, and well installation.

The details within this SOP should be used in conjunction with the project work plan.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the installation procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

This SOP was prepared in compliance with the Con Edison Utility Clearance Process for Intrusive Activities, which is provided as Attachment 1. In the event of any discrepancies between requirements described in this SOP and those in Attachment 1, the requirements contained in Attachment 1 will apply.

3. Summary of Method

Utility clearance is required before any subsurface work associated with this project. This is an Anchor QEA requirement. The following is a summary of the methods for utility clearance:

- Obtain and review plates, drawings, and maps for each subsurface work location (Anchor QEA lead) if available
- Conduct mark-outs using the following methods:

  - Code 753 call in (i.e., “811” or “Dig Safe New York”) at 800-272-4480 (drilling subcontractor lead with Anchor QEA confirmation) for public utilities
  - Private Utility Contractor for private property if applicable (Anchor QEA lead)
  - Con Edison M-Scope Survey (Anchor QEA lead)
- Site walk (Anchor QEA lead)
- Utility clearance – sample location confirmation (Anchor QEA lead)
  - Tolerance Zone
  - Test Pit/Soft Dig
  - Sample location field measurements to fixed objects
  - Re-excavate cleared locations by hand, as needed
- Documentation
  - Utility Contact Prevention Checklist (Anchor QEA lead)
- Notice-to-Proceed (Anchor QEA lead)

4. Personnel Qualifications

Only qualified personnel will manage utility clearance activities. Training requirements for direction of utility clearance activities include reviewing this SOP, other applicable SOPs, guidance documents, and health and safety training.

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for utility clearance.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) as needed.

5. Equipment List

Equipment and materials that will be used by Anchor QEA personnel for overseeing and directing utility clearance include the following:

- Camera
- Tape measure
- Spray paint
- Field logbook
- Utility Contact Prevention Checklist
- Appropriate personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP)
- Indelible ink pen

- Whiteboard with erasable markers
- Air monitoring equipment (during sample location confirmation Test Pit/Soft Dig)

6. Cautions

Special care must be taken when conducting Test Pit/Soft Dig activities, as well as subsurface work even following completion of Utility Clearance procedures. It should be assumed that utilities can exist in any work area. Completion of all Utility Clearance procedures does not fully guarantee utilities are not present in the work area. As such, subsurface work must always be conducted with an abundance of caution, given the substantial and historic level of urbanization of the site area.

7. Health and Safety Considerations

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project HASP (Appendix C). The HASP will be followed during all activities conducted by Anchor QEA personnel and subcontractors.

The site-specific HASP and (as needed) subcontracted utility clearance firm's HASP will be used to guide the locating activities in a safe manner. Job Safety Analyses (JSAs) will be prepared for oversight by Anchor QEA and subcontractors. The following specific health and safety issues must be considered when conducting locating activities:

- Underground and overhead utility hazards must be mitigated prior to subsurface work.
- Test Pit/Soft Dig equipment present a variety of safety hazards. Equipment must be inspected each day prior to use. All personal must know where the emergency "kill" switch is, and the switch must be tested daily. Only the equipment operator and helper may approach the equipment during locating activities.
- Air monitoring will be conducted for chemicals at action level as established in the site-specific HASP.
- Appropriate PPE must be worn.
- Potential hazards from working in a public area and potential hazards to the public by locating activities must be addressed before activities begin and as conditions change.
- Waste generated during the locating activities must be properly managed in accordance with facility and applicable regulatory requirements.

8. Procedure

During utility clearance activities, the Utility Contact Prevention Checklist (Attachment 2) will be used and/or filled in to ensure all practicable steps have been taken to locate utilities in the work area. It is the responsibility of Anchor QEA project managers, with the assistance of the field team members, to ensure these documents are used for each sampling location.

8.1 Obtain and Review Plates, Drawings and Maps for Each Subsurface Work Location

Efforts will be made to obtain hard copies of available utility plates, drawings, and/or maps by Anchor QEA if available. Drawings, plates, etc., should be reviewed as a preliminary step to determine the type and approximate size and location of utilities in the vicinity of the sampling location. The drawing title, most recent revision date shown on the drawings, approximate scale, and source shall be documented in the appropriate space(s) on the Utility Contact Prevention Checklist (Attachment 2).

The source of the drawings may vary depending on whether the site is a private/public property or extends into a public street/sidewalk. Drawings for private properties and facilities, such as apartments, schools, churches, residences, etc., can typically be reviewed at, and/or obtained from, the property/facility manager and Department of Public Works and/or Department of Buildings in the municipality where the property is located.

8.2 Conduct Utility Mark-Outs

Given the urban/public/private nature of the site and substantial history of development and redevelopment, three types of utility mark-outs may be required by default for each sampling location:

- Code 753 call in (i.e., "811" or "Dig Safe New York") at 800-272-4480 for public property
- Private Utility Contractor for private property
- Con Edison M-Scope Survey

The results of the utility mark-outs will be documented on the Utility Contact Prevention Checklist (Attachment 2).

8.2.1 Code 753 – Public Property

A Code 753 utility mark out by calling (800) 272-4480 must be conducted for each sampling location by the excavator with Anchor QEA support (i.e., providing sampling locations). Consistent with the One-Call (also called Dig Safe New York) criteria, the request should be made at least 72 hours prior to initiating fieldwork.

Confirmation that mark outs completed under Code 753, and as received by e-mail, facsimile or telephone from the participating utility companies, must be documented on the Utility Contact Prevention Checklist (Attachment 2). The mark-outs must be maintained by the excavator. If the physical markings become faint or obscure, they must be refreshed by over-painting with new paint as needed. When the utility mark-outs are being refreshed, the Anchor QEA field lead MUST be present and observe and document (via photographs) this activity.

When performing the Code 753 utility mark out, confirm the ticket includes the property address (in addition to cross streets) and has the "private property" portion of the Dig Site Information completed as needed:

Example Description of Dig Site Information and Location Portion of One Call Ticket

New York 811

Ticket No:	181931019	**ROUTINE**	
Original Call Date:	7/12/18	**Time:** 10:08 AM	WEB
Start Date:	7/17/18	**Time:** 7:00 AM	**Lead Time:** 20
Caller Information			
Company:	AQUIFER DRILLING	**Type:**	CONTRACTOR
Contact Name:	JOE MCGILL	**Contact Phone:**	(516)616-6026
Field Contact:	JOE MCGILL	**Alt. Phone:**	(516)616-6026
Best Time:		**Fax Phone:**	
Address:	75 EAST 2ND STREET; MINEOLA, NY 11501		
Email Address:	joe.mcgill@aquiferdrilling.com		
Dig Site Information			
Type of Work:	SOIL BORINGS		
Type of Equipment:	DRILL RIG		
Work Being Done For:	ANCHOR QEA		
In Street:	**On Sidewalk:**	**Private Property:** X	**Other:**
Front: X	**Rear:** X	**Side:** X	
Dig Site Location			
State:	NY	**County:**	NEW YORK
Place:	MANHATTAN		
Dig Street:	AVENUE C	**Address:**	285
Nearest Intersecting Street:	AVENUE C LOOP		
Second Intersecting Street:	AVENUE C LOOP		

Location of Work:
MARK FRONT REAR AND BOTH SIDES OF ADDRESS
Remarks:

Map Coord NW Lat: 40.731652 **Lon:** -73.975681 **SE Lat:** 40.729108 **Lon:** -73.973084

Operators Notified:

CEM	- CONSOLIDATED EDISON CO. OF N.Y	ECM	- EMPIRE CITY SUBWAY MANHATTAN
MBLTIE01	- EXTENET SYSTEMS	RCMT01	- RCN
TWCNYC05	- TIME WARNER CABLE - MANHATTAN		

Link To Map for C_EMAIL

EXCAVATOR RESPONSIBILITIES

IMPORTANT NOTE: YOU MUST CONTACT ANY OTHER UTILITIES DIRECTLY.

* **EXCAVATOR MUST CONFIRM ALL POSITIVE RESPONSES BEFORE COMMENCING WORK**

8.2.2 Private Utility Contractor – Public and Private Property

Sampling location may be investigated by a private utility contractor using non-intrusive methods to identify potential utilities in the work area. Locating activities will include a minimum 5-foot by 5-foot buffer around each sampling location. The non-intrusive investigations will consist at a minimum of a ground penetrating radar (GPR) survey and an electromagnetic utility clearance survey.

Following locating activities, newly identified, known utilities will be marked in standard industry colors (e.g., blue for water lines), and probable utilities (i.e., an object identified in the subsurface by either means employed but which could not be readily identified by tracing to a known termination such as a manhole or gas valve) will be marked with orange paint. Markings made by the private utility contractor will not obscure or supersede markings done during the Code 753 mark-out. Following the locating activities, the private utility contractor will prepare a report for each sampling location that documents on maps and by photographs/measurements known and probably utilities, supported by:

- Review of applicable utility drawings
- Reconciliation of drawings with mark-outs identified by the Code 753 survey at the property perimeter
- Determination of the presence and type nature of utilities and confirm their configuration during the utility survey
- Inspection of the site to identify where utility service enters and/or leaves the property and/or building
- Identification of utility access-ways including manholes, vaults, gas, and/or water valves boxes and telephone, cable and communication boxes
- Identification of apparent uncertainties such as manholes containing service lines that apparently go to the building or property, but that cannot be located within the basement of the building or on site

Prior to mobilizing to the site, the following information MUST be provided to and reviewed by the Con Edison PM:

- The name of the subcontractor
- The name of technician(s) who will perform the utility surveys
- For each technician, a summary of experience and training in conducting surveys in a setting similar that at the site (e.g., urban, inside buildings, etc.) and
- Summary of experience and training of each instrument.

Additional requirements for subcontractors providing private utility location services are provided in Attachment 1.

8.2.3 Con Edison M-Scope Survey

Con Edison engineering groups (see Attachment 1 for contacts) can conduct utility surveys using a 'MScope' on a case-by-case basis and will be limited to the engineering group' availability. This tool uses the magnetic susceptibility of subsurface features such as electrical conduits, electric cables, pipes, etc. This method of survey can be subject to interference by other conductive bodies at grade or in the subsurface, such as buried pieces of metal, rebar in concrete, iron-rich soil, etc., and may be ineffective or produce misleading results in these types of conditions. A utility survey using an M-Scope can be requested by contacting the appropriate party listed in Attachment 1.

8.3 Site Walk

After completion of the activities outlined above, a site walk shall be conducted by Anchor QEA. All site walk activities and results will be documented on the Utility Contact Prevention Checklist (Attachment 2).

The key objectives of the site walk are as follows:

- Review all planned locations where invasive activities will be performed.
- Adjust the positions of the locations away from utilities as marked out (as necessary).
- Collectively determine the appropriate utility clearance activities (e.g., test pits, soft digs) that will be performed at each location.

Other site conditions and project issues assessed during the site walk should include the following:

- Presence and location of overhead utilities and/or obstructions that might prevent the safe operation of equipment
- Presence of, or need for, appropriate grounding for electrical equipment at the site
- Site access to equipment
- Storage of equipment/supplies overnight (e.g., establish a staging area)
- Storage and management of investigative derived waste (IDW)
- Hours of on-site work
- Permits needed, if any
- Review roles and responsibilities of all project personnel who will be onsite
- Review site and emergency contacts
- Review anticipated schedule of work and contingency action as deemed appropriate

8.4 Utility Clearance – Sample Location Confirmation

Once utilities have been identified using the suite of methods described above (drawing reviews, mark-outs via Code 753, private utility contractor, and site walk), sample location confirmation will be conducted to further protect workers from contacting utilities and utility damage.

8.4.1 Tolerance Zone

Sample locations will be moved outside the tolerance zone, if possible. If no tolerance zone is marked out during the utility survey (i.e., only a utility center line is marked), the tolerance zone will be defined in the field as follows: the distance of one-half of the known diameter of the utility plus two feet on either side of the centerline as marked out.

8.4.2 Test Pit/Soft Dig

After adjusting sample locations for tolerance zones, a utility clearance test pit or soft dig will be excavated to a minimum of 5 feet below ground surface using non-mechanical methods, such as hand auger, post-hole digger and/or vacuum truck. The diameter of the test pit will be at least two inches wider than the outer diameter (OD) of the mechanized drilling equipment. The 5 foot depth is consistent with the Con Edison requirements contained in Attachment 1, as well as the concept that most utilities are typically installed within the top three to four feet of the subsurface.

NOTE: Utilities may be deeper than four feet due to buildup of surface grade on properties and/or streets or right-of-ways. Although the original depth of utilities is anticipated to be within the upper five feet, utilities that are buried in areas that have been built up will presently be deeper by the thickness of the built-up material.

Where physical constraints prohibit the relocation of proposed sample locations outside the tolerance zone, the adjacent utility(ies) will be exposed by excavating using non-mechanical methods to visually confirm its physical location and configuration. This confirmatory excavation will be completed in addition, a 6-foot excavation at the specific location being investigated (e.g., soil boring, monitoring well boring), as described above.

Photographs and measurements will be taken at each test pit/soft dig location to document the inside conditions of each excavation and the absence of utilities.

8.4.2.1 Confirmation of Previously Cleared Locations

If there is a delay of more than 24 hours between the soft dig and the start of the drilling activities at a sample location (which was previously cleared following the steps outlined in this document), the driller will confirm the bore hole was previously cleared by either:

1. Manually re-excavating, as needed, the bore hole to 5 feet below ground surface and visually re-confirming the absence of subsurface utilities. Following completion of the re-excavation and visual re-confirmation that no subsurface utilities are visibly present, the drilling will begin.
2. Following completion of the original soft dig, placing a PVC pipe (of a diameter larger than the proposed borehole) in the sample location, extending from the ground surface to the bottom of the soft dig and installing the inside of the PVC pipe.

8.4.3 Sample Location Field Measurements to Fixed Objects

Once sample locations have been confirmed and cleared, no less than three lateral measurements to the nearest inch from fixed objects will be collected, photographed, and documented on the Utility Contact Prevention Checklist (Attachment 2) to enable future precise re-location of the confirmed sample location.

8.5 Documentation

All activities conducted under this SOP will be documented, at a minimum, on the Utility Contact Prevention Checklist (Attachment 2). Additional required field documentation includes field notes and photographs. Documentation from utility mark-out efforts by others (i.e., Code 753 and private utility contractors must also be maintained).

9. Waste Management

IDW, rinse water, PPE, and other waste materials generated during utility clearance activities (waste) must be placed in appropriate containers and labeled. Waste materials will be stored securely in a location that has been approved by National Grid.

10. Data Recording and Management

All information relevant to the activities above will be recorded by Anchor QEA field staff using the field logbook and on the Utility Contact Prevention Checklist (Attachment 1) to enable future precise re-location of the confirmed sample location, at a minimum. Field equipment decontamination activities and waste management activities will be recorded in the field logbook. Records generated as a result of implementing this SOP will be controlled and maintained in the project record files in accordance with client-specific requirements.

11. Quality Assurance

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

Attachment

Attachment 1 Con Edison Utility Clearance Process for Intrusive Activities

Attachment 2 Utility Contact Prevention Checklist

Attachment 1
Con Edison Utility Clearance Process for Intrusive Activities

1.0 INTRODUCTION

This document outlines a process to identify, locate and clear subsurface utilities as part of all Environmental Health and Safety (EH&S) Department's Remediation Section intrusive site investigations. The various activities that comprise this process are specified in efforts to eliminate or substantially reduce the risk of encountering a subsurface utility while performing intrusive activities. Where appropriate, reference is made to other existing *Con Edison and or industry* safety procedures that should also be considered. **Note that modifications and additions to the text in this version of the process, relative to the topics outlined in Section 2.0, are italicized.**

Due to the potential presence of subsurface utilities and the inherent variable of their size, depth and layout, it is not possible to address all situations and circumstances that may be encountered during intrusive activities. However, adherence to the steps outlined here will effectively minimize physical impacts to subsurface utilities and prevent associated health, safety *and environmental* risks that might otherwise result from field investigation activities. The activities prescribed below should not be blindly followed. Rather, it is the intent of this document that **ALL FIELD PERSONNEL**:

1) Understand the terms of this process including all revised or added provisions;

2) Develop an awareness and be mindful of, the potential and actual risks associated with utilities and other related hazards at a site;

3) Become familiar with the location(s) and configuration(s) of all subsurface utilities at the site, *which will include surrounding/adjacent facilities and or buildings*, as marked out and as delineated on available drawings;

4) Develop an awareness and understanding of the potential uncertainties associated with utility locations as marked out;

5) Maintain a high level of vigilance while implementing all components of intrusive fieldwork.

ALL FIELD PERSONNEL, including the Con Edison Project Manager (PM), Construction Management (CM), consultants and contractors should, *at a minimum,* be familiar with the fundamental provisions of this utility clearance process PRIOR to engaging in any field activities.

The process described in the remainder of this document consists of the three (3) primary components summarized below. These components are designed for use in an integrated manner.

<u>Process Narrative</u> – The narrative provides detailed descriptions of the specific steps that should be taken prior to and during intrusive activities to minimize the potential of encountering subsurface utilities.

<u>Utility Clearance Flow Chart:</u> The key steps of the utility clearance process, as outlined in the narrative, are shown graphically on the flow chart provided in **Attachment A**. The flow chart serves as a guide and should not replace the narrative for developing an understanding of and/or implementing the process.

<u>Utility Clearance Checklist</u> - A key component of this process is the completion of the checklist provided in **Attachment B**. The checklist shall, be completed by the Con Edison PM *or their designee, such as consultant or Con Edison Construction Management Inspector.* The intent of the checklist is to ensure that all appropriate steps of the process described herein have been completed. Secondly, it will be used to document that all reasonable steps were taken to prevent conditions that may be potentially harmful to the on-site workers and the surrounding community at large, and that might otherwise adversely impact the physical integrity of, or cause damage to, the utility. The completed checklist will be incorporated in the project files maintained by the Con Edison PM *or their designee*.

2.0 REVISIONS FROM PREVIOUS VERSION

This version (**Revision 2**) *contains modifications to Revision 1 and includes additional provisions and or guidance based on lessons learned during implementation of the previous versions* for intrusive activities at various sites. The key topics that have been added or modified are listed below and described in greater detailed in the referenced sections of this protocol.

- *Considerations for potential presence of fiber optics;*
- *Accessing manholes and other utilities during field inspection and utility mark out;.*
- *Considerations for potential presence of traffic control electric lines; and*
- *Considerations for potential presence of unmapped non-routine utilities or subsurface utilities, such as drainage pipes, etc.*

Modifications and additions to the text relative to the introductory sections of this document and the topics listed above are *italicized.*

3.0 APPLICABILITY

The utility clearance process shall be performed prior to and/or during the intrusive site investigation activities listed below.

- Excavation of Soil Borings

- Installation of Monitoring Wells
- Installation of Soil Gas Sampling Probe Points
- Excavation of Exploratory Test Pits/Trenches

4.0 SUBSURFACE UTILITY CLEARANCE PROCESS

The key activities that comprise the process are listed below and a detailed description of each is provided in the remainder of this document in the order in which they should be completed (as shown in the Utility Clearance Flow Chart in **Attachment A**).

- Obtain Plates, Drawings and Maps
- Notification to Con Edison Operating Groups and Submission of Site-Specific HASP for review and approval
- Code 753 Utility Mark-Out
- Site Walk
- Utility Clearance - Sample Location Confirmation
- Checklist Completion

It is noted that completion of some steps may not be warranted for all intrusive activities at all sites. The process is designed to be flexible and, thus, allows the Con Edison PM to incorporate those utility clearance activities that are appropriate for a set of site-specific conditions, knowledge of the site, previous work completed at a site, etc. Exceptions are summarized in Section 5.0 of this document. The key premise is that any deviations and the rationale for each are well documented and reflect sound judgment on the part of the Con Edison PM and other project personnel.

4.1 Obtain Plates, Drawings and Maps

Hard copies of available utility plates, drawings and/or maps should be obtained by the Con Edison PM *or their designee.* Drawings, plates, etc. should be reviewed as a preliminary step to determine the type and approximate size and location of utilities in the vicinity of the work site. . *When working at, adjacent to or in the immediate vicinity of a Con Edison facility (”Facility”), such as substation or gas regulator station, the Con Edison PM or their designee shall also obtain and review the Facility-specific plates. These shall include all utilities (both Con Edison and non-Con Edison) on and/or entering or leaving the Facility. Regardless of who obtains the requisite utility plates and or drawings, the Con Edison PM shall ensure that the job package is complete and includes ALL required such drawings and or plates of sub-surface facilities in the* *area(s) of intrusive activity, such as excavation or drilling.* The drawing title, most recent revision date shown on the drawings, approximate scale and source shall be documented in the appropriate space(s) on the Utility Clearance Checklist (**Attachment B**).

The source of the drawings may vary depending on whether the site is a Con Edison owned/operated facility, private/public property, or extends into a public street/sidewalk. The various sources for substation utility drawings are discussed below and listed in **Table 1**. Drawings for private properties and facilities, such as apartments, schools, churches, residences, etc., can typically be reviewed at, and/or obtained from, the property/facility manager and Department of Public Works and/or Department of Buildings in the municipality where the property is located.

NOTE: Fiber optics at Con Edison facilities are not routinely identified on utility drawings. Therefore, when conducting intrusive work at Con Edison facilities, the facility engineer should be contacted in advance of the site walk to determine if fiber optic cables are known to be present and, if so, what is their layout. Fiber optic lines generally cannot be detected using routine geophysical methods accordingly, at sites with known fiber optics every effort should be made to determine their location or confirm their absence in the work area.

NOTE: Copies of all drawings obtained during this step should be available at the site during all site walks/inspections and at all times during subsequent intrusive activities. The drawings should be reviewed immediately prior to implementing intrusive activities at each new site location where intrusive activities are to be performed.

Steam, Gas and Electric
All electric and gas plates are available on Con Edison's intranet by searching for 'maps' or accessing the Advanced Mapping System website listed below.

http://maps/AdvancedMappingHomePage.htm

Similarly, steam plates can be obtained by selecting "Active" and "Archived" Steam Plates from the website:

http://maps/steam.htm

Based on agreement between Transmission Operations and EH&S, Remediation personnel may access these intranet sites and print the plates using the plotter located in the 2nd floor of Building 138. In addition, a large format photocopier, which is also located in Building 97, is available for use by EH&S remediation. A log book, which is stored at the facility, should be completed each time the facilities (i.e., computer, and or photocopier) are used.

Conduit and Duct Occupancy (C&DO) utility plates can also be obtained from the appropriate Con Edison engineering group(s) including, electric (e.g., distribution lines, transmission feeders, etc.) steam and gas by the Con Edison PM.

AFTER accessing the website and obtaining the required drawings, the appropriate party listed in **Table 1** may be contacted with inquiries regarding electric and steam plates or for questions regarding use of the Advanced Mapping System.

Sewer and Water

Drawings showing water and sewer utilities should be obtained from the New York City Department of Environmental Protection (NYCDEP) *or, if in Westchester, then the drawings and or plates should be obtained from the local authority, such as the County Health Department or municipal Departments of Public Works (DPW) and or Buildings (DOB).* Drawings can be requested from the NYCDEP by completing the form provided in **Attachment C** and faxing or mailing it using the appropriate contact information listed on the request form. If you have questions you should contact the NYCDEP personnel at the telephone number listed in **Table 1**.

Subterranean Tunnels

Drawings showing locations and depths of tunnels including subways and automobile tunnels and related subsurface infrastructure should be obtained as appropriate by contacting the Metropolitan Transportation Authority as listed in **Table 1**. It is noted that if intrusive activities will be performed in the immediate vicinity of subsurface MTA structures, such as subway or automobile tunnels, a letter submitted to the MTA may be required to request a work permit from MTA. The letter should include a brief summary of the work and a map(s)/drawing(s) of the proposed work and will be submitted to:

Mr. Rajen Ydeshi
Outside Projects
New York City Transit
2 Broadway, 7th Floor
New York, New York 10004

Fiber Optics

As noted above, fiber optic lines are typically not shown Con Edison's utility drawings. Accordingly, the facility engineer should be consulted regarding the presence,and if present, their location as discussed above.

Traffic Control Cables

Drawings and or plates for subsurface traffic control facilities should be requested from New York City Department of Transportation (NYCDOT) or the local/ municipal DPW or DOT.

Miscellaneous

Con Edison generally does not maintain plates and drawings showing detailed information of utility distribution on private property. However, as discussed above, facility managers, property owners, Department of Public Works and/or Department of Buildings of the municipality where the site is located, should be contacted in efforts to obtain available utility drawings for the facility. Contact information (e.g., telephone numbers, e-mail addresses, etc.) for municipalities can typically be obtained by accessing the municipality's website. The name, address and telephone numbers for the Department of Buildings in New York City are listed in **Table 1**.

4.2 Complete Utility Markouts

Due to the diversity and nature of sites investigated by the EH&S Remediation Group and the potential utilities at these sites, an effective mark out *will require a Code 753 utility survey with supplemental M-scope survey by Con Edison and or a subsurface utility survey by a private utility-locating contractor*. The applicability of each of these surveys is discussed below.

4.2.1 Overview of Utility Markout Methods

<u>Code 753</u>
The Con Edison PM should instruct their consultant and/or contractor to request a Code 753 utility mark out as per the 16 New York City Rules and Regulations (NYCRR) Part 753. Consistent with the One-Call (also called Dig Safe New York) criteria, the request should be made at least 72 hours prior to initiating fieldwork. The telephone numbers of the various one-call systems are listed by region below.

New York City / Long Island:	(800) 272-4480
Westchester	(800) 962-7962

Confirmation that mark outs completed under Code 753, and as received by facsimile or telephone from the participating utility companies, should be documented on spaces provided on the <u>Utility Clearance Checklist</u> (**Attachment B**). The markouts should be maintained by the Con Edison PM or designated representative. If the physical markings on the street/sidewalk become faint or obscure they should be refreshed by over-painting with new paint as needed. When the utility markouts are being refreshed, typically by consultant, contractor, or other project personnel, a Con Edison representative or their designee **MUST** be present and observe this activity.

<u>Con Edison M-Scope Survey</u>
Con Edison engineering groups (see below for contacts) can conduct utility surveys using a 'M-Scope' on a case-by-case basis and will be limited to the engineering group' availability. This tool uses the magnetic susceptibility of subsurface features such as electrical conduits, electric cables, pipes, etc. This method of survey can be subject to interference by other conductive bodies at grade or in the subsurface, such as buried pieces of metal, rebar in concrete, iron-rich soil, etc., and may be ineffective or produce misleading results in these types of conditions. A utility survey using an M-Scope can be requested by contacting the appropriate party listed below. Note for markouts inside substations contact Mark Rimler at (212) 460-3921.

County	Contact Name	Telephone Number
Manhattan	Jane Shin	(212) 894-9345
Brooklyn & Queens	John Haas	(718) 348-6725
Bronx	Greg Kasbarian	(718) 904-4659
Westchester	Faney Bantin	(914) 789-6715
Staten Island	Joseph Nappi	(718) 890-6231

Private Utility Contractor

Prior to mobilizing to the site the following information MUST be provided to and reviewed by the Con Edison PM:

- the name of the contractor;
- the name of technician(s) who will perform the utility surveys;
- for each technician, a summary of experience and training in conducting surveys in a setting similar that at the site (e.g., urban, inside buildings, etc.); and
- Summary of experience and training of each instrument.

When using a private utility location contractor, the Con Edison PM shall diligently attempt to arrange for the facility or property manager and or engineer, who is most familiar with the utility layout and distribution in the building or on the property to participate in the site walk with the private utility locating contractor during on the first day of conducting the on-site utility survey.

Private utility contractors employ a variety of utility detection and location techniques, which may include:

- Ground Penetrating Radar (GPR)
- Magnetometer *(M-Scope) [for locating metallic* ***and*** *non-metallic pipes and cables]*
- Radio Frequency Induction (RFI) *[for locating non-metallic pipes and cables]*
- Electrical Conductivity
- Electrical Resistance
- Acoustics

Use of multiple methods may permit the detection and surveying of conductive and non-conductive buried utilities.

The utility location contractor **SHALL** specify which utility detection tool/techniques they plan to bring **AND** use at the site. In addition, they **SHALL** bring **ALL** support tools and equipment necessary to allow them access to manholes, vaults, circuit boxes, pipe clean-outs, etc.

At the commencement of a utility survey using a private utility location contractor **AND** prior to them deploying any survey equipment, the utility location contractor **SHALL**, *in cooperation with the Con Edison PM and or their designee:*

1) Review **ALL** utility drawings

2) Reconcile **ALL** drawings with markouts identified by the Code 753 survey at the property perimeter.

3) Determine presence, type and nature of sub-slab utilities and diligently attempt to confirm their configuration during the utility survey.

4) Inspect the site to identify*/reconcile* where **ALL** utility service(s) enters and or leaves the property and or building. This **SHALL** include a thorough inspection of building basement(s); boiler and or machine room(s); externally-exposed utility infrastructure including manholes; vaults; electrical, gas, water valves and or meters; etc.

5) *For work at or adjacent to Con Edison Facilities, conduct the site walk and review the facilities drawings with key Facility Management personnel.*

6) Visually identify, open and inspect **ALL** relevant utility access-ways including manholes, vaults, gas and or water valves boxes and telephone, *fiber optic* cable, *traffic control lines* and communication boxes.

NOTE: Only circular manholes shall be opened. If opened improperly, rectangular manhole covers can fall into the underlying vault and damage the contained utility (e.g., transformer). If it isa anticipated that manholes will need to be opened, Con Edison Transmission and Service Operations (T&SO) shall be contacted prior to conducting the site walk and or utility clearance survey using a private locator.

7) Identify and document **ALL** apparent uncertainties such as manholes containing service lines that apparently go to the building or property, but that cannot be located within the basement of the building or on site.

NOTE: In **ALL** cases, the private utility contractor shall diligently attempt to 'hook-onto' or 'tone' each conduit source (e.g., pertinent electrical conduits in basement, water and or gas valves in valve box, *sewer and or drain pipes,* distribution lines in manhole, *telecommunication lines*, etc.). This may require opening manholes circuit electrical distribution 'trunk' boxes, moving equipment or stored materials at the facility or property to allow access. No project personnel shall enter a manhole or vault unless they are certified and trained in confined space access, have and know how to use **ALL** pertinent safety equipment, and approved by the Con Edison PM.

In some situations, multiple metallic conduits may be in direct contact in the subsurface. In this circumstance the signal of the locating tool may be transferred from the conduit being ‘toned’ to an adjacent conduit(s) and may produce a ‘secondary’ signal. In efforts to understand and identify this occurrence, the location of each apparent signal shall be visually/physically marked using pieces of tape, paint or similar method. The sources being ‘toned’ shall be numbered and the corresponding signals associated with each signal source shall be marked with the corresponding number at each location where the signals from each source is detected. Accordingly, the resulting mark outs will show apparent multiple conduits for a single source.

4.2.2 Applicability of Utility Clearance Resources

The use of the various utility markout resources that may be employed at various sites is summarized in the table below and discussed in the remainder of this section.

Site Setting	Utility Survey by Con Edison	Utility Survey by Private Contractor	Code 753 [(1)]
Con Edison Facility	X	X (optional)	X[1]
Street / Sidewalk	X (optional)	X (optional)	X
Private Property	X (optional)	X	X[1]

(1) At larger Con Edison Properties (e.g., Astoria) or large private or publicly owned properties, a Code 753 survey may not be warranted.

Con Edison Facility

Utility markouts at Con Edison facilities should be coordinated by the Con Edison PM with support from the Construction Management (CM) inspector assigned to the project (if any) and/or *key Facility Management personnel*, as appropriate. At a minimum, an M-Scope survey should be completed. In some circumstances, an independent utility locating contractor should also be used. The decision to use a utility contractor will be made by the Con Edison PM. The use of an independent utility mark-out contractor is strongly recommended at sites where a variety of utilities are known or suspected to be present and which may not be readily identified or mapped using M-Scope alone. A benefit of using a utility locator contractor is that, as described above, they can provide a greater array of tools to locate a variety of subsurface utilities that are non-conductive, such as concrete sewer lines, PVC pipes, etc. in addition to identifying/confirming the presence and location of conductive utilities.

Private Property (including Soil Gas Sampling Probes)

An independent utility locator should be used for utility markouts on private properties. It is noted that utility mark-outs in basements or slab-on-grade constructed buildings may be inconclusive due to the presence of rebar or welders-mesh commonly used as reinforcement in concrete. Accordingly, a thorough inspection of the basement floor and walls should be performed to identify where utilities enter and leave the building, as well as how the utility (elctric, water gas, steam, etc.) are distributed in the vicinity of the sample locations. Sub- or in-floor utilities often enter along the perimeter of the floor, at support columns, and/or along dividing walls. The observation of utilities entering the floor may indicate utilities that lie within or immediately beneath the concrete basement slab. If the location of the utility layout of any such sub- or in-floor utility cannot be effectively determined, then any intrusive work must be discussed with the Con Edison PM and may require that no intrusive activities be performed at that location. *However, this action should only be considered after all applicable survey tools and methods have been diligently deployed and or implemented.*

Public Street / Sidewalk

A combination of Con Edison utility survey staff and independent utility locator contractors may be used for work areas located in and along roadways. Since Con Edison maintains utilities in streets and along sidewalks, in addition to the mark outs performed through the Code 753 survey, an M-scope survey may also be requested within a 10 foot radius of each proposed sample location. It is noted that due to often heavy work loads of the M-Scope survey staff, this option may not always be available or practicable and should be considered optional.

4.3 Site Walk

After completion of the activities outlined above, a site walk shall be conducted by the Con Edison PM with participation from Construction Management (if it will be providing field oversight), contractors (drillers, soil gas, excavators, private utility location contractor, etc.), Con Edison *Facility Managers,* NYSDEC (as deemed appropriate by the Con Edison PM), private facility managers/property owners *and or owners/operators/representatives of private utilities, such as NYCDOT, municipal DPWs, Westchester Department of Sewer, Westchester County Department of Health, etc.* A list of the names and phone numbers of each participant at the site walk will be maintained by the Con Edison PM. The key objectives of the site walk are to:

- Review the all planned locations where invasive activities will be performed,
- Adjust the positions of the locations away from utilities as marked out (as necessary)
- Collectively determine the appropriate utility clearance activities (e.g., test pits, etc.) that will be performed at each location (as described in Section 3.4) and document all decisions and /or concerns using the Utility Clearance Checklist (as described in Section 4.0) and in **Table 2**.

Other site conditions and project issues assessed during the site walk should include:

- Presence and location of overhead utilities and/or obstructions that might prevent the safe operation of drilling /excavating equipment;

- Presence of, or need for, appropriate grounding for electrical equipment at the site;
- Site access to equipment;
- Storage of equipment/supplies overnight (e.g., establish a staging area);
- Storage and management of investigative derived waste (IDW);
- Hours of on-site work;
- Permits needed, if any;
- Review roles and responsibilities of all project personnel who will be onsite;
- Review site and emergency contacts; and
- Review anticipated schedule of work *and contingency action as deemed appropriate.*

4.4 Utility Clearance - Sample Location Confirmation

The appropriate actions necessary to confirm the location and/or absence of utilities, which are agreed on during the site walk and as documented in the Utility Clearance Checklist and in **Table 2**, will be implemented at each sample location during the investigation. As discussed above, and as shown the Utility Clearance Process Flow Chart, the actions will generally include one or more of the following:

- Moving the location outside the **tolerance zone**, if possible. If no ***tolerance zone*** is marked out during the utility survey (i.e., only a utility center line is marked), the **<u>tolerance zone</u>** will be defined in the field as: **the distance of one-half of the known diameter of the utility plus two feet on either side of the centerline as marked out.**
- Performing a utility clearance test pit at each location where intrusive work will be performed; and/or
- Performing a utility clearance test pit using non-mechanical means to expose and physically verify the exact location and configuration of all nearby utilities.

Brief descriptions of the activities that will be completed during the various investigation activities are discussed below.

NOTE: When working within 25 feet of high pressure gas lines (i.e., 125 psig or greater), *Gas Emergency Response Center (ERC)* shall be contacted *[718-319-2330] and notified of the planned activities <u>at least two days prior to start of intrusive work</u>. If working within 5 feet of a transmission main or within 10 feet of the tolerance zone of a main* the gas line will be

carefully excavated by hand in accordance with the Gas Operations Standard G-11863, titled <u>"Inspection and Maintenance Requirements Associated with the Excavation Activities Near Gas Pipelines Operating at 125 psig and Above".</u>

<u>Soil Borings / Monitoring Wells</u>
All locations within the tolerance zone should be moved outside the zone, if possible. After moving the location, a utility clearance test pit should be excavated to a minimum of 5-feet below ground surface using non-mechanical methods, such as hand auger, post-hole digger and/or vacuum truck. The diameter of the test pit should be at least two inches wider than the outer diameter (OD) of the mechanized drilling equipment. The 5-foot depth is consistent with the concept that most utilities are typically installed within the top five feet of the subsurface.

NOTE: Utilities may be deeper than five feet due to buildup of surface grade on properties and or streets or right-of-ways. Although the original depth of utilities is anticipated to be within the upper five feet, utilities that are buried in areas that have been built up will presently be deeper by the thickness of the built-up material.

Intrusive investigation locations where physical space prohibits the relocation of proposed sample locations outside the tolerance zone, the adjacent utility(ies) will be exposed by excavating using non-mechanical methods to visually confirm its physical location and configuration. This confirmatory excavation will be completed in addition, a 5-foot excavation at the specific location being investigated (e.g., soil boring, monitoring well boring, etc.), as described above.

<u>Soil Gas Sampling</u>
At soil gas sample locations, test pits will also be excavated to one foot below grade or below the bottom of a concrete floor, if present, prior to installation of soil gas sample probes points. The one-foot depth specified is consistent with the concept that most utilities that could be impacted by the advancement and emplacement of the probe points, such as telephone lines, local electric (e.g., for outdoor lighting), cable television, in-ground sprinkler lines, etc., are typically installed from grade to a depth of one foot.

<u>Basements / Indoor Soil Borings and Monitoring Wells</u>
Prior to installing a soil boring, monitoring well or soil gas sample probe point in the concrete slab of a basement and after identifying that no utilities are present in the floor of the basement or foundation slab (as per Section 3.2.2), an electric powered diamond core drill, concrete saw or jack hammer will be used to advance through the concrete and expose the underlying soil. *If sub-slab utilities are suspected of being present, but not confirmed during the utility location survey, the concrete shall be cored or saw cut to an estimated depth of approximately 2/3 the thickness of the concrete (if known). If the thickness of the concrete thickness is not known, it shall be assumed to 8-inches thick. Coring shall proceed at 1-inch increments, with the removal of each one-inch 'plug' of concrete and visual inspection of the core hole to verify the absence of utilities. The remaining 1/3 of the concrete shall be broken using electric jackhammer,,*

hammer drill or using hand tools. Appropriate safety equipment shall be worn during concrete removal actions.

At each location where soil borings and/or monitoring wells will be installed, a hand excavated test pit will then be advanced to a depth of five feet below the bottom of concrete slab. This test pit should be excavated using hand auger, post-hole digger and/or vacuum truck in tandem with a non-conductive probe rod, which can be used to confirm the absence of utilities to a depth of five feet below the bottom of the concrete slab.

NOTE: The use of a jack-hammer to loosen compact soil during hand excavating a utility clearance test pit is strictly prohibited, except as noted above.

<u>Exploratory Test Pit/Trench</u>
Exploratory test pits/trenches will be performed to identify the presence or absence of subsurface structures related to former operating facilities at the site, such as gas holder foundations at former manufactured gas plant (MGP) sites, and should not be confused with **utility clearance test pits** discussed above. The **exploratory test pits** or **trenches** will typical have dimensions of approximately five feet wide by 10 feet deep by 10 to 20 long, accordingly, excavating them by hand is impracticable. The excavation of **exploratory test pits/trenches** must be approached with heightened awareness as the potential for damaging subsurface utilities, if present, is great.

In efforts to develop a reasonable degree of confidence that utilities will not be encountered during excavation of **exploratory test pits/trenche**s, a focused utility survey will be conducted in the area immediately surrounding the test pit or the area defined by a boundary established by measuring two feet perpendicular from all sides of the proposed exploratory test pit boundaries. For example, if the surface dimensions of the exploratory test pit are 10 feet long by 5 feet wide, the surrounding area of the focused utility survey will have dimensions 14 feet long by nine (9) feet wide. It is suggested that the focused utility survey should be completed after all other on-site surveys have been completed. This will allow the surveyor(s) to develop a better understanding of the site-wide subsurface utility configuration.

Following completion of the focused utility survey, **utility clearance test pit**s will be excavated by hand to confirm the presence of any and all utilities identified within five feet from the exploratory test pit/trench. After exposing the utilities, the excavator can proceed to excavate the **exploratory test pit/trench**, however, the operator should be experienced with digging in areas where underground utilities may be present and should use the utmost care when performing the excavation. Excavation should proceed slowly enough so that any obstruction/structure encountered can be evaluated and to confirm that the structure is not a utility.

5.0 CHECKLIST COMPLETION

The Utility Clearance Checklist (**Attachment B**), as well as the overall Utility Clearance Process to locate and clear utilities was designed to be dynamic. Accordingly the Utility Clearance Checklist should be updated throughout the process as each utility clearance activity is completed. During the site walk and after all utility-related issues at each location have been identified and addressed to the satisfaction of all project personnel, the relevant portions of the Utility Clearance Checklist will be completed by the Con Edison PM. It is noted that the Utility Clearance Checklist will be considered complete only after all proposed utility clearance actions identified during the site walk have been successfully implemented and all pertinent information and activities have been documented.

6.0 EXCEPTIONS TO REQUIREMENTS OF THE UTILITY CLEARANCE PROCESS

Due to the inherent diversity and conditions present at project sites, some general exceptions to the utility clearance process are identified below.

- Sites where extensive utility mapping has been completed and/or where extensive intrusive activities have already been performed.
- Locations where facility layout is well documented and understood.
- Sites or portions of large sites (e.g., Astoria facility) where utilities are known not to exist currently or to not have ever existed throughout the life of the facility, property or site.

All circumstances where one or more steps of this process are not being implemented must be discussed with the Con Edison PM and must be duly documented. Regardless of whether or not exceptions are made during the utility clearance process, a Utility Clearance Checklist should always be completed for each site, in accordance with the terms outlined in Section 4.0 of this document.

Table 1 - Summary Table of Resources for Obtaining Subsurface Utility Plates and Drawings

Utility Type	County	Company	Organization	Name	Telephone Number
Electric	All	Con Edison	Electric Engineering	http://maps/AdvancedMappingSystem.htm[1]	
			For Questions contact:	John Ensemplare (Mgr. – B&Q)	(718) 802-5540
				Mike Mitchell (Mgr. – Manhattan)	(212) 460-1119
				Richard Mariani (Mgr. – Westchester)	(914) 925-6026
Gas	All	Con Edison	Gas Engineering	http://maps/steam.htm[1]	--
			For Questions contact:	Mike Verlizzo (Mgr.)	(718) 319-2357
Steam	All	Con Edison	Steam Engineering	http://maps/steam.htm[1]	--
			For Questions contact:	Tony Barbera	(212) 460-4843
Sewer /Water	NYC	NYC DEP /	Bureau of Water and Sewer Operations	Vincent Soriano/ Doug Greely	(718) 595-5330
Tunnels	Subway Crossing the East River	MTA	Outside Projects – Adjacent Work	Vasanth Battu/ Rajen Ydeshi / [If drilling in immediate vicinity of MTA structure, e.g., subway tunnel, car tunnel, etc., you will need submit a letter and plan drawing(s) to Mr. Ydeshi]	(646) 252-4473 (646) 252-3641
	Crossing the Hudson River	Port Authority of NY/NJ	Surveying	Richard Danko (rdanko@panynj.gov) Bill Kane (wkane@panynj.gov)	(201) 595-4841 (201) 595-4842

(1) "Maps" website listed is accessible on the Con Edison Intranet.

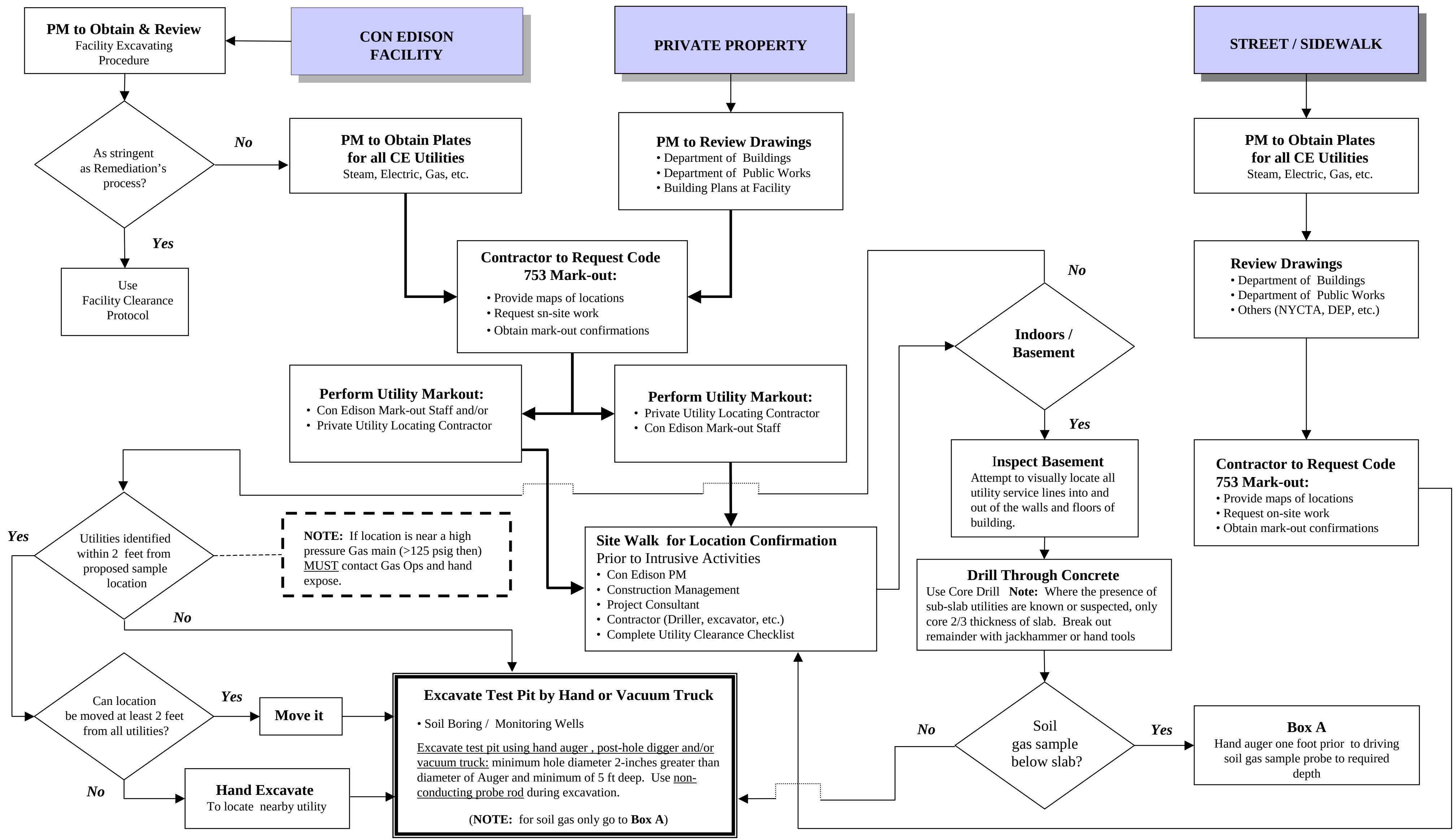
ATTACHMENT A

Utility Clearance Process Flow Chart

Utility Clearance Process During Intrusive Activities
E H & S – Remediation Group

10/08/03

Rev. 1



ATTACHMENT B

Utility Clearance Process Checklist

CHECKLIST FOR INTRUSIVE FIELDWORK

PROJECT BACKGROUND INFORMATION

Site Name: ______________________ **Job No.** ______________

Site Address: ______________________________________

Con Edison Project Manager: ______________________ **Phone:** ______________

Con Edison Site Manager: ______________________ ______________

Consultant Project Manager: ______________________ **Phone:** ______________

Consultant Site Manager ______________________ **Phone:** ______________

Subcontractor (driller, excavation, etc): ______________________________

Subcontractor's Contact Person: ______________________ **Phone** ______________

Meeting / Start Date ______________________ **Time** ______________

HEALTH AND SAFETY PLAN REVIEW

Name: ______________ **Organization:** ______________ **Date:** ________

Name: ______________ **Organization:** ______________ **Date:** ________

Name: ______________ **Organization:** ______________ **Date:** ________

Health and Safety Form Completed: ______________ **Date** ______________

Site Drawings (yes/no/NA): __________ **(Attach site figure with proposed boring locations)**

CODE 753 UTILITY MARK-OUT REQUESTED? Y / N

Called by: ______________________ **Organization:** ______________________

Date: __________ **Time** ______________ **Initials** ______________

Reference # ______________________

Utility Drawings Received: ______________ (Attach copy of utility maps)

UTILITY INVENTORY

Above Ground Services:

Utility	Utility Company Name	Depth (ft)	Phone	Date Notified	Notification Method	Marked
Electric		NA				Y / N
Telephone		NA				Y / N
Cable		NA				Y / N
Overhead Supports		NA				Y / N
Traffic light cables		NA				Y / N

Drawings/Plates Obtained (List) ______________________________

Notes: ______________________________________

CHECKLIST FOR INTRUSIVE FIELDWORK

UTILITY INVENTORY (continued) **Below Ground Services:**

Drawings/Plates Obtained (List) ____________________

Utility	Utility Company Name	Depth (ft)	Phone	Date Notified	Notification Method	Marked
Electric						Y / N
Telephone						Y / N
Cable						Y / N
Gas						Y / N
Water						Y / N
UST System						Y / N
Storm						Y / N
Sanitary						Y / N
Steam						Y / N
Pipeline Companies						Y / N
Other (Tunnels, etc.)						Y / N

PRIVATE UTILITY LOCATING SERVICE RETAINED? **Y / N**

Date ______ **Time** ______ **Initials** ______

Name of Locating Service: ____________________

Telephone #/ contact: ____________________

Name of Operator(s)/Type of sensing equipment used ____________________

METAL DETECTOR SURVEY

Drilling location cleared by ______ **(Consultant/Contractor) with a metal detecto**

Consultant / Contractor Name ______ **By (initials):** ______ **Date:** ______

INTRUSIVE SAMPLING LOCATIONS MARKED, M-SCOPED AND CLEARED

Locations Marked by: ______ Date(s): ______

______ Date(s): ______

M-Scope performed by: ______ Date: ______

Conduct Site Walk and Complete Site Walk Table

ACKNOWLEDGEMENT

The parties listed on the attached Site Walk Sign-In Sheet have participated in a site walk at ____________________ to review proposed intrusive sampling locations and to evaluate the presence, configuration and identification of utilities at this site, as marked out. The parties have agreed with the proposed activities that will be completed prior to conducting intrusive work. The utility clearance activities will be completed as summarized in Table A (attached).

ADDITIONAL COMMENTS / NOTES: ____________________

CHECKLIST FOR INTRUSIVE FIELDWORK

Site Walk Sign-In Sheet

Project Name: ______________________________

Date of Site Walk: ______________________________

Name:	Organization:	Phone No.

Utility Clearance
Site Walk Summary Table

Sampling Location	Nearest Utility Distance	Type	Depth	Clearance Required (Y/N)	Accepted Clearance Method	Rationale for Clearance Method	Depth of Clearance	Date Utility Cleared	Findings /Comments

Signature of Site Walk Participants - Remediation PM: ______________________ Date Site Walk Conducted:

Construction Management: ______________________

Consultant PM: ______________________

Contractor: ______________________

Vincent J. Soriano, Chief
New York City Department of Environmental Protection
Bureau of Water and Sewer Operations
Central Mapping and Records
59-17 Junction Boulevard, 12th Floor
Corona, New York 11368

UPDATED PROCEDURES FOR REQUESTING INFORMATION

Effective immediately, the guidelines listed below are to be followed when requesting information pertaining to the water and sewer system. Water information pertaining to water main size and location is processed by this office. Sewer information pertaining to requests for drainage plans (used in sewer design work, drainage work, a drainage plan will **not tell** you the location of the sewer), interceptors and schematic Inflow/Infiltration (I/I) maps are processed through this office. **Requests for information pertaining to the locations of sewers, which are derived from as built drawings, sewer house connections, and water house (tap) connections will not be processed by this office. You must contact the specific borough Permitting and Connection office. Also requests for flow tests are not processed in this office.** Requests for information can be mailed to the above address or faxed to (718) 595-5781. **Information is not given nor are requests taken over the telephone.** A taped message of instructions can be heard by dialing (718) 595-5779. Please do not leave requests at the end of this tape, as they will not be processed.

1) **All** requests must clearly clarify the locations and work that is being done. Specific limits or a clear site plan must be provided. Project limits marked or highlighted on a Hagstrom map, or references to address or block/lot will **not** be processed. Hagstroms are often illegible and our records are not filed by address and block and lot. You **must** submit a separate request for each borough. With the increasing amount of work being processed by the Records Unit a completed request form (a blank is attached) **must be attached to each request and be completely filled out, especially the description of work being done.**

2) **All** corporate requests **must be submitted on official company or agency letterhead.** Copies of letterhead submitted via fax are acceptable.

3) **All requests must be submitted to this office at least ten days before the work is to be started by your company/agency.** Complexity of a request, DEP emergencies to name two situations can cause a slight backlog and a delay in response time. There is also closer scrutiny in the information that is requested and released. While it is understood each job is important to the individual asking for the information, requests are processed in the order in which they are received. This office will make every attempt to meet your needs, but labeling a request an "emergency" or "need it ASAP" will not help the processing, and it is unfair to the other clients.

4) If you are faxing your request to our office please do not follow up with a hard copy request later on. With the amount of work performed, there have been instances where staff time is used processing the same request twice.

5) If you request to have your records picked up after the research is done rather than have them mailed, please check off the appropriate box on the request form. Our office will hold the package for TWO business days only, and then it will be automatically mailed out. However it is stressed for you to wait for someone from the Records Unit to call and tell you the information package is ready before you come down. This will save you a needless trip if the information is not yet available.

6) **Walk in requests are no longer accepted.**
7) Requests covering large areas can no longer be processed. We ask that you break them down and submit them separately for an area no larger than eight blocks. If you have numerous locations please prioritize them and submit the requests to us in the order for the areas you need first.

Please pass this along to colleagues in your company that might also make requests to this office. I thank you in advance for your cooperation.

Vincent J. Soriano

Vincent J. Soriano, Chief
BW&SO Mapping/Records

REV 7/02

NEW YORK CITY DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF WATER AND SEWER OPERATIONS CENTRAL MAPPING AND RECORDS
59-17 JUNCTION BLVD. - 12TH FL. CORONA, N.Y. 11368 FAX: (718)595-5781

REQUEST FOR INFORMATION FORM

NAME ______________________________

FIRM/AGENCY ______________________________

ADDRESS ______________________________

CITY ____________ STATE ____________ ZIP ________

TELEPHONE # ____________ FAX # ____________

BOROUGH (Check one)
BRONX ( )
BROOKLYN ( )
MANHATTAN ( )
QUEENS ( )
STATEN ISLAND ( )

PURPOSE OF REQUEST FOR WATER RECORDS(WORK BEING DONE)
DRILLING/BORING/EXCAVATION( ) SURVEY( )
DESIGN( ) PLANNING/ANALYSIS( ) OTHER( ) ________
PURPOSE OF REQUEST FOR SEWER RECORDS
SEWER DESIGN( ) Provide latest adopted drainage plan unless otherwise noted for the following sewer type
STORM( ) SANITARY( ) COMBINED( )
INFLOW/INFILTRATION ANALYSIS( )
INTERCEPTOR INFORMATION( ) OTHER( ) ________

IF YOU HAVE BEEN RETAINED BY A CITY, STATE OR FEDERAL AGENCY INDICATE NAME BELOW

____

AGENCY CONTRACT NUMBER ______________________________

PROVIDE A BRIEF DESCRIPTION OF THE PROJECT YOU ARE WORKING ON THAT REQUIRES THE ABOVE INFORMATION. For example, designing a new 10" sanitary sewer, excavation, drilling contract, etc. **NO REQUEST WILL BE PROCESSED WITHOUT AN EXPLANATION.**

____

____

IN HOUSE STAFF ONLY
PROJECT FOLDER ________ DATE LOANED ________ DATE RETURNED ________

LOCATION

STREET NAME	FROM	TO

PLEASE CALL TO HAVE INFORMATION PICKED UP IN PERSON( )
FOR OFFICE USE ONLY
DATE IN ________ DATE OUT ________ ASSIGNED TO ________
RECORDS SENT:

ATTACHMENT C

Instructions for Obtaining Drawings for Sewer and Water Utilities

From the NYC DEP

Steps for obtaining DEP water maps

1) Fill out a "Request for Information Form" for the NYC DEP Bureau of Water and Sewer Operations Central Mapping and Records. Specify the purpose of request and the street names. For faster result, indicate preference for picking up in person.
2) Fax the request form to NYC DEP at (718) 595-5781
3) If pick up requested, you will receive a phone call when the water maps are ready. The package can be picked up at 59-17 Junction Blvd., 12th Floor, Corona, NY 11368.
4) If not picked up after 2 business days, or if pick up was not requested, the package will be mailed to the address provided.

Note: These maps are based on the best information available for the water mains and appurtenances in the streets contiguous to the area specified. Water mains are normally installed at depths ranging from 42" to 48".

Steps for obtaining DEP sewer maps

1) Contact NYC DEP Queens borough office at 120-55 Queens Blvd., Kew Garden, NY 11424 at (718) 286-2600. [Teresa Lin]
2) Arrange an appointment or best time to stop by their office (1st Floor – Room 802). Office hours are Monday to Friday 8:00am – 4:00pm.
3) Prepare a sewer map request memo, using company letter head, justifying the reason for the request and signed by the project manager. Bring company ID card.
4) When arrive at the office, provide them with the request memo, then fill out a slip with applicant information, site location information, and the Index Map # from their hanging map for the specific streets locations.
5) Using the Index Map # or #s to get the index maps for sanitary, storm or combined sewers.
6) Find the streets on the index maps and record the stick numbers and/or file names marked on those streets.
7) Go to the map files room in the back of the office.
8) Look for the respective draws that hold each respective stick numbers. The maps are rolled tightly onto a specific numbered stick. Always look for the "Final Map". Photocopies can be made using their copying machine.
9) Roll the Map back tightly onto the respective stick and place it back to the correct drawer.
10) For the file names, look into the large drawers in the middle of the room. They should be in alphabetical order. Also, place the file back after use to the respective drawer.

Table 1 - Summary Table of Resources for Obtaining Subsurface Utility Plates and Drawings

Utility Type	County	Company	Organization	Name	Telephone Number
Electric	All	Con Edison	Electric Engineering	http://maps/AdvancedMappingSystem.htm(1)	
			For Questions contact:	John Ensemplare (Mgr. – B&Q)	(718) 802-5540
				Mike Mitchell (Mgr. – Manhattan)	(212) 460-1119
				Richard Mariani (Mgr. – Westchester)	(914) 925-6026
Gas	All	Con Edison	Gas Engineering	http://maps/steam.htm(1)	--
			For Questions contact:	Mike Verlizzo (Mgr.)	(718) 319-2357
Steam	All	Con Edison	Steam Engineering	http://maps/steam.htm(1)	--
			For Questions contact:	Tony Barbera	(212) 460-4843
Sewer /Water	NYC	NYC DEP /	Bureau of Water and Sewer Operations	Vincent Soriano/ Doug Greely	(718) 595-5330
Tunnels	Subway Crossing the East River	MTA	Outside Projects – Adjacent Work	Vasanth Battu/ Rajen Ydeshi / [If drilling in immediate vicinity of MTA structure, e.g., subway tunnel, car tunnel, etc., you will need submit a letter and plan drawing(s) to Mr. Ydeshi]	(646) 252-4473 (646) 252-3641
	Crossing the Hudson River	Port Authority of NY/NJ	Surveying	Richard Danko (rdanko@panynj.gov) Bill Kane (wkane@panynj.gov)	(201) 595-4841 (201) 595-4842

(1) “Maps” website listed is accessible on the Con Edison Intranet.

Attachment 2
Utility Contact Prevention Checklist

Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

Purpose: This form is intended to help the Field Lead confirm that underground or overhead utilities are identified to the extent practicable and consistent with applicable regulations **PRIOR** to site work.

INVESTIGATIONS MUST NOT OCCUR UNTIL MULTIPLE LINES OF EVIDENCE INDICATE THAT SUBSURFACE OR OVERHEAD UTILITIES ARE NOT PRESENT IN THE WORK AREA

Project Name/No: ______________________ **Date:** ______________________

Field Lead: ______________________ **Project Address:** ______________________

Project Manager: ______________________ **Health & Safety Officer:** ______________________

Emergency Contact Information for One Call: ______________________

Duration/Summary of Work to be Performed: ______________________

____

____

Consideration	Check		Explanation	Initial
Has the state One Call been contacted?	☐ Yes	☐ No		
Has the property owner or client been contacted for local knowledge of utilities, as applicable?	☐ Yes	☐ No		
Does the property owner or client have specific utility contact prevention procedures and, if so, have they been completed?	☐ Yes	☐ No		
Are any as-built drawings available? If so, do they show any utilities?	☐ Yes	☐ No		
Has a visual inspection of the work area(s) been completed?	☐ Yes	☐ No		
Has the potential presence of in-water utilities been assessed (shore markers, streets dead-ending at water's edge, etc.)	☐ Yes	☐ No		
Is evidence of electrical utilities present? (electric meters on structures, conduits, overhead lines, light poles, etc.)	☐ Yes	☐ No		
Is evidence of water/sewer utilities present? (water meter, hydrants, restrooms, grates in ground, etc.)	☐ Yes	☐ No		
Is evidence of telecommunications utilities present? (fiber optic warning signs, conduits from utility poles, wall-mounted boxes, etc.)	☐ Yes	☐ No		
Is other evidence of utilities present? (unknown ground markings, manholes or valve covers, "Call Before You Dig" signs, linear asphalt or concrete repair characteristics, liner subsidence of ground surface, pin flags or stakes, etc.)	☐ Yes	☐ No		

Utility Contact Prevention Checklist

NOTE: Utility mark-out requirements vary from state to state; consult state authorities before beginning work.

Consideration	Check		Explanation	Initial
Has a private locating service been contacted?	☐ Yes	☐ No		
Were any utilities identified and marked out through a private locating service? If so, duplicate mark-outs on site drawings.	☐ Yes	☐ No		
Are there any fiber optic cables, fuel lines, or high-pressure lines within 50 feet of work locations?	☐ Yes	☐ No		
If fiber optic cables, fuel lines, or high-pressure lines are within 50 feet, has an agreement with the utility owner been established?	☐ Yes	☐ No		
Can a test borehole be advanced by hand digging, probing, post-hole digging, and/or air knifing to 5 feet below ground surface (bgs)?	☐ Yes	☐ No		
If hand digging, probing, post-hole digging, and/or air knifing to 5 feet bgs is not possible, can a non-invasive geophysical investigation be conducted? If not, why?	☐ Yes	☐ No		
Other considerations:				

NOTE: Please fill in second page and attach additional reports, drawings, or other information, as necessary.

Confirmation Number: ______________________________

Contact Name: ______________________ **Organization:** ______________________

Contact Date: ______________________ **Contact Time:** ______________________

Response: ______________________________

____

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Completed by:

______________________ ______________________ ______________________
Printed Name Signature Date

Contractor:

______________________ ______________________ ______________________
Printed Name Signature Date

PLAYING IT SAFE

Standard Operating Procedure

Test Pit Excavation

SOP 005

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the excavation of fill and unconsolidated soils. Test pits may be utilized to identify subsurface structures, to obtain bulk soil samples that cannot be collected by soil borings, and/or to characterize subsurface conditions.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to excavate test pits. The details within this SOP should be used in conjunction with the project work plan and the SOP should be added as an appendix to the work plan.

2. Scope and Applicability

This SOP applies to all Anchor QEA field work involving excavation of test pits and should be included as an attachment to the work plan documentation developed for the project. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. If changes to the procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

3. Summary of Method

The subsurface investigations will use equipment such as a backhoe or excavator. The equipment type and size will be determined based on project objectives, required depth/size of excavation, and site access limitations.

Prior to any excavation, field crews will manually clear the uppermost 6 feet at each location. Manual clearing will be accomplished with shovels or post-hole diggers provided they have fiberglass handles or via non-intrusive methods such as an air knife or soil vacuum. The objective of the manual clearing is to visually inspect the uppermost 5 feet as a final check for buried utilities not identified during the public mark-out or private utility locate. In certain cases, the manual clearing may satisfy the project objectives and no further excavation will be required.

Once the location has been manually cleared and verified by the Anchor QEA field team, then the test pit can be excavated deeper, or the center of the cleared hole can be marked and backfilled to be excavated later.

4. Personnel Qualifications

Only qualified personnel will lead excavation activities as defined in the project work plan and the project specific health and safety plan. Training requirements for these activities include reviewing this SOP, applicable SOPs provided by subcontractor and/or manufacturer, guidance documents, and appropriate health and safety training, if necessary.

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for data and sample collection.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) in accordance with the project specific health and safety plan.

5. Equipment List

Equipment and materials that will be used for overseeing and directing test pit excavations may include the following:

- Appropriate personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP; Appendix C)
- Indelible ink pen
- Tape measure and/or survey rod
- Putty knife or other tools for inspection of recovered soil samples
- Camera
- Whiteboard with erasable markers
- Air monitoring equipment if required based on the project specific health and safety plan
- Soil description aids (e.g., Munsell color chart and grain or size charts)
- Field logbook; field forms for sample collection, material description, and sketches; or notebook with relevant forms
- Safety knife or scissors
- Traffic cones and flagging if working in a high traffic area
- Photo-ionization device with appropriate lamp and calibration gas

This list does not include equipment that will be provided by subcontracted equipment operators. However, to address potential releases to the environment, the following equipment is required in addition to all necessary supplies for well installation and development:

- Spill-containment and clean-up kit
- Secondary containment for backhoe/excavator and all equipment that contains fuels or hydraulic fluids

6. Health and Safety Considerations

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project HASP (Appendix C). The HASP will be followed during all activities conducted by Anchor QEA personnel and subcontractors.

The site-specific HASP and excavation subcontractor's HASP will be used to guide the installation of the test pits in a safe manner. Job Safety Analyses (JSAs), included in the HASP, will be prepared for excavation oversight by Anchor QEA and subcontractors. The following specific health and safety issues must be considered when excavating test pits in accordance with the HASP:

- Underground and overhead utility hazards must be mitigated prior to drilling.
- Excavation equipment presents a variety of safety hazards. Equipment must be inspected each day prior to use. No employee is permitted within the swing radius of the excavator bucket or underneath loads being handled by lifting or digging equipment.
- Personnel should stand upwind of the excavation area to the extent possible. Air monitoring will be conducted for chemicals at action level as established in the site-specific HASP (Appendix C).
- The subcontractor and sampling personnel will not enter a test pit that is deeper than 4 feet unless the: 1) side walls are sloped back to a grade of 1:1 or 2) side walls are braced or shored.
- A confined space entry permit is required to enter a test pit greater than 4 feet deep (refer to OSHA Regulations 29 Code of Federal Regulations [CFR] Part 1926, 1910.120 and 1910.134).
- Appropriate PPE must be worn.
- Potential hazards from working in a public area and potential hazards to the public by excavation activities must be addressed before activities begin and as conditions change.
- Waste generated during the excavation must be properly managed in accordance with facility and applicable regulatory requirements.

7. Test Pit Logging and Sampling Procedure

Prior to initializing excavation, any surface or potential subsurface conditions (e.g., utilities) that may impact the scope of work must be documented and reported to the project manager immediately, prior to continuing work. The subsurface excavation procedures are outlined as follows:

1. Excavation will be conducted at the selected locations that have been cleared for utilities per SOP 4 until the target depth, groundwater, or bedrock is encountered, or to within the physical limits of the backhoe/excavator.
2. The uppermost 5 feet of each test pit will be excavated via hand-digging or air-knifing techniques prior to any intrusive work. Procedures are outlined in the site-specific HASP (Appendix C).
3. Test pit materials and samples will be visually observed and described with respect to depth and location. Photographs of the test pit and of the removed soil will be taken during the excavation and referenced by location, depth, and direction for future use. In addition, results of soil head space screening will be recorded.
4. If the test pit is less than 4 feet deep, samples may be collected directly from the trench wall or from the backhoe bucket. Before collecting trench wall samples, the wall surface must be shaved using a decontaminated stainless steel trowel, spatula, knife, or spoon to remove the surface layer. Samples may be collected using a decontaminated stainless steel shovel, scoop, or hand auger. Alternatively, the sample bottle or tube may be pushed directly into the trench wall or the sample may be collected from the center of the backhoe bucket, as described below.
5. If the test pit is deeper than 4 feet and its walls are not graded or shored, samples will be obtained using the excavator bucket. The entire grab sample will be collected from within a 1-foot radius of the designated sampling point. Samples obtained using a backhoe will be taken from the center of the backhoe bucket from material not touching the bucket walls or teeth.
6. Samples will be placed in an appropriate sample container using decontaminated stainless-steel sampling equipment. Additional soil from the backhoe bucket or sampler may be examined for visual and olfactory evidence of contamination and field screened using a PID.
7. All field activities will be documented in the field logbook or on field forms, including sample collection activities and processing.
8. As applicable, test pits will be backfilled to original grade and compacted after sampling and inspection are complete. The backfill will be placed in approximately the same sequence as the soils were excavated prior to the initiation of the next text pit.
9. To facilitate surveying, the location of the pit will be marked with stakes after it has been backfilled. Stakes should be placed at the ends of the test pit and at any significant bend or corner, as appropriate.

8. Waste Management

Material removed from the test pit during excavation will be placed on polyethylene sheeting. If such material has been previously characterized for chemical constituents in situ, its subsequent disposition (e.g., replacement in the test pit or off-site disposal) will be based on the results of that sampling, in accordance with applicable requirements. If the material has not previously been chemically characterized, it will be so characterized ex situ as necessary to determine appropriate disposition, and its disposition will be based on those characterization results, in accordance with applicable requirements.

IDW, rinse water, PPE, and other waste materials generated during equipment decontamination (waste) must be placed in appropriate containers and labeled. Waste materials will be stored securely, and handling and disposal of waste procedures are documented in the site-specific work plan and in SOP011: Investigation-Derived Waste.

9. Data Recording and Management

All information relevant to the test pit excavation will be recorded by Anchor QEA field staff using the field logbook or on a test pit log form, including a plan view of the test pit and cross-sections of the excavation walls, where appropriate. Upon completion and prior to backfilling of the excavation, photos will be taken lengthwise and widthwise across the excavation, with a survey rod or measuring tape inserted into the open excavation if it can be safely accessed. Field equipment decontamination activities and waste management activities will be recorded in the field logbook. Records generated as a result of implementing this SOP will be controlled and maintained in the project record files in accordance with client-specific requirements.

10. Quality Assurance

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

Attachments

Attachment 1 Test Pit Log
Attachment 2 Soil Visual Description Key

Attachment 1
Test Pit Log

ANCHOR QEA	290 Elwood Davis Road Suite 340 Liverpool, NY 13088	**TEST PIT LOG** **MATERIAL DESCRIPTION**	**Test Pit No.**	
			Sheet No.	1 of 3
			Project No.	
Project Name:			**Date Began**	
Client:			**Date Finished**	
Location:			**Surface Elev.**	

METHOD OF INVESTIGATION	GROUNDWATER OBSERVATIONS			
Operator:	**Date**	**Time**	**Depth (Ft.)**	**Comment**
Inspector:				
Equipment:				
Type:				
Bucket Size:				

VISUAL CLASSIFICATION OF MATERIAL

Depth Scale (Feet)	Sample No.	Sample Depth (Ft.) From	Sample Depth (Ft.) To	PID/FID (ppm)	c - coarse m - medium f - fine	and - 35 to 50% / some - 20 to 35% little - 10 to 20% / trace - 0 to 10%	
0							
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							

Remarks:

ANCHOR QEA
290 Elwood Davis Road
Suite 340
Liverpool, NY 13088

TEST PIT LOG PHOTOGRAPHS

Test Pit No.	
Sheet No.	2 of 3
Project No.	

Photograph 1:

Photograph 2:

Remarks:

ANCHOR QEA
290 Elwood Davis Road
Suite 340
Liverpool, NY 13088

TEST PIT LOG
SKETCHES/NOTES

Test Pit No.	
Sheet No.	3 of 3
Project No.	

Remarks:

Attachment 2
Soil Visual Description Key

Soil Visual Description Key

Visual soil descriptions consist of the following:
Moisture content, density/consistency, color, minor constituent, MAJOR CONSTITUENT/GROUP NAME; structure descriptions (as needed); amount and shape of minor constituents (e.g., organics and anthropogenics); biota; odor; sheen

Recovered and in situ depths
Recovered = measured in the laboratory, actual soil depth from core tube

Soil Description Terminology		
1. Moisture Content		
Dry	Little perceptible moisture (upland only)	
Moist	Probably near-optimum moisture content, no visible water (most soil)	
Wet	Visible free water, probably above optimum	
2. Density (Core Drive Penetration and Finger Pressure)		
SAND or GRAVEL		
Density	**Visual**	**Notes**
Very loose	Freefall	May occur at the top of a core
Loose	Easy penetration	
Medium dense	Moderate penetration	Typically down core due to compaction or compression
Dense	Hard penetration	Bottom of a core, typical to glacial deposits
Very dense	Refusal	
SILT or CLAY		
Consistency	**Visual**	**Notes**
Very soft	Freefall	Soupy, not cohesive
Soft	Easy penetration	Easily penetrated, just starting to be cohesive
Medium stiff	Moderate penetration	Cohesive, molded by finger pressure
Stiff	Hard penetration	Can indent and mold by stiff finger pressure
Very stiff/hard	Refusal	Modeling clay (rolls to a ball)
3. Color and Shading		
Example Colors		**Shades**
Black		Light
Browns (olive, yellow, red)		Dark
Grays (gray, olive, brown)		Very dark
Mottling: Streaks or spots of a minor color within the larger color unit		
4. Minor and MAJOR Group Name		
Gravel		Silt
Sand		Clay
* MAJOR is written in all CAPITAL LETTERS		
* Description of minor constituent precedes MAJOR constituent, except for trace		
Minor Constituents		**Percent**
Trace (clay, silt, sand, gravel)*		0 to 5
Slightly (clayey, silty, sandy, gravelly)		5 to 15
Clayey, silty, sandy, gravelly		15 to 30
Very (clayey, silty, sandy, gravelly)		30 to 50
GROUP NAME		Greater than 50
* For trace minor constituents, place after MAJOR constituent		

Soil Description Terminology		
Descriptors		
Sand and Gravel	Rounding	
	Sorting	
	Grain color	
5. Other Minor Constituents: % by volume (e.g., organics and anthropogenics)*		
Other Minor Constituents*	**Percent**	
Trace	0 to 5	
Occasional	5 to 10	
Moderate	10 to 30	
Substantial	30 to 50	
*Separate major from other minor constituents with a period		
6. Biota		
Marsh grass, shells, worms, etc.		
7. Odor Descriptions (No odor detected unless noted)		
Intensity	**Odor Types**	
Trace (faint)	Petroleum-like	
Moderate (obvious)	Naphthalene-like	
Strong (overwhelming)	H_2S-like (Hydrogen sulfide-like)	
	Septic-like	
	Solvent-like	
	Metallic-like	
8. Visual Impacts		
8a. Sheen (No sheen observed unless noted) (Modified from ASTM F2534-06)		
Components of a sheen description: Start and end depths, modifier describing relative sample surface area with sheen, sheen color, description of sheen distribution (e.g., continuous, present as 0.5-inch spots, etc.)		
Silvery	Metallic, silver/gray colored	
Rainbow	Multicolored	
Dark Rainbow	Multicolored with some dark metallic or brown/black coloring	
Dark	Dark metallic or brown/black colored	
Sheen Distribution Terminology		
Streaks	Flat, lines of sheen (describe size and number)	
Florets	Semi-circular, flat, spots of sheen (described size and number)	
Covered	Sheen appears continuous over a portion of the sample surface	
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		

Modifiers	
Amount	**Percent**
Trace	Less than 2
Slight	2 to 15
Moderate	15 to 40
Moderate to heavy	40 to 70
Heavy	Greater than 70

Soil Description Terminology

8b. Nonaqueous Phase Liquid (NAPL)	
Components of a NAPL description: Start and end depths, color, amount (droplets, covered, soaked); droplet frequency/percent of sample covered or soaked; viscosity	
Note: Observations of sheen or NAPL on the sampling equipment during sampling will be recorded on the sampling log and included in the notes section of the core log.	
Blebs	Observed discrete sphericals of NAPL, 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.
Coated	soil grains are coated with NAPL. There is not sufficient NAPL material present to saturate the pore spaces. The degree of coating should be described as light, moderate, or heavy.
Saturated	The entirety of the pore space for a sample is saturated with the NAPL. Care should be taken to ensure that water saturating the pore spaces is not observed when using this term. Depending on viscosity, NAPL-saturated materials may freely drain from a soil sample.
Relative Viscosity	
High viscosity	Taffy-like
Viscous	No. 6 fuel oil or bunker crude-like (molasses-like)
Low viscosity	No. 2 fuel oil-like
Nonaqueous phase liquid (NAPL): NAPL is generally classified as light NAPL (LNAPL) if the density is less than that of water (i.e., will float on water) and dense NAPL (DNAPL) if the density is greater than that of water (i.e., will sink in water). Use a shake test to identify whether observation NAPL is an LNAPL or DNAPL.	

Soil Description Terminology	
9. Structure and Other soil Descriptions	
Hummocky	Cohesive soil that can be broken down into smaller lumps
Gummy	Cohesive, pliable soil with high percentage of clay
Bed	Greater than or equal to 0.5 inch thick
Thin bed	Less than 0.5 inch thick
Pockets	Semi-circular to circular inclusion/deposit
Laminated beds	Thin beds (less than 0.5 inch thick) lying between or alternating within a greater unit
Stratified beds	Beds (greater than 0.5 inch thick) lying between or alternating within a greater unit
Organic matter	Mass of leaves, twigs, wood, etc.
Anthropogenic material	Material originated from industrial activity such as coal fragments, slag, etc.
Aggregates	Industrial waste products
Anthropogenic debris	Debris originated from human activity such as trash, plastic, etc.
Decomposed	Visible sign of decomposition or discoloration
Fresh	No visible sign of decomposition or discoloration
Winnowed	Loss of material that occurred during coring, creating a washed-out void space

Notes:

* = Classification of soil on logs is based on visual field observations, which include density/consistency, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein.

Visual-manual classification method ASTM International (ASTM) D-2488 for the description and identification of soils was used as an identification guide.

"Grades to" indicates that all characteristics not called out stay the same as the unit above.

@ symbol indicates one single piece of the material (when not accompanied with a "grades to" or contact)

Acronyms/terms used in core logs:

NAPL = nonaqueous phase liquid

Native = Soil deposited prior to the physical influence of humans on the natural environment

PID = Photoionization detector, measures volatile organic compounds (VOCs)

Standard Operating Procedure

Subsurface Soil Investigations

SOP 006

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the drilling and sampling of fill and unconsolidated soils for site characterization purposes.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to perform the above-mentioned soil investigations. The details within this SOP should be used in conjunction with the project work plan.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

3. Summary of Method

The subsurface investigations to be completed will use direct-push drilling equipment such as a Geoprobe®. A direct-push machine is a vehicle-mounted, hydraulically powered machine that uses static force and percussion to advance small-diameter sampling tools into the subsurface for collecting soil core, soil gas, or groundwater samples.

Prior to any drilling, field crews will manually clear the uppermost 5 feet at each location in accordance with the procedures described in SOP004: Utility Clearance. Manual clearing will be accomplished with shovels or post-hole diggers provided they have fiberglass handles or via non-intrusive methods such as an air knife or soil vacuum. The objective of the manual clearing is to visually inspect the uppermost 5 feet as a final check for buried utilities not identified during the public mark-out or private utility locate. Once the location has been manually cleared and verified by the Anchor QEA field team, then the borehole can be drilled, or the center of the cleared hole can be marked and backfilled to be drilled later.

Electrical conductivity (EC) logging may be performed to screen soil conductivity prior to soil sampling. A copy of the EC logging procedure is included as Attachment 1 to this SOP.

4. Personnel Qualifications

Only qualified personnel will lead direct-push drilling and field screening activities. Training requirements for direction of these activities include reviewing this SOP, applicable SOPs provided by subcontractor and/or manufacturer, guidance documents, and health and safety training.

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for data and sample collection.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and at least one on-site representative from Anchor QEA and the subcontractor certified in first aid and cardiopulmonary resuscitation [CPR] training) as needed.

5. Equipment List

Equipment and materials that will be used for overseeing and directing the well installation and development may include the following:

- Appropriate personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP)
- Indelible ink pen
- Tape measure
- Putty knife or other tools for inspection of recovered soil samples
- Camera
- Whiteboard with erasable markers
- Air monitoring equipment
- Soil description aids (e.g., Munsell color chart and grain or size charts)
- Field logbook; field forms for core collection, well construction, and well development; or notebook with relevant forms
- Safety knife or scissors
- Photo-ionization device with appropriate lamp and calibration gas

This list does not include equipment that will be provided by subcontracted environmental drillers. However, to address potential releases to the environment, the following equipment is required in addition to all necessary supplies for well installation and development:

- Spill-containment and clean-up kit
- Secondary containment for drill rig and all equipment that contains fuels or hydraulic fluids

6. Cautions

The depth and volume of the borehole, including the over-drilling, if applicable, must be calculated, and the appropriate materials for investigation-derived waste (IDW) must be procured prior to drilling activities. Special care must be taken to minimize or prevent inadvertent cross-contamination between borehole locations.

No lubricating oils or grease should be used on casing threads. No glue of any type should be used to secure casing joints. Teflon O-Rings can be used to ensure a tight fit and minimize leakage; however, O-Rings made of other materials are not acceptable if the boring is going to be sampled for organic compound analyses.

7. Health and Safety Considerations

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project HASP. The HASP will be followed during all activities conducted by Anchor QEA personnel and subcontractors.

The site-specific HASP and subcontracted driller's HASP will be used to guide the installation of the wells in a safe manner. Job Safety Analyses (JSAs) will be prepared for well installation oversight by Anchor QEA and subcontractors. The following specific health and safety issues must be considered when installing the wells:

- Underground and overhead utility hazards must be mitigated prior to drilling.
- Drilling rigs and equipment present a variety of safety hazards. Drill rigs must be inspected each day prior to use. All personal must know where the emergency "kill" switch is, and the switch must be tested daily. Only the drill rig operator and helper may approach the rig during drilling activities.
- Air monitoring will be conducted for chemicals at action level as established in the site-specific HASP.
- Appropriate PPE must be worn.
- Potential hazards from working in a public area and potential hazards to the public by drilling and well installation activities must be addressed before activities begin and as conditions change.

- Waste generated during the well installation must be properly managed in accordance with facility and applicable regulatory requirements.

8. Soil Boring, Logging, and Sampling Procedure

Prior to initializing drilling, any surface or potential subsurface conditions (e.g., utilities) that may impact the scope of work must be documented and reported to the project manager immediately, prior to continuing work. The subsurface soil investigation procedures are outlined as follows:

1. A direct-push drill rig will be used to position itself at each target station for soil investigation.
2. The borehole should be drilled as close to vertical as possible. Prior to beginning any drilling or sampling, ensure the rig is level by checking with a plumb bob or level. Deviation from plumb should be within 1°per 50 feet of depth.
3. The uppermost 5 feet of each boring will be excavated via hand-digging or air-knifing techniques prior to any intrusive work. Procedures are outlined in the site-specific HASP and SOP004: Utility Clearance.
4. Once the uppermost 5 feet has been cleared the MIP and HPT field screening tools (if selected for use during the investigation) will be advanced and operated in accordance with the Geoprobe® SOP for combined MIP and HPT (Attachment 1). The tools will be advanced until refusal following guidelines included in the work plan.
    a. Once refusal is reached the borehole will be backfilled with bentonite chips or neat-cement grout.
5. To complete EC logging (if selected for use during the investigation), the direct-push rig will be positioned so a second borehole is completed where the EC tool is advanced and operated in accordance with the Geoprobe® SOP (Attachment 2). The tools will be advanced until refusal following guidelines included in the work plan.
    a. Once refusal is reached, the borehole will be backfilled with bentonite chips or neat-cement grout.
6. Locations identified for soil sample collection will be reoccupied by the direct-push rig, and steps 1 through 3 will be repeated. Soil cores may be collected at each location by using a dual tube sampling system equipped with core liners. The liners will be lowered slowly to the soil surface and allowed to penetrate the soil driven by a hydraulic hammer.
7. During dual-tube soil core collection, both the outer and inner drill rods are advanced simultaneously. The outer rods will prevent the borehole walls from collapsing and will allow for continuous soil extraction and sampling via the inner drill rods. The process for dual-tube sampling is generally described as follows:
8. Once positioned, the initial soil core will be collected by advancing both the inner and outer drill rods the length of the core barrel (typically 4 or 5 feet).

9. The inner drill rods can then be removed to inspect collected soil samples while the outer casing (4.5-inch outer diameter and 3.75-inch inner diameter) remains in place to stabilize the borehole walls.
10. With the initial soil core removed, a cutting tool will be used to open the core liner and a visual description of the soil will be recorded onto a Soil Boring Log (Attachment 3) with the aid of a Soil Visual Description Key (Attachment 4). Cores will be screened with a photoionization detector (PID) and results will be recorded in the field notes. For each core segment, a representative photograph will be taken with a place card of the sample station, and the date. A ruler will be visible in the photograph.
11. After removing the initial soil core, the core barrel will be decontaminated and then re-inserted into the borehole through the in-place outer casing to collect the second soil core interval.
12. Additional drill rods and outer casing lengths will be added to advance the core barrel to thru the next interval.
13. These steps will be repeated until target depth is reached or until refusal.
14. Soil samples will be collected from 1-foot zones identified and agreed to based upon results of the field screening as detailed in the SC Work Plan
15. After description and field screening, VOC samples (if required to be collected) will be collected from the center of the soil core interval (avoiding the sidewalls) and placed into the laboratory-provided container until full (with zero headspace remaining).
16. Only pre-cleaned stainless-steel instruments will be used to collect sample material.
17. Each sample container will be filled completely with soil, allowing minimal headspace. Samples will be stored on ice in the dark at 4°C plus or minus 2°C.
18. All material from processed cores, decontamination fluids, and used PPE will be containerized as IDW and disposed of according to SOP011: Investigation-Derived Waste.
19. All field activities will be documented, including core collection activities and core processing.

9. Waste Management

IDW, rinse water, PPE, and other waste materials generated during equipment decontamination (waste) must be placed in appropriate containers and labeled. Waste materials will be stored securely and handling and disposal of waste procedures are documented in the site-specific work plan and in SOP003: Investigation-Derived Waste.

10. Data Recording and Management

All information relevant to the drilling will be recorded by Anchor QEA field staff using the field logbook. Field equipment decontamination activities and waste management activities will be recorded in the field logbook. Records generated as a result of implementing this SOP will be controlled and maintained in the project record files in accordance with client-specific requirements.

11. Quality Assurance

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

Attachments

Attachment 1 EC Geoprobe Logging Tool SOP
Attachment 2 Soil Boring Log
Attachment 3 Soil Visual Description Key

Attachment 1

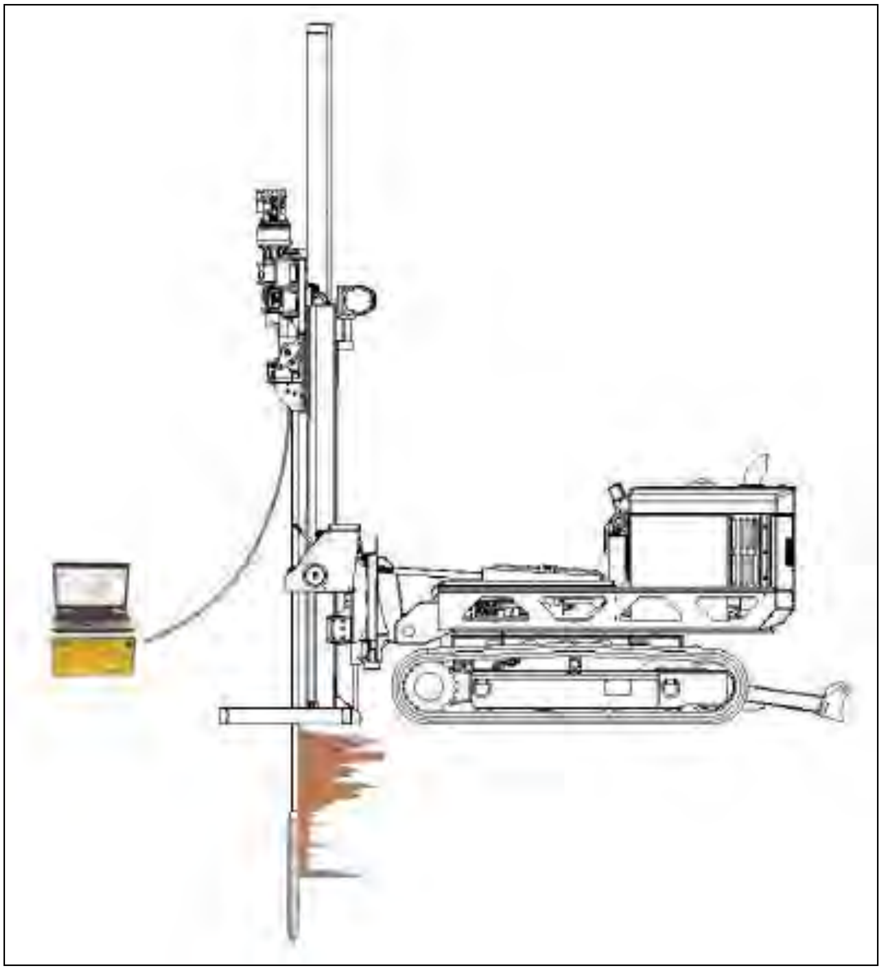
EC Geoprobe Logging Tool SOP

GEOPROBE SYSTEMS®
ELECTRICAL CONDUCTIVITY (EC) SYSTEM

STANDARD OPERATING PROCEDURE

Technical Bulletin No. MK3201

Prepared: January, 2015



1.0 Objective

This document serves as the standard operating procedure for the Geoprobe® Electrical Conductivity (EC) system. In this procedure, the EC system is used to measure the soils ability to conduct a current to assist with characterization of soil type. This document has been updated from Geoprobe Systems® Technical Bulletin No. to show the use of an FI6000 field instrument for EC system control and data acquisition.

2.0 Background

2.1 Definitions

Geoprobe®*: A brand of high quality, hydraulically-powered machines that utilize both static force and percussion to advance sampling and logging tools into the subsurface. The Geoprobe® brand name refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas. Geoprobe® tools are used to perform soil core and soil gas sampling, groundwater sampling and testing, electrical conductivity and contaminant logging, grouting, and materials injection.

**Geoprobe® and Geoprobe Systems® are registered trademarks of Kejr, Inc., Salina, Kansas.*

Electrical Conductivity System: A system manufactured by Geoprobe Systems® to evaluate the soils ability to conduct an applied current for the determination of subsurface soil types. The tool is advanced through the subsurface at a constant rate and a current is sent through the formation between two probe contacts. This current is measured along with the voltage that results. Both electrical conductivity and rate of push are logged versus depth.

2.2 Discussion

The field instrument induces a current across electrical dipoles placed in the soil. The system measures electrical current and voltage and from these parameters, calculates electrical conductivity. Higher electrical conductivities typically are representative of finer grained sediments, such as silts and clays, while sands and gravels have distinctively lower conductivities. Ionic contaminants in the soil or pore water can increase the measured conductivity.

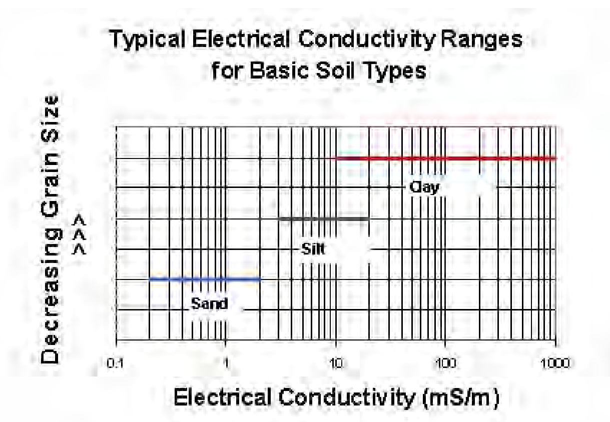
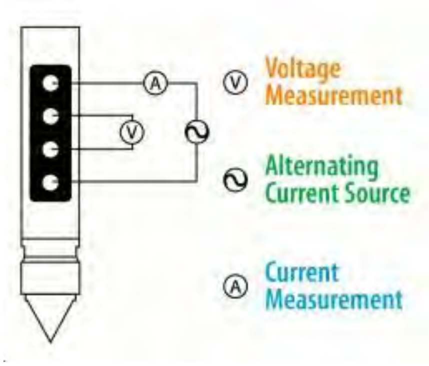


Figure 2.1: General Conductivity Ranges

Interpretation of EC logs comes with field experience and an initial core sample to confirm lithologic changes. As a generalization, a high conductivity reading indicates a smaller particle size and a low conductivity reading indicates a larger particle size (Figure 2.1).



The EC probe comes in two different configurations, Dipole Array and Wenner Array. Both configurations have the same theory of operation. A current is sent through the formation between two probe contacts. This current is measured along with the voltage that results (Figure 2.2). The conductivity is a ratio of current to voltage times a constant. The resulting reading is in milli-Siemens per meter (mS/m).

Figure 2.2: Wenner Array for Conductivity Measurements

3.0 Tools and Equipment

The following equipment is required to perform and record an EC log using a Geoprobe® 66- or 78-Series Direct Push Machine. Refer to Figures 3.1, 3.2, and 3.3 for identification of the specified parts.

Basic EC System Components	Quantity	Material Number
Field Instrument, 120V (Model FI6000)	-1-	213940
Field Instrument, 220V (Model FI6003)	*	213941
Acquisition Software	-1-	214128
EC Probe, 1.75 inch	-1-	214236
1.75 inch Connection Tube	-1-	211310
1.5 inch Drive Head	-1-	203794
EC Cordset - 97ft.	-1-	214229
EC Cord Adapter	-1-	214231
EC Probe, 2.25 inch	**	214238
2.25 Connection Tube	**	219455
2.25 Inch Water Seal Drive Head	**	212089
2.75 Inch Water Seal Drive Head	**	209796
EC Water Seal	-1-	209568
Trunkline Water Seal Spacers	-1-	207596
EC Probe Test Jig	-1-	214237
EC Test Load	-1-	208075
EC Bypass Cable	-1-	204025
Stringpot, 100-inch	-1-	214227
Stringpot Cordset, 65-feet (19.8 m)	-1-	202884

*Use in place of 120V components if desired.
**Use in place of 1.75 inch probe and components if desired.

Figure 3.1: EC Probe (214236) and FI6000 (213940)

4.0 Assembly

Threading the Rods

- Protect the end to be threaded through the rods with electrical tape or shrink tubing.
- Probe rods must alternate directions prior to threading the trunkline.
- The end of the EC trunkline with chrome connectors is the downhole or probe end.
- The probe end of the trunkline always enters the male end and exits the female end of the probe rods.
- The instrument end will always enter the female end and exit the male end of the probe rods.
- After the trunkline is through the probe rods make sure the downhole end is threaded through the male end of the drive head and connection tube prior to connecting to the probe.
- The trunkline is now ready to connect to the instrument and EC probe.

5.0 Field Operation

5.1 Instrument Setup

1. Connect the Field Instrument (FI6000) and laptop (Fig. 5.1) to an appropriate power source.

2. Connect the FI6000 to the field laptop with the USB cable.

3. Secure the EC wires into the Green terminal block connector and insert into the FI6000. The wires match to the EC dipoles in the following top down order when the probe tip is on the ground – white, black, yellow and blue (Fig 5.2).

Figure 5.1: EC Instrument (FI6000)

4. Connect the USB cable between the USB interface port on the rear of the FI6000 to USB input on the field laptop computer.

5. A stringpot is required to measure depth. Bolt the stringpot onto the machine and the stringpot onto the bracket. Connect the plastic connector end of the stringpot cable to the “Stringpot” connector on the back of the Field Instrument and the metal connector to the stringpot. Pull the stringpot cable and attach to the stringpot piston weight which should be mounted to the probe machine foot and pull the keeper pin so the weight is free to move.

5.2 Starting the Software

1. Make sure the FI6000 is powered on and connected to the computer by the USB cable for the software to load properly.

2. Start the DI Acquisition Software which will open in EC mode.

3. Select “Start New Log”. The software will request log information and have you browse for a storage location and create and save a file name for the log (Fig. 5.2).

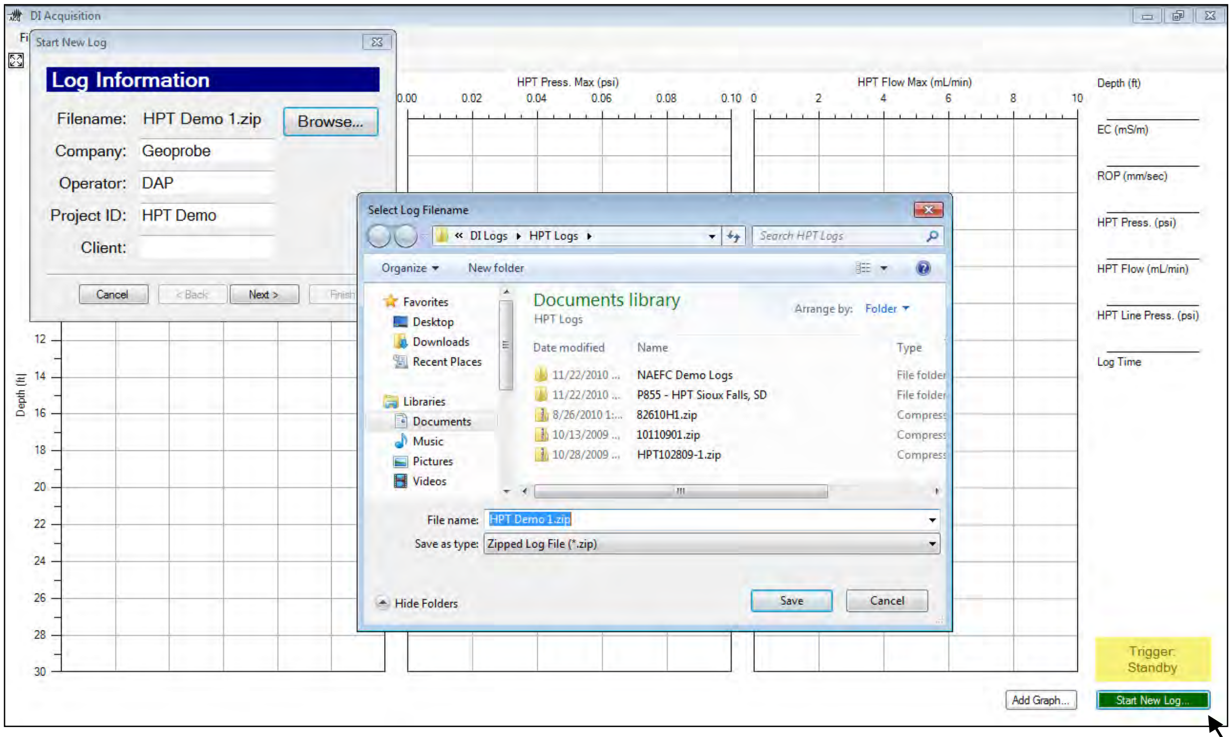


Figure 5.2: DI Acquisition Software – Start New Log Sequence

4. Select "Next". If the software has been run before it will show a list of previous settings including Probe Type, EC Configuration, Stringpot length, rod length. If any of these have changed or you are unsure select "No" but if they are all the same select "yes". If you select "No" the software will have you select the proper settings after the EC Load Test, if you selected "Yes" the selection of these settings will be bypassed.

5.2 QA Testing the EC Systems

The EC components must be tested before and after each log. This is required to ensure that the equipment is working properly and capable of generating good data before and after the log.

A. Electrical Conductivity Load Test

1. Secure the EC 3 position test load connector (208075) to the test input jack on the back of the Field Instrument.

2. Secure the EC Probe Test Jig (214237) into the input on the EC 3 position test load.

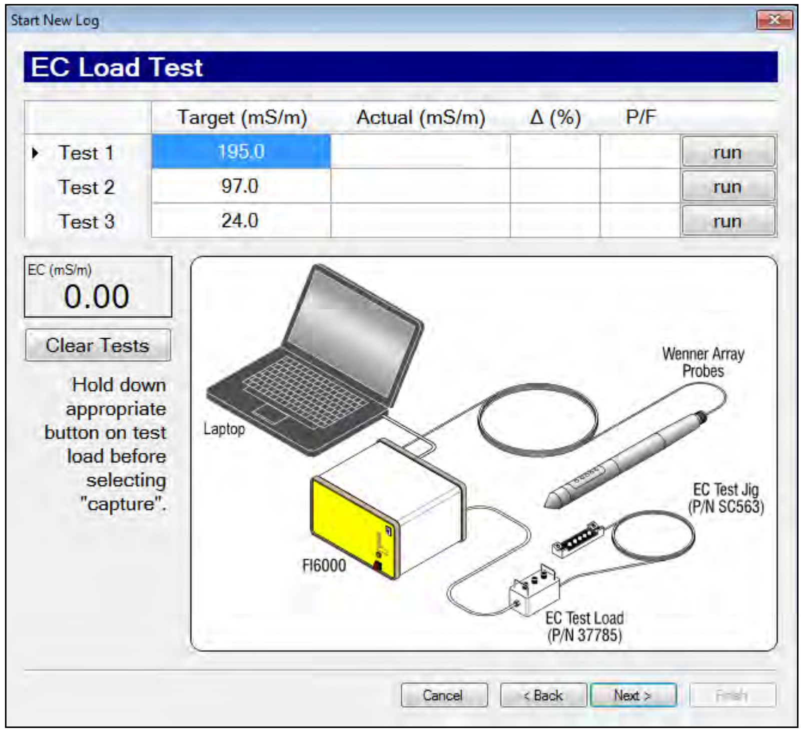


Figure 5.3: EC Load Test Screen

3. Clean and dry the EC dipoles as well as several inches of the probe body above the pins.

4. Place the EC Test Jig so that the four springs on the test jig touch the four dipoles of the Wenner EC array (Fig. 5.3). Make sure the trunkline and test jig wires go in the same direction. The other spring on the test jig will ground the probe body above the Wenner array. Make sure the springs are pulled out far enough to make a solid contact on the dipoles.

5. When you get to the EC Load Test Screen and the EC test load and test jig are in place on the probe press down on the test 1 button on the test load and select “run” of Test 1 (Fig. 5.4). After 5 seconds the actual value will acquire and will pass if within 10% of the target value. Continue on with Test 2 and 3.
6. If any of the EC load tests fail do not pass within the allowed 10% acceptance range you can make adjustments on the test jig and rerun the test by just re-clicking the “run” button for an individual test.

7. If the tests continue to fail, select “Next” and the software will conduct the “EC Troubleshooting Tests.” The Instrument Calibration Tests (Fig. 5.4) checks of the calibration within the FI6000. If these are far out of range it will influence the EC Test load values and will need to return to Geoprobe® for repair. The “Probe Continuity and Isolation Tests” confirm each of the wires is a complete circuit and is fully isolated from one another. If a probe continuity test fails just outside the target range of <8ohms this is typically a contact issue with the test jig and the dipoles. If the continuity is in the thousands of ohms this is a break in the EC wire circuit – either in the probe, the trunkline or the connection between them.

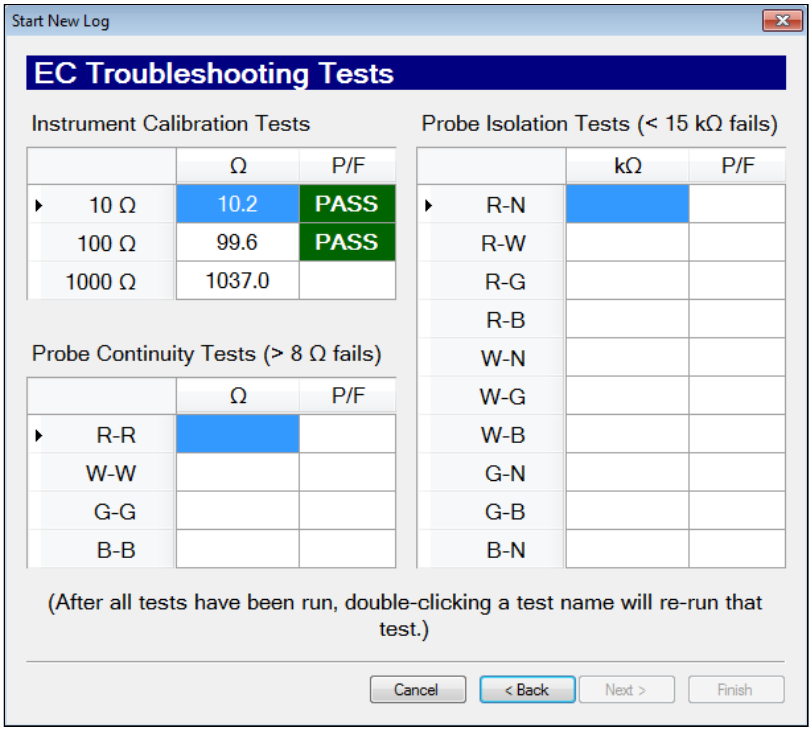


Figure 5.4: EC Troubleshooting Test Screen

8. When these tests are complete select next. In the next screen, the software will provide an EC option, if one is available. The EC Load Test will only work if EC can be operated in Wenner array meaning all of the EC wires in the continuity test pass with results <8ohms on the individual circuits. EC can be operated and collect good data in one of the dipole areas: top, middle or bottom dipole. If the R-R test fails but the others pass the software will provide the option in the next screen to run either middle dipole or bottom dipole arrays. If R-R and G-G are both an incomplete circuit then no EC array is available to run and a new probe must be connected or the problem fixed. In the Wenner configuration it requires 2 adjacent dipoles to operate in dipole mode. If an EC array is chosen and run in this last manner then all of the EC information collected will be bad data.
9. When the EC check has passed click “next”. If the rod length, stringpot length have not been selected previously do that now. Select “Next”.

5.3 Running an EC Log

1. Place the rod wiper on the ground over the probing location and install the drive cushion in place of the anvil of the probing machine.

2. Place the probe tip in the center of the rod wiper, and place the slotted drive cap on top of the EC probe.

3. Adjust the probe so that it is vertical and advance the probe until the EC dipoles are split half in half out of the ground.

4. Click the trigger button in the lower right hand corner of computer screen. (The Trigger label will flash and the background will change from yellow to green).

5. Advance the probe at a rate of 2 cm/s. If necessary, feather the hammer to maintain this advance rate.

6. The trigger may be turned off at any time to make adjustments w/o recording any probe movement. With the trigger turned “off”, the cable may be disconnected to add rods or to add an additional cable. When everything is reconnected and ready to advance turn the trigger “on”.

7. After completing the log, press the trigger button again and select “Stop Log”.

8. Disconnect the stringpot cable and pull the rod string using either the rod grip pull system or a slotted pull cap.

9. Run a post-log EC test (Section 5.3).

10. Open the log using the DI Viewer software, adjust the scales and log settings as desired and print the log (Figure 5.5).

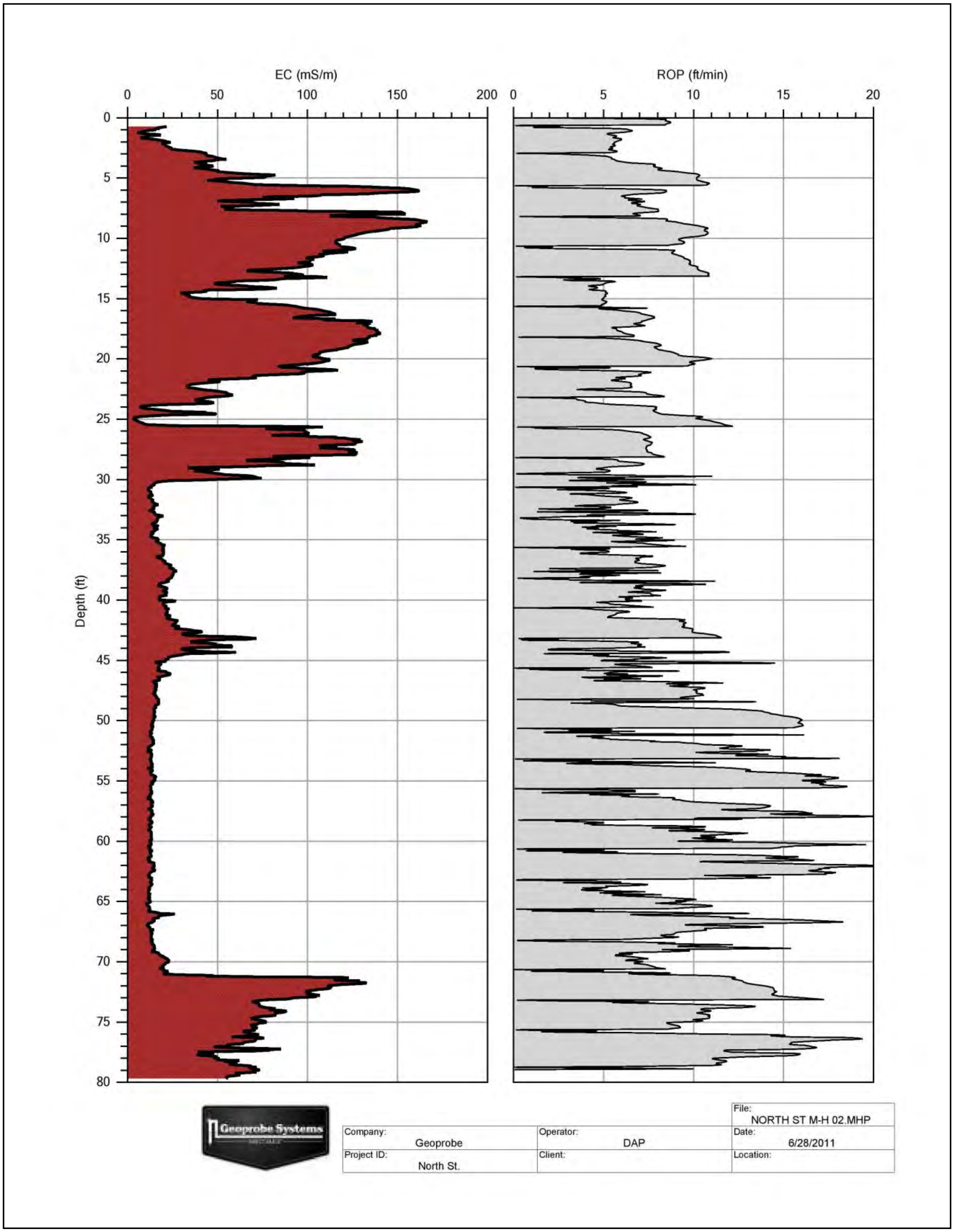
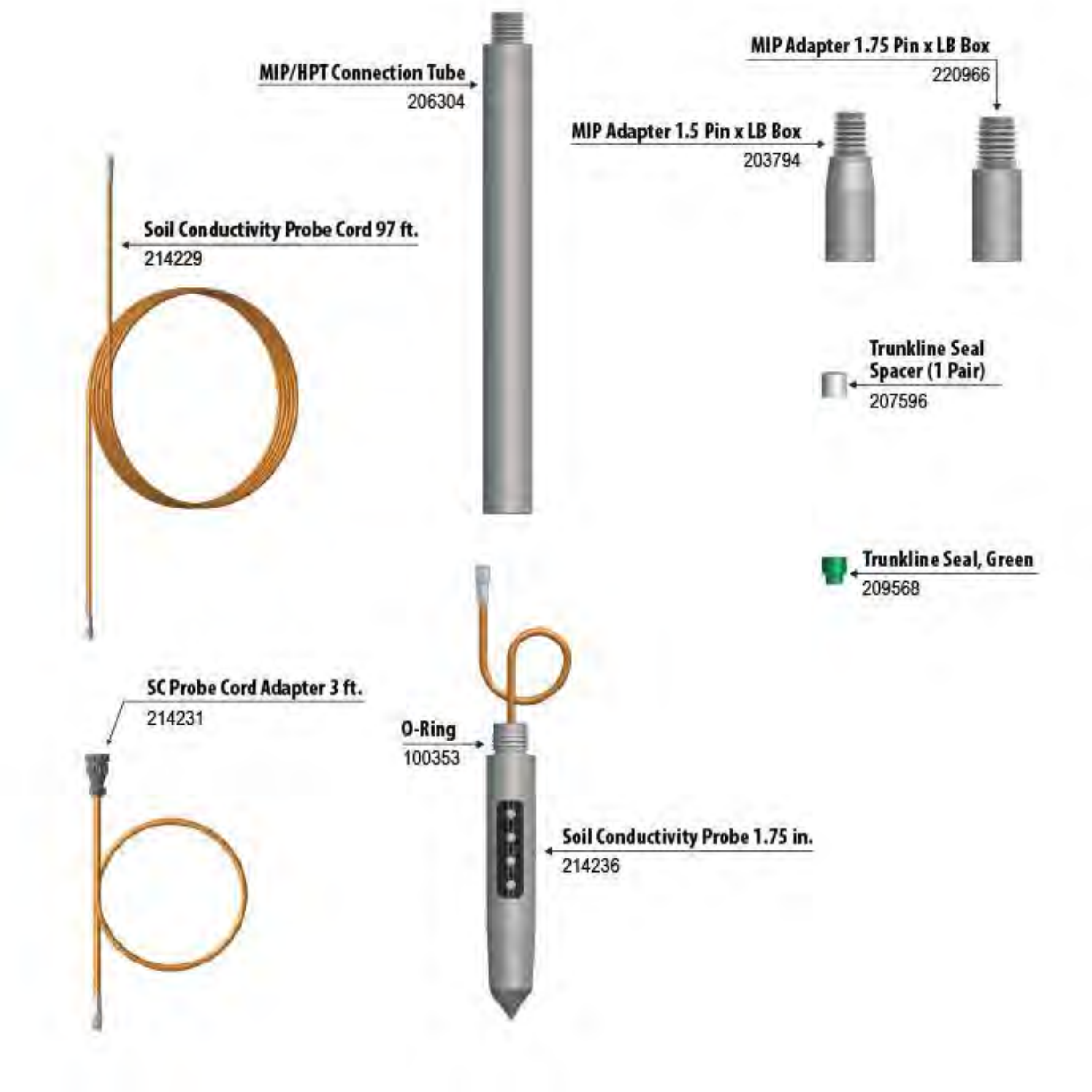


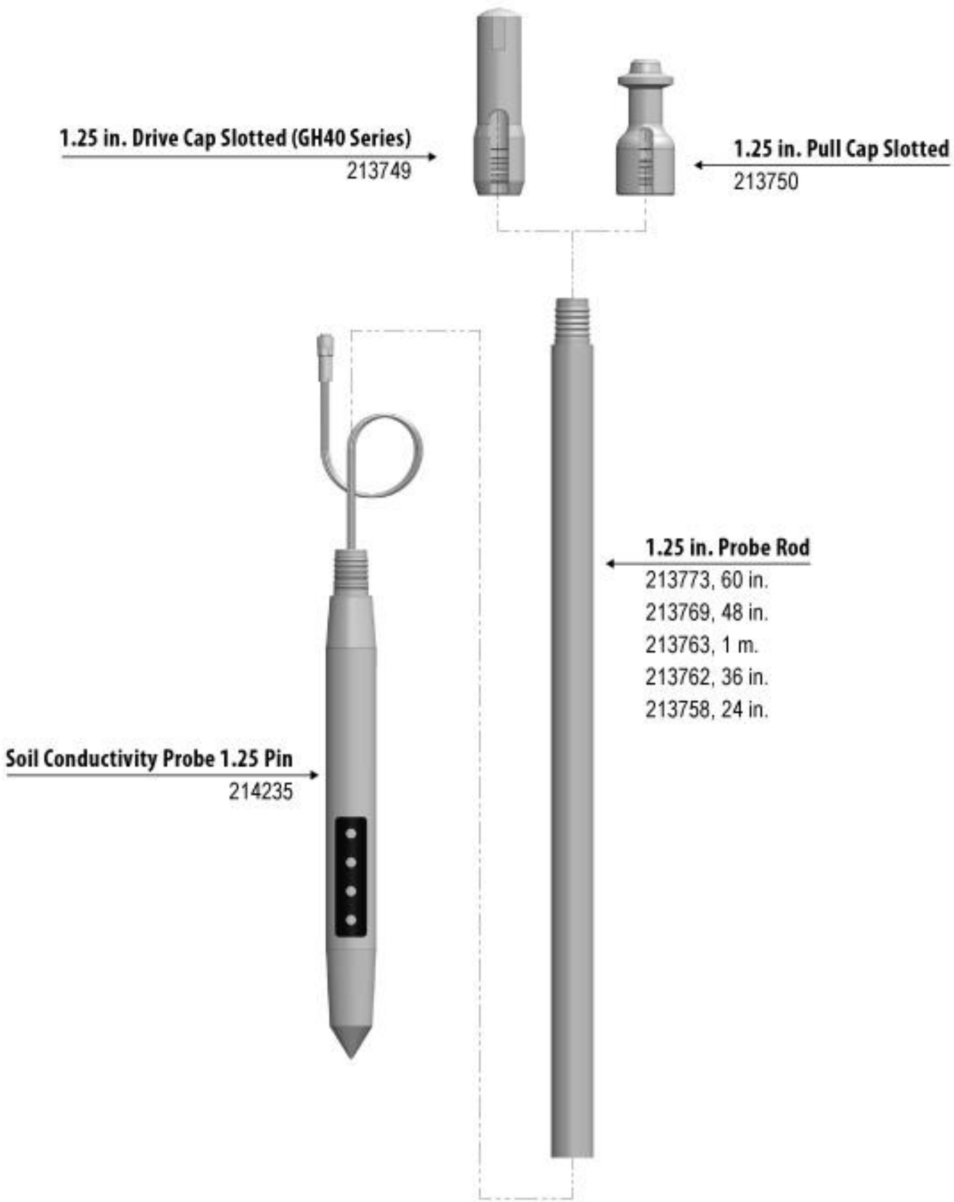
Figure 5.5: Example EC Log

APPENDIX VI
EC Tool Configurations

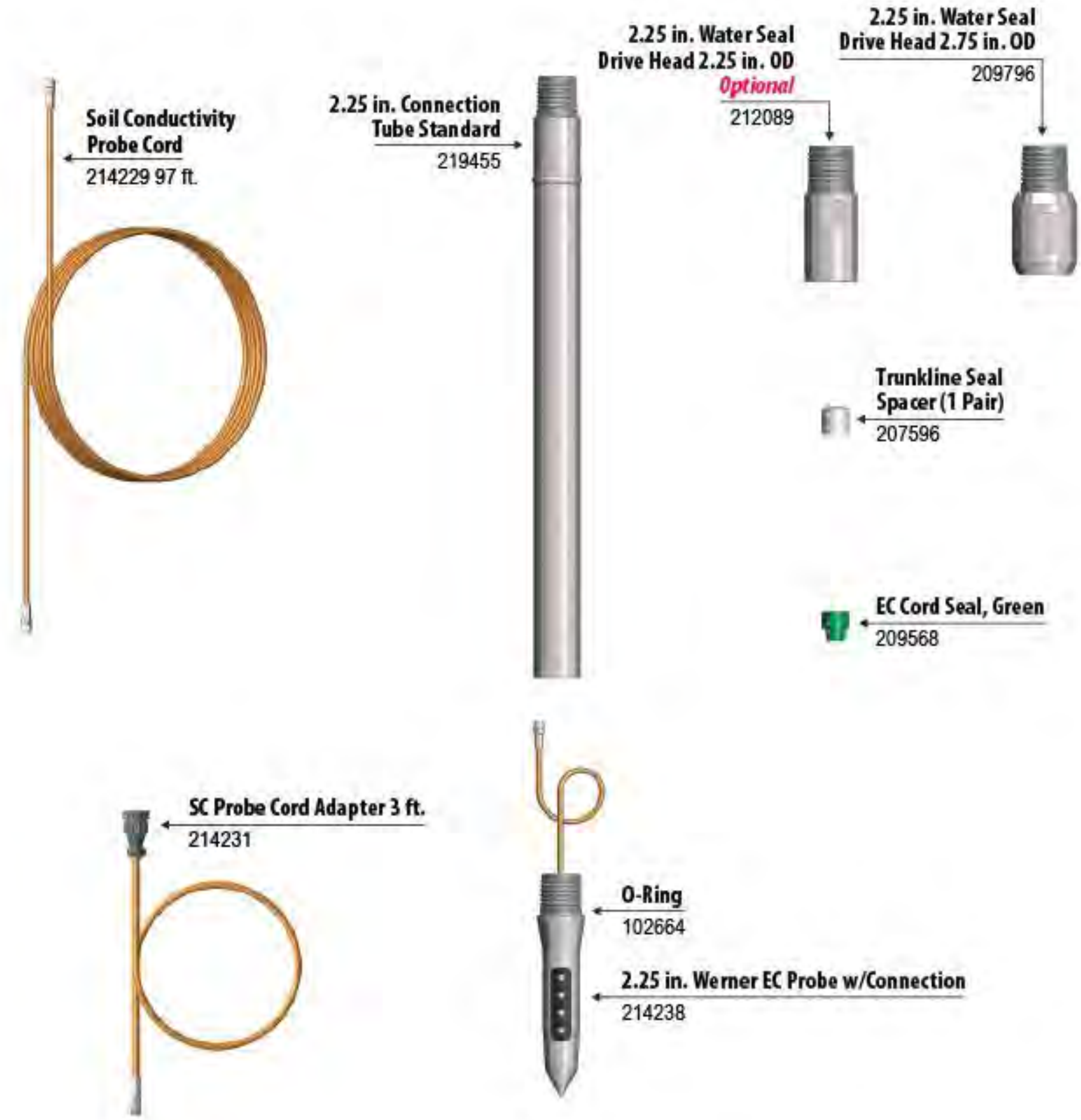
EC – SC520 (1.5 in / 1.75 in. system)



EC – SC400 (1.25 in. system)



EC – SC820 (2.25 in. system)



Attachment 2
Soil Boring Log

ANCHOR QEA

LOG OF EXPLORATORY BORING

CLIENT/PROJECT NAME:	BORING #
PROJECT NUMBER:	DATE BEGAN:
GEOLOGIST/ENGINEER:	DATE COMPLETED:
DRILLING CONTRACTOR:	TOTAL DEPTH:
DRILLING METHOD:	SHEET OF
HOLE DIAMETER:	

OTHER*	WELL OR PIEZOMETER DETAILS	SAMPLING DATA						DEPTH IN FEET	SOIL GROUP SYMBOL (USCS)	Field location of boring
		SAMPLING METHOD	SAMPLE NUMBER	FID / PID (ppm)	RECOVERY (feet)	BLOWS / 6 INCHES	DEPTH SAMPLED			LITHOLOGIC DESCRIPTION

Remarks:

Attachment 3
Soil Visual Description Key

Soil Visual Description Key

Visual soil descriptions consist of the following:

Moisture content, density/consistency, color, minor constituent, MAJOR CONSTITUENT/GROUP NAME; structure descriptions (as needed); amount and shape of minor constituents (e.g., organics and anthropogenics); biota; odor; sheen

Recovered and in situ depths

Recovered = measured in the laboratory, actual soil depth from core tube

Soil Description Terminology		
1. Moisture Content		
Dry	Little perceptible moisture (upland only)	
Moist	Probably near-optimum moisture content, no visible water (most soil)	
Wet	Visible free water, probably above optimum	
2. Density (Core Drive Penetration and Finger Pressure)		
SAND or GRAVEL		
Density	**Visual**	**Notes**
Very loose	Freefall	May occur at the top of a core
Loose	Easy penetration	
Medium dense	Moderate penetration	Typically down core due to compaction or compression
Dense	Hard penetration	Bottom of a core, typical to glacial deposits
Very dense	Refusal	
SILT or CLAY		
Consistency	**Visual**	**Notes**
Very soft	Freefall	Soupy, not cohesive
Soft	Easy penetration	Easily penetrated, just starting to be cohesive
Medium stiff	Moderate penetration	Cohesive, molded by finger pressure
Stiff	Hard penetration	Can indent and mold by stiff finger pressure
Very stiff/hard	Refusal	Modeling clay (rolls to a ball)
3. Color and Shading		
Example Colors	**Shades**	
Black	Light	
Browns (olive, yellow, red)	Dark	
Grays (gray, olive, brown)	Very dark	
Mottling: Streaks or spots of a minor color within the larger color unit		
4. Minor and MAJOR Group Name		
Gravel	Silt	
Sand	Clay	
* MAJOR is written in all CAPITAL LETTERS		
* Description of minor constituent precedes MAJOR constituent, except for trace		
Minor Constituents	**Percent**	
Trace (clay, silt, sand, gravel)*	0 to 5	
Slightly (clayey, silty, sandy, gravelly)	5 to 15	
Clayey, silty, sandy, gravelly	15 to 30	
Very (clayey, silty, sandy, gravelly)	30 to 50	
GROUP NAME	Greater than 50	
* For trace minor constituents, place after MAJOR constituent		

Soil Description Terminology

Descriptors	
Sand and Gravel	Rounding
	Sorting
	Grain color

5. Other Minor Constituents: % by volume (e.g., organics and anthropogenics)*

Other Minor Constituents*	**Percent**
Trace	0 to 5
Occasional	5 to 10
Moderate	10 to 30
Substantial	30 to 50

*Separate major from other minor constituents with a period

6. Biota

Marsh grass, shells, worms, etc.

7. Odor Descriptions
(No odor detected unless noted)

Intensity	**Odor Types**
Trace (faint)	Petroleum-like
Moderate (obvious)	Naphthalene-like
Strong (overwhelming)	H_2S-like (Hydrogen sulfide-like)
	Septic-like
	Solvent-like
	Metallic-like

8. Visual Impacts

8a. Sheen (No sheen observed unless noted)
(Modified from ASTM F2534-06)

Components of a sheen description: Start and end depths, modifier describing relative sample surface area with sheen, sheen color, description of sheen distribution (e.g., continuous, present as 0.5-inch spots, etc.)

Silvery	Metallic, silver/gray colored
Rainbow	Multicolored
Dark Rainbow	Multicolored with some dark metallic or brown/black coloring
Dark	Dark metallic or brown/black colored

Sheen Distribution Terminology

Streaks	Flat, lines of sheen (describe size and number)
Florets	Semi-circular, flat, spots of sheen (described size and number)
Covered	Sheen appears continuous over a portion of the sample surface

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

Modifiers	
Amount	**Percent**
Trace	Less than 2
Slight	2 to 15
Moderate	15 to 40
Moderate to heavy	40 to 70
Heavy	Greater than 70

Soil Description Terminology	
8b. Nonaqueous Phase Liquid (NAPL)	
Components of a NAPL description: Start and end depths, color, amount (droplets, covered, soaked); droplet frequency/percent of sample covered or soaked; viscosity	
Note: Observations of sheen or NAPL on the sampling equipment during sampling will be recorded on the sampling log and included in the notes section of the core log.	
Blebs	Observed discrete sphericals of NAPL, 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.
Coated	soil grains are coated with NAPL. There is not sufficient NAPL material present to saturate the pore spaces. The degree of coating should be described as light, moderate, or heavy.
Saturated	The entirety of the pore space for a sample is saturated with the NAPL. Care should be taken to ensure that water saturating the pore spaces is not observed when using this term. Depending on viscosity, NAPL-saturated materials may freely drain from a soil sample.
Relative Viscosity	
High viscosity	Taffy-like
Viscous	No. 6 fuel oil or bunker crude-like (molasses-like)
Low viscosity	No. 2 fuel oil-like
Nonaqueous phase liquid (NAPL): NAPL is generally classified as light NAPL (LNAPL) if the density is less than that of water (i.e., will float on water) and dense NAPL (DNAPL) if the density is greater than that of water (i.e., will sink in water). Use a shake test to identify whether observation NAPL is an LNAPL or DNAPL.	

Soil Description Terminology	
9. Structure and Other soil Descriptions	
Hummocky	Cohesive soil that can be broken down into smaller lumps
Gummy	Cohesive, pliable soil with high percentage of clay
Bed	Greater than or equal to 0.5 inch thick
Thin bed	Less than 0.5 inch thick
Pockets	Semi-circular to circular inclusion/deposit
Laminated beds	Thin beds (less than 0.5 inch thick) lying between or alternating within a greater unit
Stratified beds	Beds (greater than 0.5 inch thick) lying between or alternating within a greater unit
Organic matter	Mass of leaves, twigs, wood, etc.
Anthropogenic material	Material originated from industrial activity such as coal fragments, slag, etc.
Aggregates	Industrial waste products
Anthropogenic debris	Debris originated from human activity such as trash, plastic, etc.
Decomposed	Visible sign of decomposition or discoloration
Fresh	No visible sign of decomposition or discoloration
Winnowed	Loss of material that occurred during coring, creating a washed-out void space

Notes:

* = Classification of soil on logs is based on visual field observations, which include density/consistency, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein.

Visual-manual classification method ASTM International (ASTM) D-2488 for the description and identification of soils was used as an identification guide.

"Grades to" indicates that all characteristics not called out stay the same as the unit above.

@ symbol indicates one single piece of the material (when not accompanied with a "grades to" or contact)

Acronyms/terms used in core logs:

NAPL = nonaqueous phase liquid

Native = Soil deposited prior to the physical influence of humans on the natural environment

PID = Photoionization detector, measures volatile organic compounds (VOCs)

Equipment Decontamination

SOP 007

Project: 164 John Street

Date: September 2021

1. Purpose

This Standard Operating Procedure (SOP) describes the decontamination of non-dedicated sampling equipment, instruments, and other materials used during implementation of field tasks at the project site that come in contact with contaminated site media. Decontamination is the process of neutralizing, washing, and rinsing field sampling equipment to clean field equipment and minimize the potential for sample cross-contamination.

Personnel performing decontamination activities shall wear appropriate personal protective equipment (PPE), as presented in the site-specific Health and Safety Plan.

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 on the Daily Field Log and communicated to task and project management.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the installation procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

Sample containers, instruments, working surfaces, technician 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 use in the field.

3. Equipment List

- Personal protective equipment, as required by the HASP
- Scrub brushes
- Plastic wash and rinse buckets or tubs

- Phosphate-free biodegradable detergent (e.g., Liquinox® or Alconox®)
- Deionized (DI) water (or distilled water)
- Spray bottles
- Aluminum foil
- Tap water source (any treated municipal water supply)
- Investigation-derived waste (IDW) storage containers (refer to SOP 011: Investigation derived Waste Handling and Disposal)

4. Summary of Method

Generally, dedicated sampling equipment will be used during the investigations (i.e., stainless-steel trowels and shovels, plastic scoops, ground-water sample bailers). However, equipment that is not dedicated (i.e., non-dedicated drilling equipment) will be decontaminated prior to each use to mitigate the potential for cross-contamination of the samples collected for laboratory analysis.

The following steps will be used to decontaminate supporting equipment that are not in direct contact with samples or mercury contaminated media:

1. Equipment will be rinsed with tap water or wiped down as appropriate.
2. Rinse water will be contained, and any wipes used to clean containerized as IDW.

The following decontamination steps will be used to decontaminate sampling equipment that come into contact with sample media in areas of suspected impacts. Decontamination of all items will follow the *Field Branches Quality Management Plan* (USEPA 2009) and *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (SW-846 protocols; USEPA 2013). The decontamination procedure for sampling equipment is as follows:

1. Rinse in phosphate-free wash and sufficiently scrub to remove any remaining sample material.
2. Rinse with tap water.
3. Rinse with distilled water. If significant contamination is anticipated, the following steps may be added:
    a. Rinse with 10% Nitric acid (when sampling for metals).
    b. Rinse with methanol rinse (when sampling for volatiles).
4. Rinse with hexane (when sampling for PCBs).
5. Rinse with distilled water.
6. Air dry sampling equipment.
7. Use immediately or cover all decontaminated items with aluminum foil once dry.

The following decontamination steps will be used to decontaminate sampling equipment that come into contact with sample media and is being removed from the work area. The decontamination procedure for sampling equipment is as follows:

1. Rinse in phosphate-free wash and sufficiently scrubbed to remove any remaining sample material.
2. Rinse with tap water.
3. Rinse with distilled water.
4. Air dry sampling equipment.
5. Screen equipment for mercury vapors following the screening protocol outlined in SOP-012.

All used decontamination fluids will be collected and placed in labeled, designated containers suitable for disposal in accordance with IDW procedures outlined in SOP-011 – Investigation-Derived Waste.

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. As described in the QAPP (Appendix A to the SC Work Plan), equipment blanks will be collected periodically to validate the effectiveness of decontamination procedures.

References

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 from: http://www.epa.gov/osw/hazard/testmethods/sw846/online/index.htm.

Standard Operating Procedure

Monitoring Well Installation and Development

SOP 008

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the installation and development of fill and unconsolidated soils for groundwater monitoring wells.

This SOP describes the equipment, field procedures, materials, and documentation procedures necessary to install the above-mentioned wells. The details within this SOP should be used in conjunction with the project work plan.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the installation procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

3. Summary of Method

Geoprobe® direct push machine is a vehicle-mounted, hydraulically powered machine that uses static force and percussion to advance small-diameter sampling tools into the subsurface for collecting soil core, soil gas, or groundwater samples. The Geoprobe® refers to both machines and tools manufactured by Geoprobe Systems®, Salina, Kansas.

Following borehole drilling, a groundwater monitoring well is constructed in the temporary Geoprobe® casing in the boring. The well casing and screen are inserted into the casing. The temporary casing allows the passage of the tremie pipe for well grout placement, as well as free passage of filter sands and bentonite pellets dropped through the casing. The wells are finished with a flush mount vault and a lockable cap.

Well development is conducted to remove residual materials remaining in the monitoring wells after installation has been completed and to re-establish the natural hydraulic flow conditions of the formations that were disturbed during well construction. The well is developed until the column of water in the well is free of visible soil and the pH, temperature, turbidity, and specific conductivity have stabilized.

4. Personnel Qualifications

Only qualified personnel will direct well installation activities. Training requirements for direction of well installation activities include reviewing this SOP, other applicable SOPs, guidance documents, and health and safety training.

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for sample collection.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) as needed.

5. Equipment List

Equipment and materials that will be used for overseeing and directing the well installation and development may include the following:

- Appropriate personal protective equipment (PPE), as specified in the site Health and Safety Plan (HASP)
- Water-level indicator or interface probe
- Indelible ink pen
- Tape measure
- Small-diameter water-level indicator
- Peristaltic, small-diameter bladder or Waterra inertial lift pump (or similar) with dedicated polyethylene tubing
- Silicone flexible tubing (for peristaltic pump)
- Marine battery
- Multi-parameter water quality meter and manufacturer's operating manual
- Calibration standards
  - pH (4.0, 7.0, and 10.0 standard buffer solutions)
  - Conductivity
  - Turbidity standards (0 nephelometric turbidity units [NTU], 40 NTU, and 100 NTU)
  - Miscellaneous others (as necessary)
- Camera
- Whiteboard with erasable markers

- Air monitoring equipment
- Field logbook; field forms for core collection, well construction, and well development; or notebook with relevant forms
- Safety knife or scissors
- Photo-ionization device with appropriate lamp and calibration gas

This list does not include equipment that will be provided by subcontracted well drillers. However, to address potential releases to the environment, the following equipment is required in addition to all necessary supplies for well installation and development:

- Spill-containment and clean-up kit
- Secondary containment for drill rig and all equipment that contains fuels or hydraulic fluids

6. Cautions

The depth and volume of the borehole, including the over-drilling, if applicable, must be calculated, and the appropriate materials for well construction and investigation-derived waste (IDW) must be procured prior to drilling activities.

Special care must be taken to minimize or prevent inadvertent cross-contamination between borehole locations.

No lubricating oils or grease should be used on casing threads. No glue of any type should be used to secure casing joints. Teflon O-Rings can be used to ensure a tight fit and minimize leakage; however, O-Rings made of other materials are not acceptable if the well is going to be sampled for organic compound analyses.

7. Health and Safety Considerations

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the project HASP. The HASP will be followed during all activities conducted by Anchor QEA personnel and subcontractors.

The site-specific HASP and subcontracted driller's HASP will be used to guide the installation of the wells in a safe manner. Job Safety Analyses (JSAs) will be prepared for well installation oversight by Anchor QEA and subcontractors. The following specific health and safety issues must be considered when installing the wells:

- Underground and overhead utility hazards must be mitigated prior to drilling.
- Drilling rigs and equipment present a variety of safety hazards. Drill rigs must be inspected each day prior to use. All personal must know where the emergency "kill" switch is, and the switch must be tested daily. Only the drill rig operator and helper may approach the rig during drilling activities.

- Air monitoring will be conducted for chemicals at action level as established in the site-specific HASP.
- Appropriate PPE must be worn.
- Potential hazards from working in a public area and potential hazards to the public by drilling and well installation activities must be addressed before activities begin and as conditions change.
- Waste generated during the well installation must be properly managed in accordance with facility and applicable regulatory requirements.

8. Procedure

The following general activities and procedures will be implemented for groundwater monitoring wells.

8.1 Well Installation

1. After notification of appropriate parties, the drilling subcontractor will install the monitoring wells. The work areas will be cordoned off and a traffic plan implemented to direct road traffic as necessary.
2. A decontamination area will be established.
3. Once drilling activities commence, soil cores will be collected at each location by using a Geoprobe® drill rig or similar drill rig. Soil samples may be collected using a dual tube sampling system equipped with core liners will be advanced into the soil by a hydraulic hammer.
4. During soil sample collection, one set of drill rods will be advanced and serve as an outer casing. This will prevent the boring from collapsing and will allow for continuous extraction and sampling. The process for dual-tube sampling is generally described as follows:
    a. Once positioned, the initial soil core will be collected beginning at the ground surface and advancing the length of the core barrel (typically 4 or 5 feet).
    b. Before removal of the initial soil core, a second drill string will be advanced downward, outside of the initial soil core. This will serve as the outer casing (4.5-inch outer diameter and 3.75-inch inner diameter).
    c. Once the outer casing is in place, the initial soil core will be removed for visual description.
    d. After removing the initial soil core, the core barrel will be decontaminated and then re-inserted into the borehole through the in-place outer casing to collect the second soil core interval.
    e. Prior to removing the second soil core, the outer casing will be advanced the length of the core barrel to prevent the boring from collapsing.
    f. These steps will be repeated until target depth is reached.

5. A cutting tool will be used to open core liners, and a physical description of the sediment and depth of native material will be recorded.
6. Borings will be advanced into the soils to a pre-determined target depth below ground surface.
7. After soil core collection and processing, a monitoring well will be installed in the existing borehole or the borehole can be re-drilled and widened using appropriately sized augers.
8. A 10-foot-long, 2-inch-diameter, 0.010-inch slot monitoring well will be installed within the borehole. The flush-thread riser pipe will be connected to the well screen and continue to the surface.
9. An appropriately sized filter sand will be placed around the well screen to a height within the borehole two-feet above the top of the well screen.
10. Above the filter sand, a seal consisting of bentonite chips or fine-grained sand (No. 00 or similar) will be placed above the well screen until at least a 1 foot of thickness is reached.
11. Cement and bentonite grout will then be placed above the seal to the ground surface where a flush-mount type surface completion will be installed.
12. Completed monitoring wells will be surveyed by a licensed surveyor to establish the elevation of the well casing for use in groundwater level monitoring.
13. All information relevant to the drilling and well installation beyond the items identified in the Well Construction Log (Attachment 1).
14. Should a monitoring well need to be abandoned, the monitoring wells will be abandoned by removing the well casing and monitoring screen if possible and backfilling the borehole with bentonite pellets or cement and bentonite grout to a depth of approximately 1 foot below ground surface and then placing a 1-foot-thick concrete patch. Alternatively, the monitoring well can be abandoned in place by filling the monitoring well with bentonite pellets or cement and bentonite grout to the ground surface and completing the abandonment as described previously.

8.2 Well Development

1. The installed monitoring well will not be developed for at least 12 to 24 hours after the cement grout has been installed.
2. After the appropriate amount of time has passed, assemble the necessary equipment on a plastic sheet surrounding the well. Record pertinent information on the Well Development Log (Attachment 2).
3. Open monitoring well and take air reading at the top of casing and in the breathing zone as appropriate.
4. Measure depth to water and the total depth of the monitoring well. Calculate the water column volume of the well.
5. Surge the well using appropriately sized surge block to loosen soil buildup in well within the surrounding filter pack. Following the removal of suspended sand-sized soil, the well

development process should include over-pumping the well (that is, pumping the well at a higher rate where drawdown is induced). Using a downhole pump, begin development and measure the initial pH, temperature, turbidity, and specific conductivity of the water and record on the field Well Development Log (Attachment 2). Note the initial color, clarity, and odor of the water.

6. Continue to develop the well (alternating pumping and surging the well) and periodically measure the water quality parameters indicated in Step 5 (above). Development will proceed until water quality parameters stabilize or until the water has a turbidity of less than 50 NTUs for three consecutive readings are recorded or a maximum of 5 well volumes have been purged from the well. Anchor QEA personnel will record well development measurements and observations in Well Development Log (Attachment 2).
7. All water produced by development must be containerized or treated. Each container must be clearly labeled with the location ID and date collected. Determination of the appropriate disposal method will be based on the analytical results from each well.

9. Waste Management

IDW, rinse water, PPE, and other waste materials generated during equipment decontamination (waste) must be placed in appropriate containers and labeled. Waste materials will be stored securely in a location. Handling and disposal of waste procedures are documented in the site-specific work plan and in SOP011: Investigation-Derived Waste.

10. Data Recording and Management

All information relevant to the drilling and well installation beyond the items identified in the Well Construction Log (Attachment 1) will be recorded by Anchor QEA field staff using the field logbook. Field equipment decontamination activities and waste management activities will be recorded in the field logbook. Records generated as a result of implementing this SOP will be controlled and maintained in the project record files in accordance with client-specific requirements.

11. Quality Assurance

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

Attachments

Attachment 1 Well Construction Log
Attachment 2 Well Development Log

Attachment 1
Well Construction Log

MONITORING WELL CONSTRUCTION DATA

DATE:	CLIENT:	PROJECT NO:

WELL/BORING NO: ____________

STATE PLANE COORDINATES:
NORTH ____________
EAST ____________

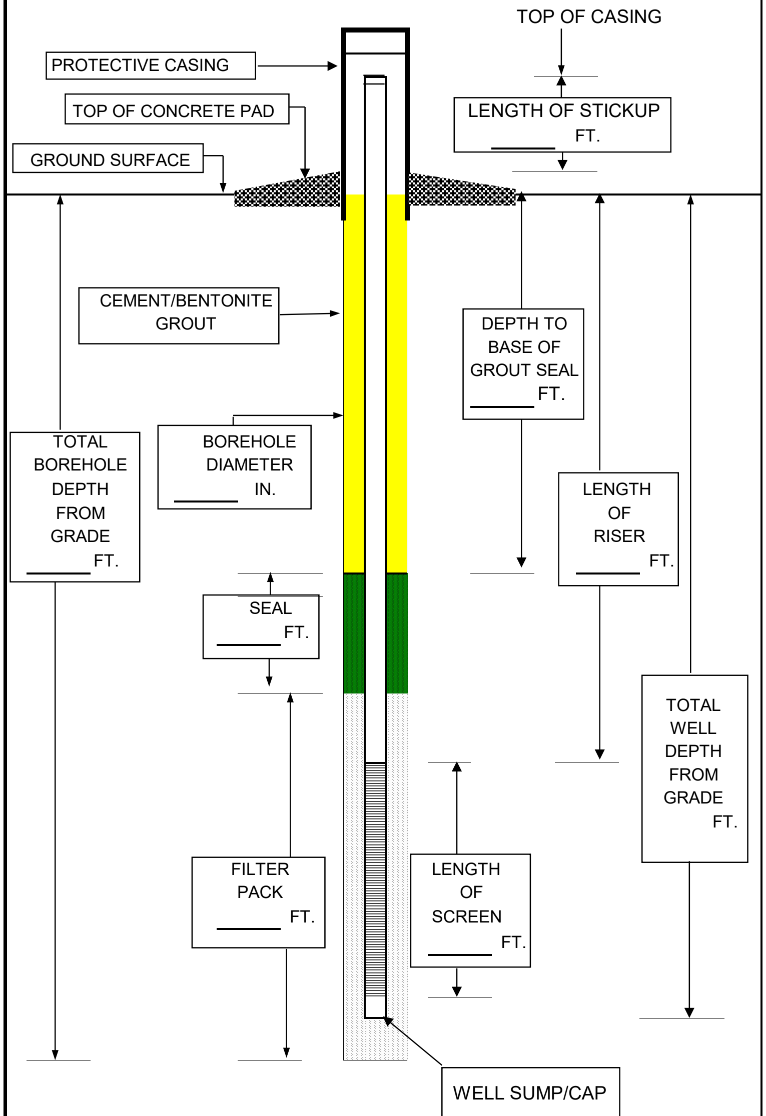
PROJECT NAME: ____________________
ADDRESS: ____________________
____

TOP OF SLAB ELEVATION: ____________

WELL CONTRACTOR: ____________________

TOP OF CASING ELEVATION: ____________

WELL SCHEMATIC



ALL ELEVATIONS ARE IN FEET NGVD

CONSTRUCTION DATA

CASING INFORMATION

MATERIAL: ☐ PVC ☐ STAINLESS ☐ CARBON
☐ OTHER ____________
DIAMETER: ☐ 2" ☐ 4" ☐ 6"
☐ OTHER ____________ IN.
JOINTS: ☐ THREADED ☐ WELDED
☐ SCREWED ☐ COUPLED
☐ OTHER ____________
SCHEDULE: ____________

SCREEN INFORMATION

MATERIAL: ☐ PVC
☐ STAINLESS
☐ TEFLON
☐ OTHER ____________
DIAMETER: ☐ 2"
☐ 4"
☐ 6"
☐ OTHER ________ IN
SLOT: ☐ 0.010
☐ 0.020
☐ OTHER ________ IN

CENTRALIZER: ☐ YES ☐ NO
SHOW LOCATION OF CENTRALIZER(S) ON SCHEMATIC

FILTER PACK MATERIAL

20/40 SAND ☐
OTHER ☐ ____________

SECONDARY FILTER PACK MATERIAL

SUGAR SAND ☐
OTHER ☐ ____________

BENTONITE WELL SEAL

☐ 1/2-INCH PELLETS
☐ 1/4-INCH PELLETS
☐ CHIPS
☐ OTHER ____________

SURFACE PROTECTION

CONCRETE PAD: ☐ 3'X3'
☐ 4'X4'
☐ OTHER ________ FT

WELL SUMP/CAP

☐ YES
☐ NO
LENGTH ____ FT.

Anchor QEA of North Carolina, PLLC
231 Haywood Street
Asheville, North Carolina 28801
828.281.3350

Attachment 2
Well Development Log

ANCHOR QEA

Well Development Log

FACILITY NAME:	DATE:
LOCATION:	ARRIVE TIME:
FIELD PERSONNEL:	WEATHER:

WELL NUMBER:________________ WELL DEPTH IN FEET (WD):__________________ START TIME:_______

WELL DIAMETER:__________________ WATER LEVEL IN FEET (WL):___________________

TYPE OF CASING:___________________ LENGTH OF WATER COLUMN :_________ FEET

MEASURING POINT: _________________ (WD) - (WL) = (LWC)

FLUSH MOUNT / STICK-UP ONE CASING VOLUME:_______________ GALLONS

COMMENTS:_________________________________ (LWC) x (WCV)

____ THREE CASING VOLUMES:____________ GALLONS

____ ACTUAL VOLUME DEVELOPED:_________ GALLONS

WELL CASING VOLUMES (WCV)

2" = 0.17 Gal/Ft 3" = 0.38 Gal/Ft 4" = 0.66 Gal/Ft 6" = 1.5 Gal/Ft 8" = 2.6 Gal/Ft 12" = 5.8 Gal/Ft

TIME	DEVELOPMENT METHOD	ESTIMATED FLOW RATE (gpm)	GALLONS PURGED	pH UNITS	SPECIFIC COND. (µS)	TEMP (C°)	DISSOLVED OXYGEN (mg/L)	OXIDATION REDUCTION POTENTIAL (mV)	TURBIDITY (NTU)	DEPTH TO WATER (feet TOC)

PROTECTIVE CASING:_______ PAD:_______ LOCK:_______ VEGETATION:_______ ACCESS: _______

Field Personnel Signature: **Date:**

Comments:

Notes: µS = micro-Siemen
C° = degrees Celsius
mg/L = milligrams per liter
mV = millivolt
NTU = nephelometric turbidity units

Method Reference: Temperature: SM 2550 B-2000
Specific conductivity: EPA Method 120.1, Rev. 1982
DO: SM 4500 O G-2001
pH: SM 4500-H^+ B-2000

ANCHOR QEA

Standard Operating Procedure

Low-Flow Groundwater Sampling

SOP 009

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the documentation of field activities during implementation of field tasks. Field documentation will consist of field forms, daily logs, photographs, and electronically recorded field measurements.

2. Equipment List

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 may include, but are not limited to, the following:

- Daily logs
- Field forms and records
- Small-diameter water-level indicator
- Peristaltic, small-diameter bladder or Waterra inertial lift pump with dedicated polyethylene tubing
- Silicone flexible tubing (for peristaltic pump)
- Marine battery
- Multi-parameter water quality meter and manufacturer's operating manual
- Supplemental turbidity meter (if necessary)[1]
- Calibration standards
  - pH (4.0, 7.0, and 10.0 standard buffer solutions)
  - Conductivity
  - Turbidity standards (0 nephelometric turbidity units [NTU], 40 NTU, and 100 NTU)
  - Miscellaneous others (as necessary)
- 0.45-micron field sampling filters
- Deionized water

[1] Turbidity measurements collected with multi-parameter meters have been shown to sometimes be unreliable due to fouling of the optic lens of the turbidity meter within the flow-through cell. A supplemental turbidity meter may be utilized to verify turbidity data during purging if such fouling is suspected.

- Laboratory-issued sampling containers
- 5-gallon buckets with lids or suitable containers for purge water
- Graduated measuring cup
- Tape measure
- Plastic or duct tape
- Paper towels
- Camera
- Waterproof pen

3. Groundwater Sampling

The following general activities and sampling procedures will be implemented for groundwater sampling:

1. A depth-to-groundwater reading from the top of the well casing will be measured using a water-level indicator and will be recorded in the field notes.
2. A total depth of well casing will be measured using a water-level indicator and recorded in the field notes. The depth-to-groundwater measurement and total depth of well casing will be used to assess how much water is present in the well casing before sampling starts.
3. Polyethylene tubing will be lowered to the well screen for groundwater sampling using a peristaltic pump. Pump instrumentation may vary due to water-level depths. For example, in areas where depth-to-water is greater than 27 feet, a Waterra inertial pump with dedicated Waterra tubing and check-valve may be used. For depths greater than 50 feet, an electrical submersible or bladder pump system may be allowed.
4. Collect purge water in 5-gallon buckets and transfer to investigation-derived waste 55-gallon drums when needed.
5. During purging of groundwater, water quality parameters (pH, conductivity, dissolved oxygen [DO], temperature, oxidation reduction potential [ORP], and turbidity) will be measured and recorded with a portable instrument (Horiba U-10 or similar instrument).
6. Samples will be collected after field water quality parameters have stabilized. The groundwater will be considered adequately purged when the water quality parameters have stabilized as follows (for three consecutive measurements collected at approximate three to five minute intervals):
    a. ± 0.1 units for pH
    b. ± 3% for temperature and specific conductance (conductivity)
    c. ± 10 millivolts for ORP
    d. ± 10% for DO (or within 0.1 mg/l if the dissolved oxygen level is less than 1.0 mg/l)
    e. ± 10% for turbidity (or within 1 NTU if the turbidity reading is less than 10 NTU)

7. During sampling, the pump will be run at a purge rate of less than 500 milliliters (mL) per minute to avoid over-pressure and clogging or excessive vacuum bubbles in the sampling line as well as minimizing the chance of pulling groundwater that is not local to the depth of the monitoring well.
8. In the event that the parameters or water level within the monitoring well do not stabilize during purging, the purge rate will be adjusted in an attempt to stabilize.
9. Should the monitoring well become evacuated or the purging rate fall below 50 mL per minute, purging will be stopped and the well allowed to recover (with periodic water level monitoring) for up to 4 hours.
10. After the well has recovered or 4 hours have passed, the water level will be measured again and samples will be collected for chemical analyses.
11. Groundwater samples will be packaged for shipment and placed in a cooler at 4°C for transport.
12. All field activities will be documented.

4. 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.

Attachment

Attachment 1 Groundwater Sampling Form

Attachment 1
Groundwater Sampling Form

Low-Flow Groundwater Sample Collection Field Form

Project:	Date:	▯ QC Sample
Project No:	Location ID:	
Field Staff:		

A. Monitoring Setup

Time:		Pump Installed Depth (feet; measured from top of inner casing):	
Depth to Water (feet; measured from top of inner casing):		NAPL Present (Yes/No):	

Water Quality Instrument Make/Model:				Instrument Serial No.			
Sensor (check applicable parameters)	▯ Temperature	▯ pH	▯ Spec. Conductance	▯ Diss. Oxygen	▯ Oxygen Reduction Potential	▯ Turbidity	▯ Other?
Sensor ID/serial No.	#______	#_____	#______	#______	#______	#______	#______

B. Water Quality Data

Pre-Purge Start Time*:	Sampler Inlet Depth:
Pre-Purge Rate*:	Initial Depth to Water:

Time	Pump Rate (mL/min)	Temperature (°C)	pH	Specific Conductance (µS/cm)	Dissolved Oxygen (mg/L)	ORP (mV)	Turbidity (NTU)	Water Level (feet)	Notes (color, odor, etc.):

Sampling ID	Sampling Depth (Below Mudline) (ft)	Sample Time	Analyses

Notes:

Standard Operating Procedure

Slug Testing

SOP 010

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the documentation of field activities during implementation of field tasks. Field documentation will consist of field forms, daily logs, photographs, and electronically recorded field measurements.

2. Equipment List

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 may include, but are not limited to, the following:

- Daily logs
- Field forms and records
- Waterproof pen
- Camera
- PVC slug pipe and rope
- Water level meter
- Stopwatch
- Pressure transducer

3. Hydraulic Conductivity (Slug) Testing

Slug tests may be performed at each of the site monitoring wells. Slug tests will be completed using a 1-inch-diameter PVC pipe that is 3 feet long, sealed at both ends, and filled with clean sand as ballast. A stop-watch or timepiece will be used to record time during the testing or a pressure transducer programmed for data collection in very short intervals (e.g., every second or every 5 seconds) may be used as well.

Slug tests conducted will be both a falling-head and a rising-head test, as described in the following:

- Falling-head slug test (slug-in test)

- At the selected monitoring well, measure the static water level from an established reference point and record. If using, install the pressure transducer at least 4 feet below the water level so as to not interfere with the slug. Allow the water level to stabilize for up to 15 minutes after installing the pressure transducer or wait until the water level has returned to static level.
- Prepare a stop-watch or timepiece and lower the slug into the monitoring well until the slug is fully submerged below the water level.
  - The lowering of the slug displaces the water within the monitoring well and starts the slug test. The test will continue until the water level within the monitoring well returns to at least 90% of the static water level.
- Begin recording the change in water level as soon as possible after lowering the slug. Water level measurements should be taken at the following intervals:
  - Every 0.1 or 0.2 second for the first 2 minutes (collected by the pressure transducer)
  - Every 1 second for the next 3 to 5 minutes (collected by the pressure transducer)
  - Every 30 seconds until approximately 10 minutes have passed
  - If water level has not returned to 90% of static water level after 10 minutes, the field team will determine a water level measurement interval to use until the test is complete.
  - If the water level has not returned to 90% of static water level after 2 hours, the test will be terminated.
- Rising-head slug test (slug-out test)
  - At the selected monitoring well, measure the static water level from an established reference point and record. If using, install a pressure transducer at least 4 feet below the water level so as to not interfere with the slug.
  - Insert the slug into the monitoring well and allow the water level to stabilize for up to 15 minutes or until the water level has returned to static level.
  - Prepare a stop-watch or timepiece and remove the slug from the monitoring well.
    - The removal of the slug displaces the water within the monitoring well and starts the slug test. The test will continue until the water level within the monitoring well returns to at least 90% of the static water level.
  - Begin recording the change in the water level as soon as possible after removing the slug. Water level measurements should be taken at the following intervals:
    - Every 0.1 or 0.2 second for the first 2 minutes (collected by the pressure transducer)
    - Every 1 second for the next 3 to 5 minutes (collected by the pressure transducer)

- Every 30 seconds until approximately 10 minutes have passed
- If water level has not returned to 90% of static water level after 10 minutes, the field team will determine a water level measurement interval to use until the test is complete.
- If the water level has not returned to 90% of static water level after 2 hours, the test will be terminated.

4. 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.

Standard Operating Procedure

Investigation-Derived Waste

SOP 011

Project: 164 John Street

Revision Date: September 2021

1. Purpose

The purpose of this Standard Operating Procedure (SOP) is to establish uniform procedures for the proper disposal of investigation-derived waste (IDW; i.e., 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 on the Daily Log (see SOP001: Field Records). The details within this SOP should be used in conjunction with project work plan.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or report. If there are changes made to the IDW handling and disposal due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and documented in the project report.

3. Personnel Qualifications

Only qualified personnel will direct IDW handling and disposal activities. Training requirements for IDW handling and disposal activities include reviewing this SOP and other applicable SOPs and/or guidance documents and health and safety training.

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP. Additionally, field personnel will be under the direct supervision of qualified professionals who are experienced in performing the tasks required for IDW handling and disposal.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, first aid and cardiopulmonary resuscitation [CPR] training), as needed.

4. Equipment List

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 may include, but are not limited to, the following:

- Appropriate PPE, as specified in the site Health and Safety Plan (HASP)
- U.S. Department of Transportation (DOT)-approved 55-gallon open-top or closed-top drums, roll-off or Baker tank with lid for collection of solids and liquids
- Garbage bags
- 5- to 10-gallon buckets or carboys to be used as satellite waste-collection containers
- 55-gallon DOT chemical drums (as needed)
- Drum pad or secondary containment
- Drum cart
- Bung tool to open closed-top drums (as needed)
- Drum wrenches to tighten open-top drum lids
- Spill kits
- Labels and tags
- Drum log forms
- Drum marking crayons (or similar)

5. Health and Safety Considerations

Health and safety issues for the work associated with this SOP, including physical, chemical, and biological hazards, are addressed in the site-specific HASP. The HASP will be followed during all activities conducted by Anchor QEA personnel and its subcontractors.

The site-specific HASP will be used to guide the IDW handling in a safe manner. Job Safety Analyses will be prepared as part of the HASP for IDW handling. The following specific health and safety issues must be considered for management of IDW:

- IDW should be placed in secondary containment to minimize risk of a release to the environment whenever practical.
- Appropriate PPE must be worn to avoid contact with chemicals during IDW handling activities.
- Potential hazards from management of IDW in a public area and potential hazards to public must be addressed before activities begin and as conditions change (e.g., waste secured away from public).

6. Secondary Containment

Prior to storage of IDW, a secondary containment area should be established as follows:

1. Identify a location where IDW can be stored. The area should be relatively flat and secure so that any IDW and associated equipment to be stored is not at risk of being disturbed, stolen, or tampered with.
2. Once the storage area has been selected, construct a secondary containment. Pre-made secondary containments can be used or new containments can be constructed, but either should able to contain solids and/or liquids spilled within the secondary containment.
3. If a secondary containment is constructed, a minimum of 2x4-inch lumber or similar material will be used and wrapped in plastic. The lumber will be arranged into a square or rectangular shape so that the plastic wraps over the lumber, creating a lip with plastic stretching between.
4. Once the plastic sheeting has been stretched, IDW drums can be placed within the secondary containment.

7. 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. These wastes are classified into the following three categories:

1. Solid materials consisting of soils, used core tubes, used PPE, and other materials used in the handling, processing, and storage of soil
2. Liquid wastes, such as waste 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.

7.1 Solid Waste

Solid residual wastes generated during field activities will consist of two types of materials—soil and non-soil solids. Soil wastes could include discarded soil or waste soil generated during drilling activities. Non-soil wastes may include items such as used PPE (e.g., gloves, Tyvek suits, and plastic sheeting). Non-soil and soil wastes will be segregated and stored in separate containers pending characterization and disposal. Loose soil will be removed from non-soil waste items prior to disposal, to the extent practical.

Soil and non-soil wastes will be segregated and containerized in closed 5-gallon buckets or trash bags, as necessary and appropriate, and secured until transferred into labeled 55-gallon drums (or dedicated roll-off container). Soil and non-soil wastes placed in labeled 55-gallon drums (or dedicated roll-off container) will be stored temporarily pending characterization and transfer to an approved disposal facility.

7.2 Waste Water

Waste water will be generated during sample collection, well installation, decontamination, and well development activities. Soils recovered during this process will be handled as solid waste as described above. Waste water will be collected in 55-gallon closed-top drums or in a large, contaminated-liquid waste tank until the material is characterized and transferred off site for disposal.

7.3 IDW Management

Soil and non-soil wastes generated will be placed in labeled drums or dedicated roll-off containers. Individual drums will be tracked using sequential numbers. Sequential drum numbers and the type of material placed in each drum will be indicated on the top and sides of the drums using a drum-marking crayon and a log recording this information. Placement of soil, non-soil, and/or liquid waste into sequentially numbered disposal drums will be documented in IDW logs (see example of IDW log in Attachment 1) listing the sample ID from which waste material originated. Information recorded on the IDW logs will include the following:

- Sequential drum number
- Type of waste stored in drum (e.g., wet soil or water)
- Accumulation start and end dates
- Hazardous waste manifest number and date
- Transport contractor name and date of pickup

A composite sample may be collected and analyzed for compounds specific to the project disposal facility at the frequency required by the disposal facility or project manager/client.

8. Data Recording and Management

Anchor QEA field sampling personnel will record all IDW in the IDW log (Attachment 1). Records generated as a result of implementing this SOP will be controlled and maintained in the project record files in accordance with client-specific requirements.

9. 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.

Attachment

Attachment 1 Investigation-Derived Waste Log

Attachment 1

Investigation-Derived Waste Log

Investigation-derived Waste Drum Log

Drum Number:	Investigation-derived Waste (IDW) Medium:
Accumulation Start Date:	Manifest Number:
Accumulation End Date:	Manifest Date:
Transport Contractor:	Lab ID Number:
Transport Pick-up Date:	Haz Characterization Date:
Manifest Copy Received from Waste Facility: _______________	Date:

Samples placed in Drum	Date of Placement	Comment	Initials

IDW Medium:
Soil
Soiled PPE

Mercury Scanning of Decontaminated Equipment

SOP 012

Project: 164 John Street

Date: September 2021

1. Purpose

This Standard Operating Procedure (SOP) describes the monitoring requirements for decontaminated, non-disposable, equipment utilized during the Site characterization activities. This SOP addresses instrumentation, action levels, sampling location, and duration. This SOP is not intended for the screening of waste materials (i.e., demolition debris, excavated soil, subsurface structure debris) generated by the investigation activities.

Procedures for equipment scanning outlined in this SOP are expected to be followed. Substantive deviations from the procedures detailed in this SOP will be recorded on the Daily Field Log and communicated to task and project management.

2. Scope and Applicability

This SOP applies to task orders and projects associated with Anchor QEA. This SOP may be modified, as required, depending on site-specific conditions, equipment limitations, or limitations imposed by the procedure. The ultimate procedure employed will be documented in the appropriate project work plan or reports. If changes to the installation procedures are required due to unanticipated field conditions, the changes will be discussed with the project manager as soon as practicable and will be documented in the final project report.

3. Summary of Method

Sample containers, instruments, working surfaces, technician protective gear, and other items that may come into contact with sample media must meet high standards of cleanliness. All non-dedicated equipment (i.e., re-usable equipment and equipment that may be used at other site locations) and instruments that are in direct contact with the sample medium will be decontaminated prior to use in the field in accordance with SOP 7 and scanned following the procedures in this SOP.

A minimum of one location per running foot of equipment will be scanned with the MVA. Each location will be scanned three times at a close proximity to the item being tested, and the resulting average concentration utilized to confirm decontamination has been completed.

Action Levels

- If the item sampled is below 5 micrograms per cubic meter (ug/m^3), then the item may be reused for sampling activities.
- If the item sampled is below 1 ug/m^3, then the item may be removed from the site.

Equipment that does not meet the action levels above will be decontaminated again, and rescreened. Equipment that does not meet the action levels following three rounds of decontamination will be managed as investigation-derived waste per SOP 11.

4. Documentation Procedures

A log describing equipment decontamination will be maintained at the site for all non-disposable equipment used. The log will have entries for the date an item was decontaminated, date the item was dry, and the scanning results. This log will be maintained throughout the entirety of the sampling program.

5. Personnel Qualifications

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan (Anchor QEA 2021), and the corresponding documents (i.e., HASP, Quality Assurance Project Plan [QAPP, Anchor QEA 2021], etc.). Specialized training is not required for scanning and use of equipment; however, field staff will be supervised by experienced staff.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) as needed.

6. Equipment List

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. Equipment includes:

- Mercury Vapor Analyzer (MVA; Jerome Model 431X, Jerome Model J405 or other equivalent MVA)

Sample Custody

SOP 013

Project: 164 John Street

Date: September 2021

1. Scope and Applicability

This Standard Operating Procedure (SOP) addresses the sampling program requirements for maintaining custody of samples throughout the sample collection and shipping process. The objective of chain-of-custody (COC) procedures is to provide sufficient evidence of sample integrity to satisfy data defensibility requirements.

Procedures for sample custody outlined in this SOP are expected to be followed. Substantive deviations from the procedures detailed in the SOP will be recorded on the Daily Field Log and communicated to task and project management.

2. Personnel Qualifications

Field personnel executing these procedures will have read, be familiar with, and comply with the requirements of this SOP, the Field Sampling Plan (Anchor QEA 2021), and the corresponding documents (i.e., HASP, Quality Assurance Project Plan [QAPP, Anchor QEA 2021], etc.). Specialized training is not required for scanning and use of equipment; however, field staff will be supervised by experienced staff.

Anchor QEA field personnel and subcontractors will have completed current company-required health and safety training (e.g., 40-hour Hazardous Waste Operations training, site-specific training, and first aid and cardiopulmonary resuscitation [CPR] training) as needed.

3. Equipment List

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. Equipment includes:

- Approved documents including HASP and Site Characterization Work Plan (Anchor QEA 2021)
- Bound, waterproof field logbooks
- Ballpoint black ink pens or permanent markers (or equivalent)
- Custody tape or seals
- Sample labels
- COC forms on waterproof paper (see example in Attachment 1)

- Waterproof bags for COCs
- Clear-plastic sealing tape

4. Chain-of-Custody Procedures

As few people as possible should handle the samples. Each sample generated in the field will be assigned a unique identification. A label will be attached to each bottle used for sampling. Labels will be applied to the container, not the lid, whenever possible. The lid will also be labeled with the sample identification written in waterproof, indelible black ink as a backup for the container label.

When practical, the project identification, sample matrix, laboratory designation/analyses requested, field sample identification code, and preservation will be typed or printed onto the label before sampling. Completion of the sample labels (including the field team staff's initials and the date and time of sample collection) will occur prior to filling the sample bottles. Labels will be completed in waterproof, indelible black ink. Individual sample bottles will be properly labeled and securely sealed before being placed in the container for shipment to the laboratory.

Samples are considered to be in one's possession if the samples are: 1) in the custodian's possession or view; 2) in a secured location (under lock) with restricted access; or 3) in a container that is secured with an official seal(s) such that the sample cannot be reached without breaking the seal(s). Field COC procedures shall be followed from the time a sample is collected until it is relinquished to the analytical laboratory (either in person or to a shipper). The principal document used to track possession and transfer of samples is the COC form. A COC form shall be filled out in duplicate and initiated when the first sample is collected and updated continuously through the sampling event. A new COC form shall be prepared for each day of field sampling. Information to be entered on the COC form includes the following:

- Project identification (project and task number)
- Sample identification
- Time and date of sampling
- Sample matrix (e.g., sediment, water, and air)
- Number of containers for each sample
- Analyses requested
- Preservative, if applicable
- Grab or composite sample designation, if applicable
- Signatures of field team staff/sample custodian
- Field team staff's remarks
- Destination (e.g., laboratory name and location)
- Page number (e.g., 1 of 2, 2 of 2)
- Air bill or other shipping number, if applicable

- Any special instructions

All data entries will be made using a waterproof, indelible ink pen. Corrections will be made by drawing a single line through the error, writing in the correct information, and then dating and initialing the change. Blank lines and spaces on the COC form will be lined-out, dated, and initialed by the individual maintaining custody. A COC form will accompany each cooler of samples to the analytical laboratories. Each person who has custody of the samples will sign the COC form and ensure that the samples are not left unattended unless properly secured. One copy of the COC form should be placed in a waterproof bag and attached to the inside of each sample cooler. In the event that sediment subsamples are being sent to different laboratories, separate COC forms should be prepared for each laboratory and each sample cooler. A custody seal should be placed on the sample cooler when it is not in the custody of a member of the sampling team.

When samples are relinquished, either to the laboratory or for shipment, the COC form must be completed by the sample deliverer (except in the case of a commercial carrier such as FedEx). It should include the printed and signed name of the deliverer, the organization that person represents, date and time of sample relinquishment, and method of shipment, if appropriate. A completed copy of the laboratory-verified COC form will be distributed via email or fax to the Project Chemist within 24 hours of sample receipt at the laboratory. The original will be retained by the laboratory.

5. Quality Assurance/Quality Control

Completed COC forms will be reviewed by the individuals preparing the samples for shipment for completeness, accuracy, and legibility. Specifically, the sample labels and COC record will be compared to ensure agreement between the samples and the COC and to verify the number of sample containers.

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.

Appendix C
Community Air Monitoring Plan

November 2021
164 John Street
Brooklyn, New York

Community Air Monitoring Plan

Prepared for Consolidated Edison Company of New York
31-01 20th Ave
Building 136, 2nd Floor
Astoria, NY 11105

November 2021
164 John Street
Brooklyn, New York

Community Air Monitoring Plan

Prepared for
31-01 20th Ave
Building 136, 2nd Floor
Astoria, NY 11105

Prepared by
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Project Number: E80327-05.02
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TABLE OF CONTENTS

TABLES

FIGURE

ABBREVIATIONS

$\mu g/m^3$	micrograms per cubic meter
ACGIH	American Conference of Governmental Industrial Hygienists
CAMP	Community Air Monitoring Plan
mg/m^3	milligrams per cubic meter
MVA	Mercury vapor analyzer
NIOSH	National Institute of Occupational Safety and Health
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PEL	permissible exposure limit
PM_{10}	Particulates (dust) that are less than 10 microns in diameter
REL	recommended exposure limits
RSL	risk-based screening level
SC	Site characterization
SL	screening level
Site	Hudson Avenue East Substation located at 164 John Street, Brooklyn, NY
TLV	Threshold Limit Values
TWA	time weighted average
USEPA	United States Environmental Protection Agency

1 Introduction

This *Community Air Monitoring Plan* (CAMP) has been prepared by Anchor QEA Engineering, PLLC (Anchor QEA) on behalf of Consolidated Edison Company of New York, Inc. (Con Edison) to support site characterization (SC) activities to be conducted on an approximate 0.2-acre area that encompasses the northwest corner of the Con Edison's Hudson Avenue East Substation, and is located at 164 John Street, Brooklyn, New York (the Site; attached **Figure 1-1)**. During recent (July 2021) excavation activities to support electrical infrastructure upgrades at the Site, a previously undocumented masonry subsurface structure was encountered. Visible elemental mercury was observed on the subsurface structure and in the adjacent soils; as a result, a spill report was filed with the New York State Department of Environmental Conservation (NYSDEC). Spill No. 2104180 was opened for the Site on August 2, 2021.

The purpose of this CAMP is to present air monitoring activities to be performed while implementing the *Site Characterization Work Plan* (Anchor QEA 2021) intrusive activities that may produce fugitive dust emissions or mercury vapors. This CAMP identifies action levels and associated control measures to be implemented based on the results of air monitoring. Air monitoring for on-Site personnel safety is addressed separately in Anchor QEA's Site-specific Health and Safety Plans.

The air monitoring activities described in this CAMP will be performed by Anchor QEA during implementation of SC activities that may produce fugitive dust or fugitive mercury vapors.

This CAMP has been prepared in conformance with the New York State Department of Health (NYSDOH) Generic CAMP (Exhibit I).

1.1 CAMP Organization

This CAMP is organized into the sections described in Table 1-1.

Table 1-1
CAMP Organization

Section	Description
1 – Introduction	Presents general plan information, plan organization, and potential air emissions.
2 – Air Monitoring Program	Describes the equipment, air monitoring program, and action levels.
3 – Control Measures	Describes potential control measures to be used during the SC.
4 – Data Management	Describes how the air monitoring data will be managed and reported.
5 - References	References identified in the CAMP.

2 Air Monitoring Program

This section presents a description of air monitoring to be implemented during the SC. Air monitoring activities will include the collection of real-time wind direction and air monitoring data for particulate (dust) levels and mercury vapor concentrations. The air monitoring activities will be conducted by Anchor QEA, as described in this section. Additional parameters for personal air monitoring will be presented in the Site-specific HASP to be prepared by Anchor QEA.

The air monitoring program to be implemented during the work activities will consist of the following monitoring tasks:

- Wind direction monitoring
- Work area perimeter air monitoring
- Site perimeter air monitoring
- Off-Site/Community Air Monitoring

A description of the monitoring activities to be conducted is presented in Section 2.2.

2.1 Monitoring Equipment

Table 2-1 presents the air monitoring devices to be used, at a minimum.

Table 2-1
Monitoring Equipment

Parameter	Monitoring Equipment
Mercury Vapors – Real Time and Average Concentrations (see Note 1 below)	• Jerome Mercury Vapor Analyzer J405 & 451– Arizona Instruments, LLC • VM 3000 – Mercury Instruments • Approved Equal
Mercury Vapors – 8-hour Average Concentrations via National Institute of Occupational Safety and Health (NIOSH) Method 6009	• Sensidyne Gilian GilAir 3 air sampling pump (low flow module) • Mesa Labs Defender 500 series air sampling pump flow calibrator • Solid sorbent glass tubes containing Hopcalite • Approved Equal
Airborne Particulates	• MIE DataRAM™ Portable Particulate Monitor • TSI Dusttrak Particulate Monitor • Approved Equal

Note:

1. The selection of the mercury vapor analyzers will be based on availability, capability to meet minimum detection limits of 1 µg/m^3, and capability of the analyzer to provide real-time averaging and email/text notifications to Anchor QEA (for stationary sampling locations).

In addition, a wind sock will be installed at the Site to assess wind direction and daily weather conditions (such as temperature and precipitation) will be monitored and recorded at the start of each work shift (morning and afternoon).

Air monitoring equipment will be maintained and calibrated in accordance with the manufacturers' procedures. Equipment calibrations will be recorded in the field activity logbook. Preventive maintenance and repairs will be conducted in accordance with the respective manufacturers' procedures.

If an instrument is found to be inoperative or fails a calibration check, the instrument must be removed from service and repaired or replaced. Contingency monitors (at least one per monitor type) will be maintained onsite for both mercury vapor and airborne particulates during the removal action.

Air monitoring will be conducted at the breathing zone, located approximately 5 feet above ground (or above floor level, if applicable).

2.2 Air Monitoring

2.2.1 Daily Baseline Air Monitoring

Prior to conducting SC activities with the potential to generate dust, baseline levels for particulate (dust) that are less than 10 microns in diameter (PM_{10}) will be assessed. Baseline levels will be representative of ambient air levels at the Site when non-intrusive activities are being conducted. Site baseline values for airborne particulates will be compared to the air monitoring results obtained for particulates during the intrusive SC activities to differentiate baseline concentrations from airborne concentrations generated by the SC.

Baseline air monitoring data for PM_{10} will be collected each morning prior to the start of intrusive activities and during lunch breaks. Readings will not be collected on days with sustained (more than 30 minutes) precipitation and as determined by Anchor QEA because generated dust levels will be minimal.

In addition, if upwind monitoring data (collected during Site perimeter air monitoring) indicates an upwind source of particulate matter, this information may be used along with the morning baseline monitoring results to modify work zone action levels as discussed in Section 2.3.

2.2.2 Work Area Perimeter Air Monitoring

Air monitoring will be performed at up to three locations on the perimeter of the SC work area to document that particulate and mercury vapors above action levels are not migrating out of the work area. The work area perimeter monitoring locations will be determined twice daily (once at the start of work in the morning and once after lunch) by Anchor QEA in consideration of the ongoing SC activities and prevailing wind direction. The monitoring points will be located at the work area perimeter boundaries closest to work areas that are most likely to produce fugitive dusts and/or mercury vapors. The work area perimeter monitoring locations may be located on the interior of Building C or at exterior locations depending on the type of SC activity. In the event that the work area perimeter coincides with an exterior building wall, the Site perimeter monitoring readings may serve as both the work area perimeter and Site perimeter monitoring readings, and the Site perimeter action levels will be the overriding criteria.

The work area perimeter monitoring locations will be documented on field electronic tablets, along with information regarding prevailing wind direction as measured by the weather station during the workday.

While implementing SC activities that have the potential to produce fugitive dust or mercury vapor above the action levels, Anchor QEA will conduct real-time air monitoring for PM_{10} and mercury vapor and record data at the work area perimeter every 15 minutes. Readings will be recorded and maintained on-Site by Anchor QEA as described in Section 4.

Results of the PM_{10} and mercury vapor monitoring will be compared to the action levels presented in Section 2.3. Should action levels be met or exceeded at the work area perimeter, control measures will be implemented as needed. Potential control/mitigation measures are described in Section 3. The selection of the control measures will be determined by Anchor QEA.

2.2.3 Site Perimeter Monitoring

Site perimeter monitoring will be performed by Anchor QEA to document that the SC has not resulted in an exceedance of the action levels for particulate (PM_{10}) or mercury vapor levels. Three monitoring stations will be located around the Site perimeter; one upwind station, and up to two downwind stations. Figure 2-1 presents an example of potential locations of site perimeter stations, based on a presumed wind direction.

While implementing SC activities that have the potential to produce fugitive dust or mercury vapor levels above the action levels, Anchor QEA will conduct real-time air monitoring for PM_{10} and mercury vapor and record data at each Site perimeter monitoring location every 15 minutes. Readings will be recorded and maintained on-Site by Anchor QEA.

Results of the PM_{10} and mercury vapor monitoring will be compared to the baseline levels for PM_{10} and the action levels presented in Section 2.3.

2.2.4 *Off-Site/Community Air Monitoring*

Off-Site air monitoring for mercury vapors will be performed at the corner of Plymouth Street and Hudson Avenue. As further discussed in Section 2.5, off-Site/community air monitoring is proposed to be performed during the following SC work activities and/or monitoring events:

- On days when the most likely vapor-generating activities are being performed (i.e., manual utility clearance and test pit installation)
- At least once per week during the SC program when vapor-generating activities are not being performed
- When Site perimeter monitoring levels have been exceeded.

The off-Site/community air monitoring station will be located within the public right of way, and access agreements will not be required. Figure 2-1 presents the proposed location of the off-Site community air monitoring station. As shown on Figure 2-1, the proposed location will be near the corner of

During the implementation of the off-Site/community air monitoring activities, Anchor QEA will collect air samples for mercury vapor analysis in conformance with one of the following methods:

- National Institute for Occupational Safety and Health (NIOSH) 6009 procedures (NIOSH 2001)
- Real-time MVA monitors equipped with a data logger

Samples collected using NIOSH 6009 procedures will be submitted for expedited (24-hour turnaround time) analysis. Monitoring data collected using MVA monitors will be reviewed at the end of the 8-hour period, with average concentrations developed for the 8-hour day. Section 2.5.2 discusses the proposed off-Site/community air monitoring action levels and response activities.

2.3 Development of Air Monitoring Action Levels

Action levels have been selected for mercury vapor and airborne particulates to protect Site personnel and the public during the implementation of SC activities. These action levels have been selected based on the both federally- and NYS-mandated standards, as well as industry-accepted guidance. Presented below is an overview of the standards and guidance reviewed to develop action levels.

2.3.1 *Occupational Safety and Health Administration*

OSHA was created by the US Congress as a result of the Occupational Safety and Health Act of 1970. OSHA was created to ensure safe and healthful working conditions for working men and women by setting and enforcing standards and by providing training, outreach, education and assistance (OSHA 2019).

OSHA’s exposure criteria are based on federal law and presented in Part 1910 of Title 29 of the Code of Federal Regulations. OSHA’s exposure criteria are based on 8-hour time weighted average (TWA) permissible exposure limit (PEL) as defined in 29 CFR 1910.1000 for inorganic mercury and airborne particulates. Per the Federal Register, Vol. 57, No. 114 and dated June 12, 1992, TWA PEL is defined as the employee's average airborne exposure in any 8-hour work shift of a 40-hour work week which shall not be exceeded.

2.3.1.1 OSHA Elemental Mercury TWA PEL

OSHA regulates occupational exposure to elemental mercury at 100 micrograms per cubic meter of air (µg/m^3) for an eight-hour time-weighted average exposure and as a ceiling limit[1]. The mercury TWA PEL established by OSHA accounts for consecutive daily exposures over a working lifetime for all working-age adults, male or female.

2.3.1.2 OSHA Respirable Dust TWA PEL

OSHA regulates exposure to respirable inert or nuisance dust (particulates that are less than 10 microns in diameter) at a level of 5 mg/m^3 for an eight-hour time-weighted average exposure. In addition, OSHA regulates worker exposure to silica dust under 29 CFR 1926.1153. The Contractor shall be required to comply with the OSHA silica standards and detail their compliance as part of their Site-specific HASP.

The respirable dust PEL established by OSHA accounts for consecutive daily exposures over a working lifetime for all adults, male or female.

2.3.2 National Institute of Occupational Safety and Health

The National Institute of Occupational Safety and Health (NIOSH) was established as a research agency as a result of the Occupational Safety and Health Act of 1970. NIOSH’s role is focused on the study of worker safety and health and creating safe and healthy workplaces. NIOSH is part of the U.S. Centers for Disease Control and Prevention, in the U.S. Department of Health and Human Services (CDC 2019). Acting under the authority of the Occupational Safety and Health Act of 1970 (29 USC Chapter 15) and the Federal Mine Safety and Health Act of 1977 (30 USC Chapter 22), NIOSH develops and periodically revises recommended exposure limits (RELs) for hazardous substances or conditions in the workplace, including mercury and respirable dust. NIOSH also recommends appropriate preventive measures to reduce or eliminate the adverse health and safety effects of these hazards. To formulate these recommendations, NIOSH evaluates all known and available medical, biological, engineering, chemical, trade, and other information relevant to the hazard. These

[1] As defined in 29 CFR 1910.1000(a)(1), ceiling limits represent maximum allowable instantaneous (if measurable) exposure limit given for that substance.

recommendations are then published and transmitted to OSHA and the Mine Safety and Health Administration (MSHA) for use in promulgating legal standards.

For NIOSH RELs, TWA indicates a time-weighted average concentration for up to a 10-hour workday during a 40-hour work week (NIOSH 2007). Although not legally enforceable, NIOSH RELs are considered by OSHA during the promulgation of legally enforceable PELs.

2.3.2.1 NIOSH Elemental Mercury TWA REL

NIOSH has developed a TWA REL for elemental mercury as 50 $\mu g/m^3$ for a ten-hour time-weighted average exposure. Similar to the OSHA PEL, the NIOSH TWA REL was developed to be protective of worker safety and health over a working lifetime.

2.3.2.2 NIOSH Respirable Dust TWA REL

NIOSH has not established a REL for respirable dust.

2.3.3 American Conference of Governmental Industrial Hygienists

The American Conference of Governmental Industrial Hygienists (ACGIH®) is a 501(c)(3) charitable scientific organization that advances occupational and environmental health (ACGIH 2019a). ACGIH has developed Threshold Limit Values (TLVs®) and Biological Exposure Indices (BEIs®) for a range of occupational exposures. TLVs and BEIs are health-based values established by committees that review existing published and peer-reviewed literature in various scientific disciplines (e.g., industrial hygiene, toxicology, occupational medicine, and epidemiology).

The ACGIH TLV TWA indicates a time-weighted average concentration for up to an 8-hour workday during a 40-hour work week. Similar to the NIOSH RELs, TLVs and BEIs are not legally enforceable standards. They are guidelines designed for use by industrial hygienists in making decisions regarding safe levels of exposure to various chemical substances and physical agents found in the workplace (ACGIH 2019b).

2.3.3.1 ACGIH Elemental Mercury TWA TLV

ACGIH has developed a TWA TLV for elemental mercury as 25 $\mu g/m^3$ for an eight-hour time-weighted average exposure. Similar to the OSHA PEL, the ACGIH TWA TLV was developed to be protective of worker safety and health over a working lifetime.

2.3.3.2 ACGIH Respirable Dust TWA TLV

ACGIH recommends a TWA TLV for respirable inert or nuisance dust (particulates that are less than 10 microns in diameter particulates) at a level of 3 milligrams per cubic meter (mg/m^3) for an eight-hour time-weighted average exposure.

2.3.4 USEPA

2.3.4.1 Risk-Based Screening Levels - Mercury

USEPA has developed risk-based screening levels (RSLs) for a range of chemical contaminants. As detailed on the USEPA's website, screening levels (SLs) are not cleanup standards. They are used to determine whether levels of contamination found at a Site may warrant further investigation or Site cleanup. RSLs can be derived based on noncarcinogenic or carcinogenic effects. According to USEPA, elemental mercury is not classifiable as to carcinogenicity. In calculating RSLs for noncarcinogens, USEPA uses a reference concentration (RfC) as an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime (USEPA 2019a).

Using formulas presented on USEPA's RSL webpage, the residential default air land use equation for estimating the SL for non-carcinogenic substances is presented below:

Equation 1

$$\frac{\text{THQ x AT x CF}}{\text{EF x ED x ET x }(1/\text{RfC})}$$

where:

THQ	=	Target Hazard Quotient (1)
AT	=	Averaging Time (365 days)
CF	=	Conversion Factor (1,000 µg/mg)
EF	=	Exposure Frequency (days per year with exposure)
ED	=	Exposure Duration (years)
ET	=	Exposure Time (hours per day with vapor generating activities)
RfC	=	Reference Concentration (3E-04 mg/m^3)

Based projects performed under USEPA Region 2 personnel oversight, the above listed SL formula has been adapted to develop off-Site action limits for shorter term remedial programs, as appropriate. As discussed in Section 2.5.2, a project-specific action level has been developed for off-Site/Community monitoring.

2.3.4.2 USEPA Standards for Respirable Dust

The Clean Air Act (Chapter 7401 of Title 42 of the US Code [42 USC 7401]), requires USEPA to set National Ambient Air Quality Standards (NAAQS) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of national ambient air quality standards: *Primary standards* to provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly; and *Secondary standards* to provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings (USEPA 2019b).

The NAAQS are applied to states and or territories in all areas of the United States. NAAQS are not applied to an individual Site or location, however activities which generate particulates can impact a designated area. The Site is located in the New York – Northern New Jersey-Long Island designated area (USEPA 2019c).

The NAAQS standard for respirable dust (PM_{10}), for both primary and secondary standards is 150 μg/m^3, averaged over a 24-hour period. This average may not be exceeded more than once per year on average over a 3-year period.

2.3.5 New York State Regulations and Guidance

Under DER-10, NYS requires that a CAMP be developed to identify monitoring requirements and response measures to protect the public (living and working) near the Site from exposure to Site contaminants during intrusive activities.

2.3.5.1 Mercury Vapor Action Levels

NYSDOH issued a guidance document entitled "How are Mercury Air Levels Interpreted" in 2013 which provides suggested interpretation and response to vapor concentrations encountered when handling mercury or performing assessment or remediation. Table 2-2, below presents NYSDOH's suggested actions to various mercury vapor levels as determined by laboratory analysis and based on field-portable detectors. The mercury air levels presented below, are applicable to scenarios where a mercury source is present in indoor air and are used to guide cleanup and confirmation testing.

Table 2-2
NYSDOH – Suggested Interpretation and Responses to Mercury Air Levels

Area Sampled	Mercury Vapor Level (μg/m^3)	NYSDOH Suggested Response
Certified Laboratory Analysis – Based on Exposure Duration[2]		
Indoor Breathing Space	>1	• Depending on level of mercury and potential vulnerability of occupants consider limiting access. • Further investigation to determine source and extent of contamination is recommended. • Remove mercury source(s), increase ventilation, repeat sampling.

[2] Samples collected for laboratory analysis would be collected using NIOSH 6009 methodology, and would be an 8-hour sample collection

Area Sampled	Mercury Vapor Level ($\mu g/m^3$)	NYSDOH Suggested Response
Certified Laboratory Analysis – Based on Exposure Duration[2]		
	≤1	• Mercury air levels are likely to decrease over time with continued normal room ventilation. • Confirmation sampling and analysis to demonstrate that levels of mercury are declining may be desirable if vulnerable occupants are present.
Mercury Vapor Based on Portable Field Detector (Direct Read Instruments)		
Indoor Breathing Space OR Near Suspected Source	≥10 $\mu g/m^3$	• Consider options for limiting access to affected areas. • Investigate to determine source and extent of contamination recommended. • Remove mercury source(s). • Increase ventilation. • Repeat sampling after cleanup.
Indoor Breathing Space	>1 and <10	• Search for and remove additional mercury sources • Increase ventilation • Repeat sampling after cleanup
Limited Area Near Suspected Source	>3 and <10	• Suggests presence of mercury source(s) that could potentially contaminate other areas. • Determine appropriate response(s) on case-by-case basis
	>1 and ≤ 3	• Minimal potential for significant mercury exposure. • Consider increased ventilation.

2.3.5.2 Particulate Levels

Appendix 1B of DER-10 establishes a particulate action level for PM_{10} of 150 $\mu g/m^3$ based on 15-minute averages. If particulate levels are detected in excess of 150 $\mu g/m^3$, the upwind background level much be confirmed immediately. Per Appendix 1B, if the average ambient air particulate concentration (calculated for continuous 15-minute increments as specified above) at the downwind Site perimeter location exceeds 100 $\mu g/m^3$ above the average background concentration (calculated for continuous 15-minute increments as specified above), or if airborne dust is visually observed leaving the work area, then dust suppression measures will be implemented, and air monitoring will continue. Work activities may continue following the implementation of dust suppression measures provided that the average ambient air particulate concentration does not exceed 150 $\mu g/m^3$ above the average background concentration.

2.3.6 NYC Department of Environmental Protection Action Levels

During an August 11, 2021 conference call between Con Edison and the NYC Department of Environmental Protection (NYCDEP), NYCDEP requested that Con Edison adopt an off-Site mercury vapor action level of 3 $\mu g/m^3$ at the Site property line and an off-Site mercury vapor action level of 1 µg/m^3 for residential areas near the Site (located near the intersection of Plymouth Street and Hudson Avenue). These action levels are based on an 8-hour time weighted average.

2.4 Proposed Action Levels – PM_{10}

PM_{10} action levels have been developed for both the work area and Site perimeter monitoring program. The action levels presented in Table 2-3 are based on NYSDOH requirements. The proposed action levels represent protective levels based on a combination of instantaneous visual data, as well monitoring data averaged over a 15-minute period. These action levels would be in addition to the average baseline levels (to be determined as previously discussed). Note that the control measures described under the table heading"PM_{10} Response Action" are presented in Section 4.

Table 2-3
PM_{10} Action Levels and Response Actions

Monitoring Location	Monitoring Period	Action Level[1]	PM_{10} Response Action
Work Area Perimeter	Instantaneous	Visible dust (from work area)	• Implement control measures
	15-minute average	PM_{10} <125 µg/m^3	• Normal operations
		PM_{10} ≥125 and <150 µg/m^3	• Identify source of dust, and implement control measures
		PM_{10} ≥150 µg/m^3	• Stop work • Identify source of dust, and implement control measures • Resume work after source of PM_{10} has been controlled and levels return to normal operation levels (<125 µg/m^3)
Site Perimeter	Instantaneous	Visible dust (from work area)	• Stop work • Identify source of visible dust, and implement control measures • Resume work after source of visible dust has been controlled (such that there is no visible dust documented at the Site perimeter)
	15-minute average	PM_{10} <100 µg/m^3	• Normal operations
		PM_{10} ≥100 and <150 µg/m^3	• Identify source of dust and implement control measures
		PM_{10} ≥150 µg/m^3	• Stop work • Identify source of dust, and implement control measures • Resume work after source of PM_{10}has been controlled

Notes:

1. The PM_{10} action levels listed above may be adjusted based on the background (upwind) PM_{10} concentrations observed, as determined through real-time background (upwind) monitoring, contingent upon USEPA review and

approval. The action levels for PM need to remain flexible in the event that uncharacteristically poor air quality is observed at the upwind monitoring stations on any given day.

2. Specific control measures shall be proposed by the Contractor; however, potential control measures that may be employed are provided in Section 3.
3. Averaging procedures will be based on the specific equipment selected for the monitoring activities. For the PM_{10} monitoring, an estimated 3 readings per minute will be collected and averaged to generate the 15-minute average concentrations.

The above-listed particulate air monitoring levels were developed to be protective of the Site workers and surrounding community. From a worker perspective, the proposed PM_{10}, stop work action level is two orders of magnitude lower than the OSHA 8-hour TWA PEL and is measured based on a 15-minute averaging period rather than the 8-hour averaging incorporated into the OSHA PEL. In addition, dust-generating work activities will be conducted during daytime work hours (presumed to be between 8 am and 5 pm), and as such, would not be considered a substantial contributor to the regional-wide implementation area for compliance with NAAQS. Based on the inherent protectiveness of the work area and Site perimeter action levels, off-Site/Community monitoring and associated action levels for PM_{10} are not proposed.

2.5 Proposed Action Levels – Mercury Vapor

Mercury vapor action levels have been developed for the Site work area, the Site perimeter and off-Site/community locations. The work area and Site perimeter action levels are presented in Section 2.5.1, and the off-Site/community air monitoring levels are presented in Section 2.5.2.

2.5.1 Work Area and Site Perimeter Action Levels – Mercury Vapor

Table 2-4 presents mercury vapor action levels and response actions that are based on a review of the standards and guidelines presented in Section 2.3. The control measures described under the table heading “Mercury Vapor Response Action” are presented in Section 3.

Table 2-4
Mercury Vapor Action Levels and Response Actions

Monitoring Location	Monitoring Period	Mercury Vapor Action Levels	Mercury Vapor Response Action
Work Area Perimeter	Single MVA reading	$<10\ \mu g/m^3$	• Normal operations
	3+ MVA readings during a 1-minute interval	≥ 10 and $<25\ \mu g/m^3$	• Identify mercury vapor source • Implement control measures
	3+ MVA readings during a 5-minute interval	$\geq 25\ \mu g/m^3$	• Identify mercury vapor source • Verify control measures are suppressing vapor levels • Implement additional control measures

Monitoring Location	Monitoring Period	Mercury Vapor Action Levels	Mercury Vapor Response Action
	Average MVA readings during a 15-minute interval	≥25 μg/m^3	• Stop work • Identify mercury vapor source • Implement additional control measures • Verify control measures are suppressing vapor levels • Resume work after mercury vapor levels decrease below 10 μg/m^{3}or a 5-minute period based on instantaneous or average readings
Site Perimeter	Average 15-minute MVA reading	<3 μg/m^3	• Normal operations
	Average MVA readings during 15-minute interval	≥3 and <10 μg/m^3	• Confirm mercury vapor source has been identified in the work area • Implement control measures • Verify control measures are suppressing vapor levels in the work area by continuing 15-minute readings until levels appropriate for normal operations (<3 μg/m^3) are observed within a 1-hour period (after which work will be stopped as noted below); if repeated events in which levels above 3 μg/m^3 are identified, work practices will be re-evaluated
	Average MVA readings during a 60-minute interval	≥3 μg/m^3	• Stop work • Confirm mercury vapor source has been identified in the work area • Implement additional control measures and verify control measures are suppressing vapor levels • Implement off-Site/community action monitoring (Event No. 1 monitoring) [1] • Resume work after average MVA level decreases below 3 μg/m^{3}for a 15-minute period

Note:

1. Event No. 1 monitoring is described in Section 2.5.2.
2. Specific control measures shall be proposed by the Contractor; however, potential control measures that may be employed are provided in Section 3.

The site perimeter action levels are two orders of magnitude less than the promulgated OSHA standards for workplace exposure to mercury. In addition, the stop work action levels are one-fifth the NIOSH REL and more than half the ACGIH TLV. As detailed above, the action levels are based on short duration monitoring periods, as compared to the 8-hour and 10-hour averaging (over a 40-hour work week) that is used to determine a potential exceedance of OSHA standards, or NIOSH or ACGIH guidance. The work and site perimeter area action levels presented above may be modified in the future based on consideration of regulatory guidance and criteria, as well as the anticipated work activities.

2.5.2 Off-Site/Community Air Monitoring Action Levels

The action levels selected for off-Site/Community air monitoring are based on the USEPA's RSL formula, as modified to represent the short duration of potential exposures to the community during the removal action.

The anticipated duration of the SC, from mobilization to demobilization is estimated to be 3-weeks. This duration includes work activities that will not be generating dust or mercury vapors (such as mobilization and non-intrusive work activities. Using the estimated project duration when mercury vapors have the potential to be generated (i.e., 2months), a 5-day work week, and assumed 8-hours per day of vapor-generating activities, an 8-hour TWA off-Site mercury vapor action level was developed following USEPA's residential default air land use equation for estimating the SL for non-carcinogenic substances. Table 2-5 presents the assumptions used to estimate the off-Site Action Level.

Table 2-5
Assumptions for Estimating Off-Site/Community Action Level

Parameter	Value	Units	Definition/Assumption
THQ	1	unitless	Target Hazard Quotient
AT	365	days	Averaging Time (365 days x 1 year)[1]
CF	1,000	µg/mg	Conversion Factor
EF	60	days	Exposure Frequency, based on an assumed number of vapor emitting days.[2]
ED	1	year	Exposure Duration [3]
ET	0.33	(10 hr/24 hr)	Exposure Time (10 hours of vapor emitting activity per 24 hours)
RfC	3.00E-04	mg/m^3	Reference Concentration for mercury

Notes:

1. Averaging Time (AT) uses 365 days. However, the actual estimated duration is expected to be 4 months.
2. The exposure frequency will likely be less than 60 days, however this assumption allows for additional potential vapor generating days performed during subsequent work over a calendar year.
3. The actual exposure duration will be much less than 1 year, based on the total estimated number of field days and mercury vapor generating activities to be performed as part of the SC. This is a conservative approach that assumes the exposure occurs over one year

Based on the USEPA's residential default air land use equation and the assumptions listed above, the calculated off-Site action level of mercury vapor is 4.38 $\mu g/m^3$. This number represents an average concentration as measured over a 10-hour period (coincident with the on-Site work activities). Because the likelihood of exposures to off-Site residents will be very infrequent (if at all) and of extremely brief duration, combined with the protectiveness of the RSL approach to estimating risk, the calculated off-Site action level for mercury vapor may be considered an overly conservative value.

In consideration of NYCDEP's request that the off-Site action level be 1 μg/m^3 based on a standard work day, the off-Site community air monitoring program has been designed to incorporate the lower (NYCDEP) off-site action level. This action level may be modified in the future (during remedial planning) to reflect calculated risk-based action levels and anticipated duration of likely exposures.

As discussed in Section 2.2, off-Site/community air monitoring is proposed to be performed during specific phases of the SC. Table 2-6 presents the specific SC work tasks/events that will require off-Site/community air monitoring. The results of this monitoring activity will serve to further document that the SC was performed in a manner that was protective to the surrounding community.

Table 2-6
Off-Site Mercury Vapor Monitoring Events

Event Description	Minimum Frequency	Mercury Vapor Monitoring/Sampling Method[1]	Mercury Vapor Monitoring/Sampling Duration[2]
1. Utility Clearance/Soft Dig	During event	Direct read mercury vapor instrument or NIOSH 6009	10 hours
2. Test Pit Installation	One 8-hour day during event	Direct read mercury vapor instrument or NIOSH 6009	10 hours
3. Handling mercury impacted soils	Daily	Direct read mercury vapor instrument or NIOSH 6009	10 hours
4. 60-minute mercury vapor Site Perimeter action level is exceeded (unless off-Site/community air sampling is already underway)	As needed	Direct read mercury vapor instrument	Minimum of 4 hours, up to 8 hours following start of event

Notes:

1. Direct read mercury vapor instrument, if used, will have capability of performing time-weighted averaging for various time intervals, as needed.
2. Work activities duration will be a maximum of 10 hours per workday. Specific activities may be of shorter duration and have a shorter corresponding monitoring duration.

Based on the above anticipated off-Site mercury vapor monitoring events, mercury vapor action levels and response actions for off-Site/community monitoring have been developed as presented below in Table 2-7.

Table 2-7
Off-Site Mercury Vapor Action Levels and Response Actions

Sampling Duration	Mercury Action Levels	Mercury Vapor Response Action
• 60-minute average readings	<3 µg/m^3	• Normal operations
	≥ 3 µg/m^3	• Review SC operations and identify mercury sources • Implement control measures Review average mercury vapor results hourly to confirm results (based on 60-minute averaging) are less than 3 µg/m^3 – If readings are not below 3 µg/m^3 based on average hourly readings, stop work – Resume activities once average hourly readings are less than 3 µg/m^3 – Continue direct read monitoring for remainder of day
• 8-Hour Samples	<1 µg/m^3	• Normal operations
	≥ 1 µg/m^3	• Review SC operations, identify mercury sources • Implement control measures • Re-sample next workday: – 8-hour sample duration using direct read instruments – Review average mercury vapor results hourly to confirm results are less than 1 µg/m^3 – If readings are not below 1 µg/m^3 based on average hourly readings, stop work – Resume activities once average hourly readings are less than 1 µg/m^3 • Continue direct read monitoring for remainder of intrusive SC activities

Note:
1. Potential control measures that may be employed are provided in Section 3.

3 Control Measures

Measures for airborne particulate control may include, but are not limited to, the following items:

- Apply water mist to point of dust generation.
- Apply water to exposed material piles.
- Cover staged material piles with polyethylene sheeting or other appropriate material.
- Reduce surface area of exposed material area.
- Containerize and cover material.
- Modify the material handling methods.
- Modify the rate of SC activities or specific methods.

Measures for mercury vapor control may include, but are not limited to, the following items:

- Ventilate work area.
- Perform work in temporary enclosures equipped with negative-pressure air control or local exhaust ventilation.
- Use mercury vapor suppressants (e.g., HgX, RESISORB®, Merconspray®, sulfur solution, or calcium polysulfide solution).
- For large areas, use water mist amended with vapor suppressant.
- Containerize and cover material.
- Modify the SC activities or debris handling methods.
- Modify the rate of SC activities or specific methods.
- Covering the mercury-vapor emitting source until other controls (such as ventilation or application of suppressants) are implemented.

4 Data Management

This section of the CAMP discusses the data management procedures that will be used during the SC. Air monitoring data will be generated from a variety of sources, including real-time and hand-held monitoring instruments.

Instruments capable of data logging will have data downloaded at the end of each work day. Air monitoring data that has been downloaded will be stored and maintained by Anchor QEA.

Air monitoring data generated from hand-held instruments without data logging capabilities will be entered in field tablets or recorded in notebooks by Anchor QEA. Information associated with monitoring locations, observations that may impact monitoring, and weather changes will also be entered onto field tablets.

Air monitoring data will be available for NYSDEC's review during the work days. Air monitoring data will be provided to NYSDEC (or NYCDEP) upon request. Anchor QEA will notify Con Edison as soon as practicable of any exceedances of Site perimeter action levels and of any stop work actions due to on Site work area exceedance of air monitoring action levels.

A summary of the air monitoring activities and collected data will be included in the SC Report.

5 References

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Figure

SOURCE: Subsurface utility locations from Con Edison sketch "Plan of Feeders 38B21, 38B22, and Relocated Feeder 32078", dated July 7, 2021. Aerial by Bing Imagery 2021.
HORIZONTAL DATUM: New York State Plane, Long Island Zone, NAD83, U.S. Survey Feet **VERTICAL DATUM:** North American Vertical Datum of 1988 (NGVD88)

NOTE:
1. All locations are approximate, contractor to field verify.
2. Air monitoring station locations are approximate and will be determined based upon prevailing wind direction as described in the CAMP.

LEGEND:

Approximate Location of Mercury-Contaminated Subsurface Structure Encountered in July 2021

0 40
Feet

Publish Date: 2021/11/08 1:54 PM | User: psciaba
Filepath: K:\Projects\0921-Con_Edison\194 John Street\0921-RP-003 Site Plan.dwg Figure 1-1

ANCHOR QEA

Figure 2-1
Potential Air Monitoring Locations
Community Air Monitoring Plan
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, NY

Exhibit I

NYSDEC Generic CAMP

Appendix 1A
New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most, sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical- specific monitoring with appropriately-sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

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

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

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

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

December 2009

Appendix 1B
Fugitive Dust and Particulate Monitoring

A program for suppressing fugitive dust and particulate matter monitoring at hazardous waste sites is a responsibility on the remedial party performing the work. These procedures must be incorporated into appropriate intrusive work plans. The following fugitive dust suppression and particulate monitoring program should be employed at sites during construction and other intrusive activities which warrant its use:

1. Reasonable fugitive dust suppression techniques must be employed during all site activities which may generate fugitive dust.

2. Particulate monitoring must be employed during the handling of waste or contaminated soil or when activities on site may generate fugitive dust from exposed waste or contaminated soil. Remedial activities may also include the excavation, grading, or placement of clean fill. These control measures should not be considered necessary for these activities.

3. Particulate monitoring must be performed using real-time particulate monitors and shall monitor particulate matter less than ten microns (PM10) with the following minimum performance standards:

(a) Objects to be measured: Dust, mists or aerosols;
(b) Measurement Ranges: 0.001 to 400 mg/m3 (1 to 400,000 :ug/m3);
(c) Precision (2-sigma) at constant temperature: +/- 10 :g/m3 for one second averaging; and +/- 1.5 g/m3 for sixty second averaging;
(d) Accuracy: +/- 5% of reading +/- precision (Referred to gravimetric calibration with SAE fine test dust (mmd= 2 to 3 :m, g= 2.5, as aerosolized);
(e) Resolution: 0.1% of reading or 1g/m3, whichever is larger;
(f) Particle Size Range of Maximum Response: 0.1-10;
(g) Total Number of Data Points in Memory: 10,000;
(h) Logged Data: Each data point with average concentration, time/date and data point number
(i) Run Summary: overall average, maximum concentrations, time/date of maximum, total number of logged points, start time/date, total elapsed time (run duration), STEL concentration and time/date occurrence, averaging (logging) period, calibration factor, and tag number;
(j) Alarm Averaging Time (user selectable): real-time (1-60 seconds) or STEL (15 minutes), alarms required;
(k) Operating Time: 48 hours (fully charged NiCd battery); continuously with charger;
(l) Operating Temperature: -10 to 50^{o} C (14 to 122^{o} F);
(m) Particulate levels will be monitored upwind and immediately downwind at the working site and integrated over a period not to exceed 15 minutes.

4. In order to ensure the validity of the fugitive dust measurements performed, there must be appropriate Quality Assurance/Quality Control (QA/QC). It is the responsibility of the remedial party to adequately supplement QA/QC Plans to include the following critical features: periodic instrument calibration, operator training, daily instrument performance (span) checks, and a record keeping plan.

5. The action level will be established at 150 ug/m3 (15 minutes average). While conservative,

this short-term interval will provide a real-time assessment of on-site air quality to assure both health and safety. If particulate levels are detected in excess of 150 ug/m3, the upwind background level must be confirmed immediately. If the working site particulate measurement is greater than 100 ug/m3 above the background level, additional dust suppression techniques must be implemented to reduce the generation of fugitive dust and corrective action taken to protect site personnel and reduce the potential for contaminant migration. Corrective measures may include increasing the level of personal protection for on-site personnel and implementing additional dust suppression techniques (see paragraph 7). Should the action level of 150 ug/m3 continue to be exceeded work must stop and DER must be notified as provided in the site design or remedial work plan. The notification shall include a description of the control measures implemented to prevent further exceedances.

6. It must be recognized that the generation of dust from waste or contaminated soil that migrates off-site, has the potential for transporting contaminants off-site. There may be situations when dust is being generated and leaving the site and the monitoring equipment does not measure PM10 at or above the action level. Since this situation has the potential to allow for the migration of contaminants off-site, it is unacceptable. While it is not practical to quantify total suspended particulates on a real-time basis, it is appropriate to rely on visual observation. If dust is observed leaving the working site, additional dust suppression techniques must be employed. Activities that have a high dusting potential--such as solidification and treatment involving materials like kiln dust and lime--will require the need for special measures to be considered.

7. The following techniques have been shown to be effective for the controlling of the generation and migration of dust during construction activities:

(a) Applying water on haul roads;
(b) Wetting equipment and excavation faces;
(c) Spraying water on buckets during excavation and dumping;
(d) Hauling materials in properly tarped or watertight containers;
(e) Restricting vehicle speeds to 10 mph;
(f) Covering excavated areas and material after excavation activity ceases; and
(g) Reducing the excavation size and/or number of excavations.

Experience has shown that the chance of exceeding the 150ug/m3 action level is remote when the above-mentioned techniques are used. When techniques involving water application are used, care must be taken not to use excess water, which can result in unacceptably wet conditions. Using atomizing sprays will prevent overly wet conditions, conserve water, and provide an effective means of suppressing the fugitive dust.

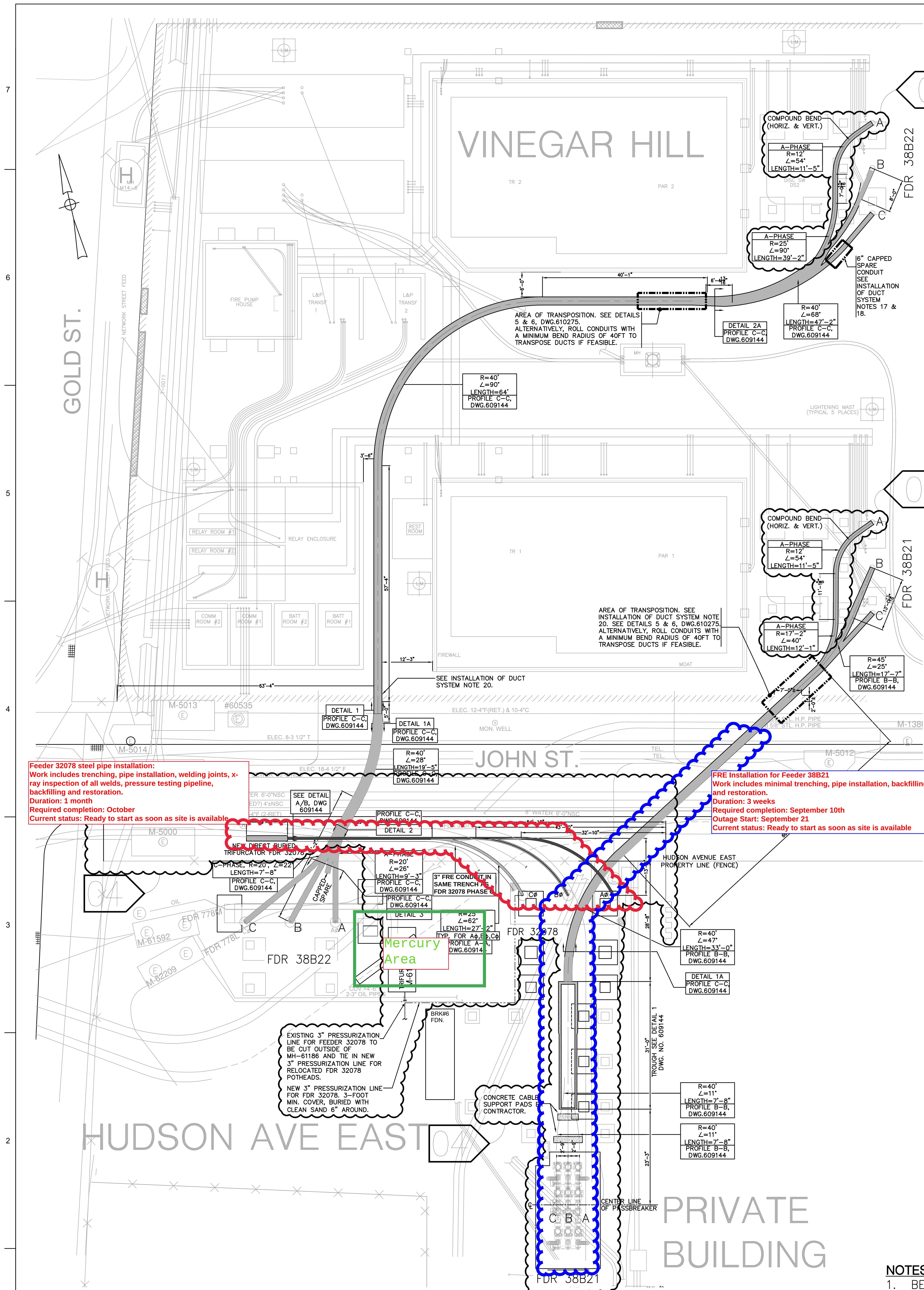
8. The evaluation of weather conditions is necessary for proper fugitive dust control. When extreme wind conditions make dust control ineffective, as a last resort remedial actions may need to be suspended. There may be situations that require fugitive dust suppression and particulate monitoring requirements with action levels more stringent than those provided above. Under some circumstances, the contaminant concentration and/or toxicity may require additional monitoring to protect site personnel and the public. Additional integrated sampling and chemical analysis of the dust may also be in order. This must be evaluated when a health and safety plan is developed and when appropriate suppression and monitoring requirements are established for protection of health and the environment.

Appendix 1C
DEC Permits Subject to Exemption

In accordance with section 1.10, exemptions from the following permit programs may be granted to the person responsible for conducting the remedial programs undertaken pursuant to section 1.2:

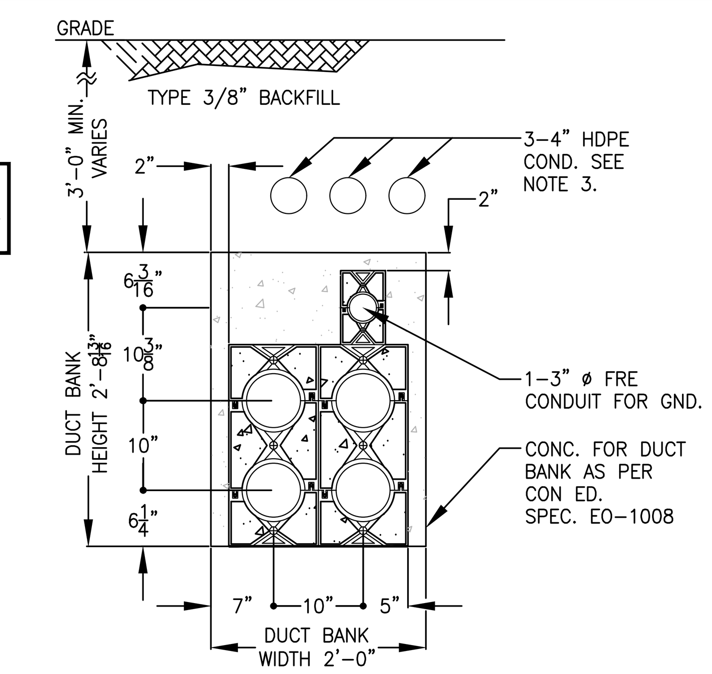
Air - Title 5 permits
Air - State permits
Air - Registrations
Ballast Discharge
Chemical Control
Coastal Erosion Hazard Areas
Construction of Hazardous Waste Management Facilities
Construction of Solid Waste Management Facilities
Dams
Excavation and Fill in Navigatable Waters (Article 15)
Flood Hazard Area Development
Freshwater Wetland
Hazardous Waste
Long Island Wells
Mined Land Reclamation
Navigation Law - Docks
Navigation Law - Floating Objects
Navigation Law - Marinas
Non-Industrial Waste Transport
Operation of Solid Waste Management Facilities
Operation of Hazardous Waste Management Facilities
State Pollution Discharge Elimination Systems (SPDES)
Stream Disturbance
Tidal Wetlands
Water Quality Certification
Water Supply
Wild, Scenic and Recreational Rivers

Appendix D
Current Site Utility Drawings



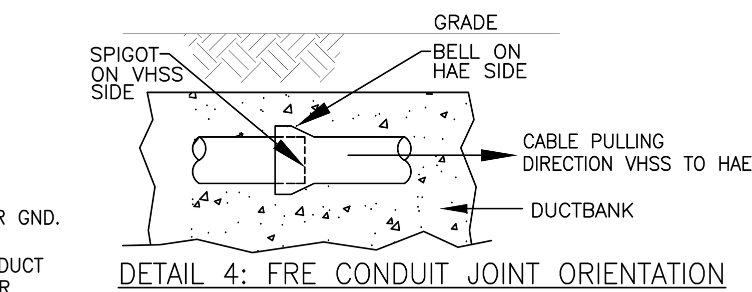
PLAN: 138KV FEEDERS BETWEEN HUDSON AVENUE EAST YARD AND VINEGAR HILL SWITCHING STATION

SCALE: N.T.S.



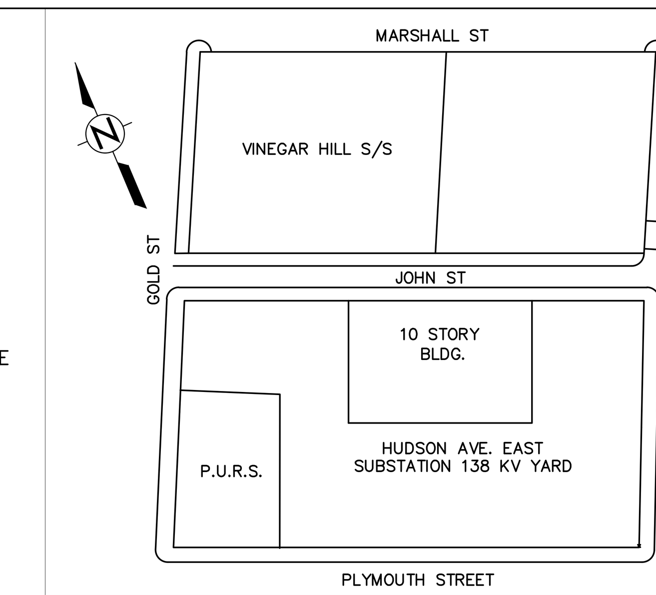
DETAIL 1: DUCT BANK CONFIGURATION FOR 4-6" I.P.S. FRE CONDUITS (1-SPARE) FOR SOLID DIELECTRIC CABLES (LOOKING NORTH)

SCALE: 1" = 1'-0"



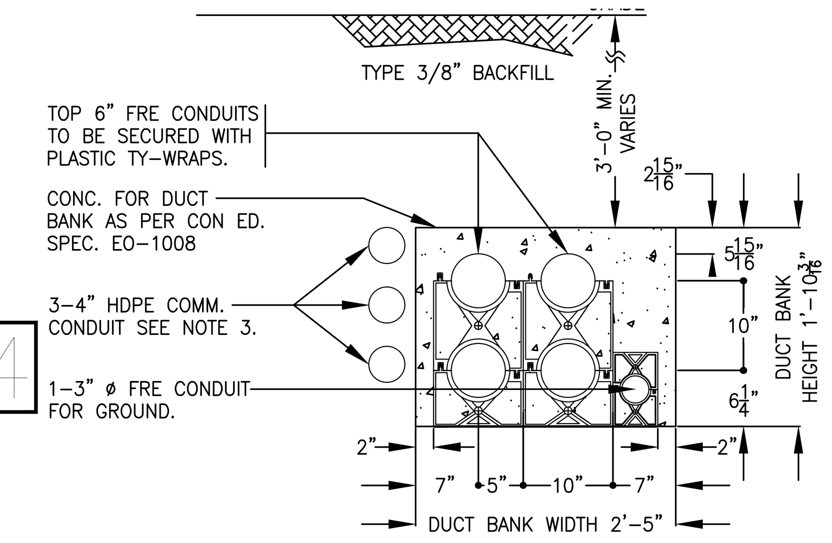
DETAIL 4: FRE CONDUIT JOINT ORIENTATION

SCALE: 1" = 1'-0"



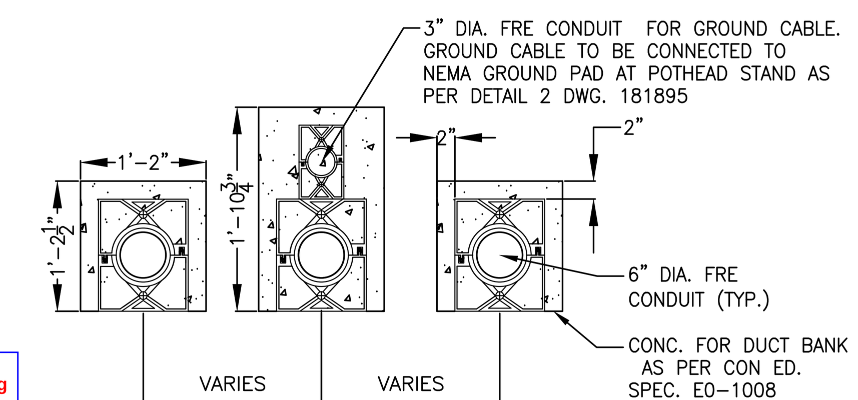
KEY PLAN

NOT TO SCALE



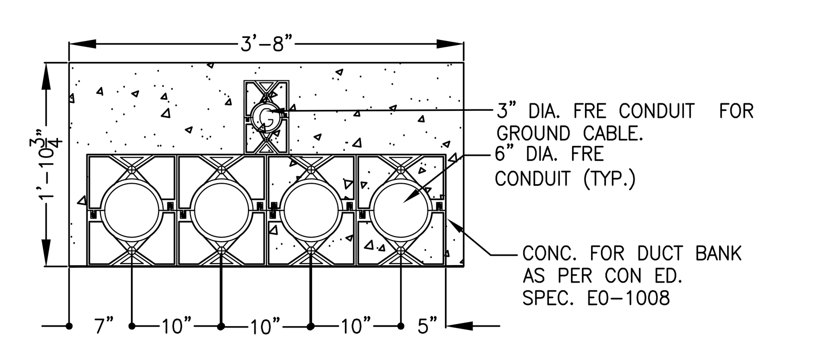
DETAIL 1A: DUCT BANK CONFIGURATION FOR 4-6" I.P.S. FRE CONDUITS (1-SPARE) FOR SOLID DIELECTRIC CABLES (LOOKING NORTH)

SCALE: 1" = 1'-0"



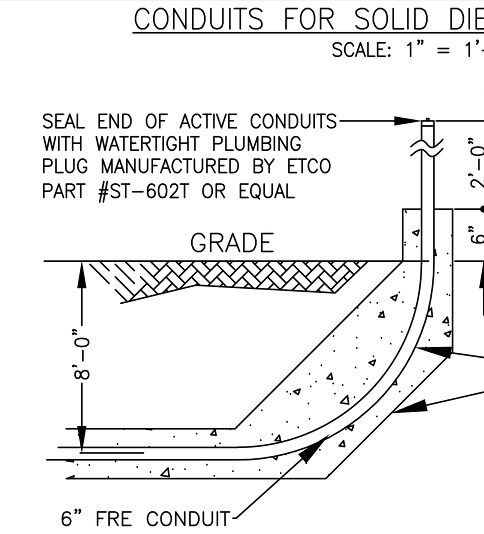
DETAIL 2: DUCT BANK CONFIGURATION FOR 3-6" I.P.S. FRE CONDUITS FOR SOLID DIELECTRIC CABLES AT RISER AREA

SCALE: 1" = 1'-0"



DETAIL 2A: DUCT BANK CONFIGURATION FOR 4-6" I.P.S. FRE CONDUITS FOR SOLID DIELECTRIC CABLES

SCALE: 1" = 1'-0"



DETAIL 3 NOTES:

1. MIN. 2'-0" STUB UP PIECE WITH PLUG ON TOP.
2. ALL REINFORCEMENT TO BE FIBER GLASS.

DETAIL 3: TYPICAL PROTECTION OF 6" I.P.S. FRE CONDUITS UNDER POTHEAD

SCALE: 1" = 1'-0"

INSTALLATION OF DUCT SYSTEM

1. CONTRACTOR TO VISUALLY INSPECT EACH LENGTH OF CONDUIT AS DELIVERED AND/OR INSTALLED FOR DAMAGE, MISSING OR POORLY INSTALLED GASKETS, SPLIT ENDS, DELAMINATING INTERIOR SURFACE.
2. DUCT BANK TO BE CONSTRUCTED IN TRENCH AND DUCTS INSTALLED ON A "PIECE-BY-PIECE" BASIS, NOT ABOVE GROUND.
3. ENSURE THAT BELL/SPIGOT ORIENTATION IS INSTALLED SUCH THAT CABLE WILL BE PULLED INTO THE BELL, PER DETAIL 4.
4. CONCRETE SHALL BE POURED WITH CHUTE JUST ABOVE DUCTS TO MINIMIZE WEIGHT IMPACT OF CONCRETE ON DUCTS AND SPACER COMPONENTS. A CHECKERBOARD PATTERN OF POURING IS TO BE USED, TO PREVENT DUCTS FROM FLOATING.
5. DUCT SPACERS TO BE EVENLY SPACED AS PER CE-TS-3355 LATEST REVISION.
6. CONCRETE ENCASEMENT TO BE POURED IN TWO LIFTS TO PRECLUDE DAMAGE TO SPACERS.
7. CONCRETE ENCASEMENT SHALL BE VIBRATED TO ENSURE NO VOIDS.
8. DUCTS SHALL BE MANDRELED AT THE COMPLETION OF THE DUCT BANK SECTION AS PER CE-TS-3355 LATEST REVISION.
9. DUCT MANUFACTURER WILL PROVIDE ON-SITE INSTALLATION TRAINING PRIOR TO COMMENCEMENT OF PROJECT.
10. A CLEAN TRENCH IS ABSOLUTELY REQUIRED. NO ROCKS OR OTHER POSSIBLY DAMAGING MATERIAL SHALL BE ALLOWED UNDER THE DUCT.
11. SHOULD PROBLEMS DEVELOP WITH THE DUCT INSTALLATION AFTER CONCRETE IS POURED SUBSEQUENT INTERNAL INSPECTION AND REMOVAL/REPLACEMENT COST WILL BE AT THE CONTRACTOR'S EXPENSE AS PER CE-TS-3355 LATEST REVISION.
12. ALL CONCRETE SHALL BE NON-AIR ENTRAINED CONCRETE WITH A 3500 PSI 28-DAY COMPRESSIVE STRENGTH AS PER CE-TS-3355 LATEST REVISION.
13. ALL DUCT CONSTRUCTION SHOULD UTILIZE IN PLACE FORM FOR CONCRETE POURING AND NOT CAST DIRECTLY AGAINST DIRT.
14. USE ONLY FIBER GLASS REINFORCEMENT FOR DUCT BANK CONCRETE AND THRUST BLOCK CONCRETE AT THE TERMINATION RISERS. DO NOT USE STEEL REBARS.
15. DUCT BANK REINFORCEMENT SHALL ONLY BE USED IN AREAS WITHIN CON EDISON PROPERTIES I.E., PROPERTY LINE TO POINT OF TERMINATION.
16. REINFORCEMENT SHALL NOT BE USED IN AREAS OUTSIDE OF CON EDISON PROPERTIES, UNLESS OTHERWISE NOTED.
17. ALL SPARE CONDUITS TO BE SWABBED CLEAN, FRE CAPPED AND SEALED TO PREVENT DEBRIS AND MOISTURE ON BOTH ENDS. SEE SPEC CE-TS-3355 LATEST REVISION.
18. SPARE CONDUITS TO BE LEFT WITH $\frac{5}{8}$" NYLON ROPE THROUGHOUT ENTIRE RUN FOR FUTURE CABLE PULL USE.
19. ALL FRE DUCT BENDS ARE TO BE FACTORY MANUFACTURED. INSTALLED BENDS, INCLUDING COMPOUND BENDS, ARE TO BE CONTINUOUS AND SMOOTH, WITH NO STRAIGHT SECTIONS INSERTED WITHIN A GIVEN BEND DURING INSTALLATION. BENDS SHOULD BE SUPPLIED IN THE LONGEST POSSIBLE LENGTHS. BENDS WHICH ARE EXCESSIVELY LONG TO MANUFACTURE AND/OR FOR INSTALLATION PURPOSES DUE TO FIELD CODITIONS CAN BE SUPPLIED IN MULTIPLE SUB-SECTION LENGTHS FROM THE FACTORY AND ASSEMBLED DURING INSTALLATIONS BUT NO STRAIGHT SECTIONS ARE TO BE INSERTED WITHIN THE BEND DURING FIELD ASSEMBLY; THE BENDS SHOULD BE SMOOTH AND CONTINUOUS. AN EXAMPLE OF A 40 FT, 90 DEGREE BEND SUPPLIED IN FOUR EQUAL LENGTH PIECES FOR ASSEMBLY IN THE FIELD IS SHOWN IN REFERENCE DETAIL 7 ON DRAWING 610275. ALL OTHER APPLICABLE DUCT BANK INSTALLATION DETAILS AS REFERENCED IN SPECIFICATION CE-TS-3355 APPLY. (DETAIL 7 IS PROVIDED FOR INFORMATIVE PURPOSES ONLY).
20. DUCT BANK PENETRATION THROUGH EXISTING REINFORCED WALL:
    - A. THE CONTRACTOR SHALL PROVIDE OPENING IN EXISTING WALL FOR INSTALLATION OF NEW FEEDERS AS DESCRIBED BELOW:
        - PROVIDE TEMPORARY SUPPORTS/SHORING (AS REQUIRED) PRIOR TO START OF REMOVALS.
        - CORE DRILL EACH CORNER OF OPENING WITH 10"ø CORE DRILL PRIOR TO REMOVAL OF CONCRETE.
        - THE CONTRACTOR SHALL SAW CUT OPENING IN EXISTING WALL TO RADIUS OF CORE HOLES. DO NOT OVER-CUT.
    - B. AFTER INSTALLATION OF FEEDERS AND DUCT BANK, THE CONTRACTOR SHALL FILL CONCRETE OPENING AS DESCRIBED BELOW:
        - APPLY SIKA ARMATEC 110 TO ALL EXPOSED REBAR AND STEEL SHEET PILING EDGES.
        - CONTRACTOR SHALL USE SIKA SWELL BETWEEN INTERFACE OF EXISITNG CONCRETE (DUCT BANK AND EXISTING WALL) AND NEWLY PLACED CONCRETE REPAIR CONCRETE MATERIAL.
        - THE CONCRETE AND SIKASWELL SHALL BE PLACED TO COMPLETELY SEAL, TO THE FULL DEPTH OF THE WALL, THE ANNULAR SPACE BETWEEN DUCT BANK AND EXISTING CONCRETE WALL.
    - C. DUCT BANK SHALL NOT BE IN CONTACT WITH WALL OPENING.

NOTES:

1. BELOW GRADE CONDUITS SHALL BE IN ACCORDANCE WITH CON ED SPECS. CE-TS-3352, CE-ET-3354 & CE-TS-3355.
2. FOR 4" HDPE CONDUITS ALONG FEEDERS 38B21 & 38B22, REFER TO DRAWINGS 131746 & 608414.
3. SEE ALL STATION DWG: EO-17177 FOR TYPICAL UNDERGROUND DUCT BANK CONFIGURATION.
4. CONTRACTOR TO OFFSET BELOW GRADE FEEDERS WHERE INTERFERENCE OCCURS MINIMUM 12".
5. SPACE BETWEEN CONDUITS SHALL BE MAINTAINED PER ASSOCIATED SPECIFICATION UNLESS OTHERWISE NOTED.
6. WHERE SHEETING IS TO BE USED, THE TRENCH DIMENSIONS SHALL BE MEASURED FROM THE INSIDE FACE OF THE SHEETING.
7. WHEN NATURAL COVER IS LESS THAN 24" OVER FRE OR HDPE COND., PROT. GUARDS SHALL BE INSTALLED AS PER CE-TS-3355.
8. CABLE TROUGH SHALL BE BACKFILLED WITH THERMAL SAND BACKFILL AS PER SPEC. CE-TS-4074.
9. DUCT BANK CONDUIT SPACERS SHALL BE WESCO DISTRIBUTION PART NUMBERS S288RLN AND S289RLN FOR 6" I.P.S. CONDUITS, AND S288LHN FOR 3" I.P.S. CONDUITS, OR EQUIVALENT.
10. THERMAL SAND BACKFILL SHALL BE PLACED IN THE CABLE TROUGH IN 12" LIFTS AND LIGHTLY COMPACTED AFTER THE CABLES ARE COVERED WITH A MINIMUM OF 12" OF SAND.

WORK THIS DRAWING WITH DRAWINGS 609144 & 610275

REFERENCE DRAWINGS

133686	FDNS FOR ADDITIONAL 138KV OUTDOOR EQPMT IN N.W. CORNER OF YD.
131965	FOUNDATIONS FOR 138KV OUTDOOR SWITCHING EQUIPMENT
131966	FOUNDATIONS FOR 138KV OUTDOOR SWITCHING EQUIPMENT
EO-12640	HP CABLE AND DIELECTRIC FLUID CIRC. PIPE TRENCHING AND BACKFILL
218486	TYP. UNDERGROUND COND. AND PIPE DETAILS & DIRECT BURIAL CABLE
131746	MISC. 138KV CONDUITS
608412	GENERAL ARRANGEMENT OF 138/27KV SWITCHING EQPMT & CONN. PLAN
608413	GENERAL ARRANGEMENT OF 138/27KV SWITCHING EQPMNT & CONN. SECT.
608414	UNDERGROUND CONDUIT & TRENCHES LAYOUT
608395	138KV EQUIPMENT AND PASS BREAKER FOUNDATION PLANS
609144	PROFILES OF FEEDERS 38B21, 38B22 AND RELOCATED FEEDER 32078.

REVISION

USE .1 SIZE TEXT ONLY

M. BUCKWEITZ	SK1
SKETCH CREATED IN RESPONSE TO HUDSON AVENUE EAST RFI #3 FEEDER TRENCH DESIGN AND TO UPDATE REFERENCE DIMENSIONS FOR PASSBREAKER FEEDER LOCATIONS. ISSUED FOR INFORMATION. P/N: 28198-18. D.JASOPERSAD 02/04/2021	
M. BUCKWEITZ	SK2
SKETCH FOR THE NEW ROUTE OF RELOCATED FEEDER 32078. ISSUED FOR INFORMATION. P/N: 28198-18. D.JASOPERSAD 03/11/2021	
M. BUCKWEITZ	SK3
SKETCH TO SHOW CHANGE TO AREA OF TRANSPOSITION NOTE. PASSBREAKER LOCATION UPDATED. ISSUED FOR CONSTRUCTION. P/N: 28198-18. D.JASOPERSAD 03/17/2021	
M. BUCKWEITZ	SK4
FDRS 38B21 & 38B22 - UPDATED FEEDER ROUTES NEAR THE VHDSS POTHEAD STANDS AND THE HAE PASS BREAKER. FDR 32078 - UPDATED THE RELOCATED ROUTE PORTION OF THE FEEDER, INDICATED THE ROUTE FOR THE PRESSURIZATION PIPE, AND THE RUN FOR THE CATHODIC PROTECTION DUCT. P/N: 28198-18. D. JASOPERSAD 07/07/2021	

PROJECT NUMBER 28198-18

DWG. NO. 609143 - SK4

DWG. SIZE A | DWG. TYPE COMPANY | SHT. 0

CON EDISON | LOCATION HUDSON AVE EAST

TITLE: PLAN OF FEEDERS 38B21, 38B22 AND RELOCATED FEEDER 32078.

HUDSON AVENUE EAST TO VINEGAR HILL SWITCHING STATION

CURRENT ENGINEERING APPROVALS	
ENGINEERING MANAGER	NOT REQUIRED
ENGINEER	M.BUCKWEITZ / C. LOPEZ
DESIGNER	D. JASOPERSAD
DESIGN CHECKER	A. ORTIZ
SCALE AS NOTED	DISCIPLINE CODE TM

Appendix E
Historical Site Mapping

Source : Plan of the village of Brooklyn and part of Long Island 1766; [1864], Map Collection, B A-1776 (1864).Fl; Brooklyn Historical Society.an of the village of Brooklyn and part of Long Island 1766; [1864], Map Collection, B A-1776 (1864).Fl; Brooklyn Historical Society. https://mapcollections.brooklynhistory.org/map/plan-of-the-village-of-brooklyn-and-part-of-long-island-1766/. Accessed August 22, 2021.

★ = Approximate Site location

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ANCHOR QEA

Exhibit E-1

1766 Land Use Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York

Source : Brooklyn Historical Society. A New Accurate Plan of the City of New York in the State of New York in North America.; [1864], Map Collection, B A-1776 (1864).Fl; Brooklyn Historical Society. https://mapcollections.brooklynhistory.org/map/a-new-accurate-plan-of-the-city-of-new-york-in-the-state-of-new-york-in-north-america-published-in-1797/ . Accessed August 22, 2021.

★ = Approximate Site location

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ANCHOR QEA

Exhibit E-2

1797 Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York

Source: New York Public Library. *Original High and Low Grounds, Salt Marsh and Shorelands in the City of Brooklyn from Original Government Surveys made in 1776-7.* Dated 1876. https://mapcollections.brooklynhistory.org/map/map-showing-the-original-high-and-low-grounds-salt-marsh-and-shore-lines-in-the-city-of-brooklyn-from-original-government-surveys-made-in-1776-7/. Accessed August 22, 2021.

★ = Approximate Site location

Source: Brooklyn Historical Society. *Peremptory sale of valuable property in the city of Brooklyn near the Navy Yard belonging to the estate of John Jackson, decd., by Jas. Bleecker & Sons on Thursday, 25th Octr., 1838, at 12 o'clock at their sales room, 13 Broad St.* https://bobcat.library.nyu.edu/primo-explore/fulldisplay?docid=nyu_aleph003396341&context=L&vid=BHS&lang=en_US&tab=bhs. Accessed August 22, 2021.

★ = Approximate Site location

ANCHOR QEA

Exhibit E-3

1776 Shoreline and 1838 Property Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York

Source Lionel Pincus and Princess Firyal Map Division, The New York Public Library. (1855). *Plate 3: Map bounded by East River, Brooklyn Navy Yard, York Street, Bridge Street* Retrieved from https://digitalcollections.nypl.org/items/510d47e0-c000-a3d9-e040-e00a18064a99

★ = Approximate Site location

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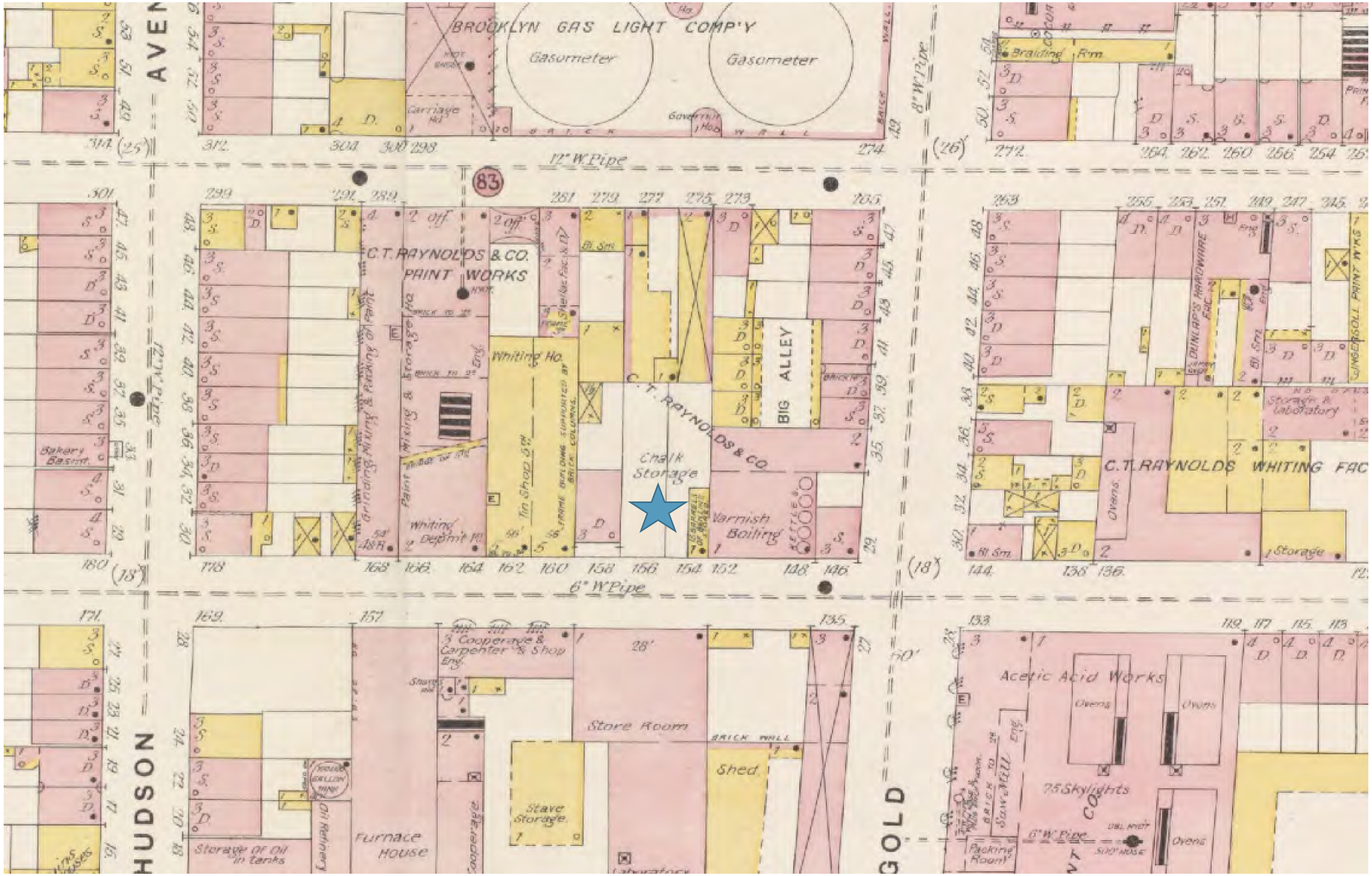
Exhibit E-4
1855 Perris Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York



Source Lionel Pincus and Princess Firyal Map Division, The New York Public Library. "Brooklyn V. 2, Double Page Plate No. 35 [Map bounded by Water St., Bridge St., East River, Little St.]" New York Public Library Digital Collections. Accessed August 28, 2021. https://digitalcollections.nypl.org/items/7ac9917a-0365-0aeb-e040-e00a18063919

★ = Approximate Site location

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Exhibit E-5
1887 Sanborn Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York

Source: US Geographical Survey National Geospatial Program – Historical Topographical Maps – Preserving the Past. file:///C:/Users/mcarrillo-sheridan/Downloads/NY_Brooklyn_8033200_1889_62500_geo.pdf. Accessed September 15, 2021.

★ = Approximate Site location

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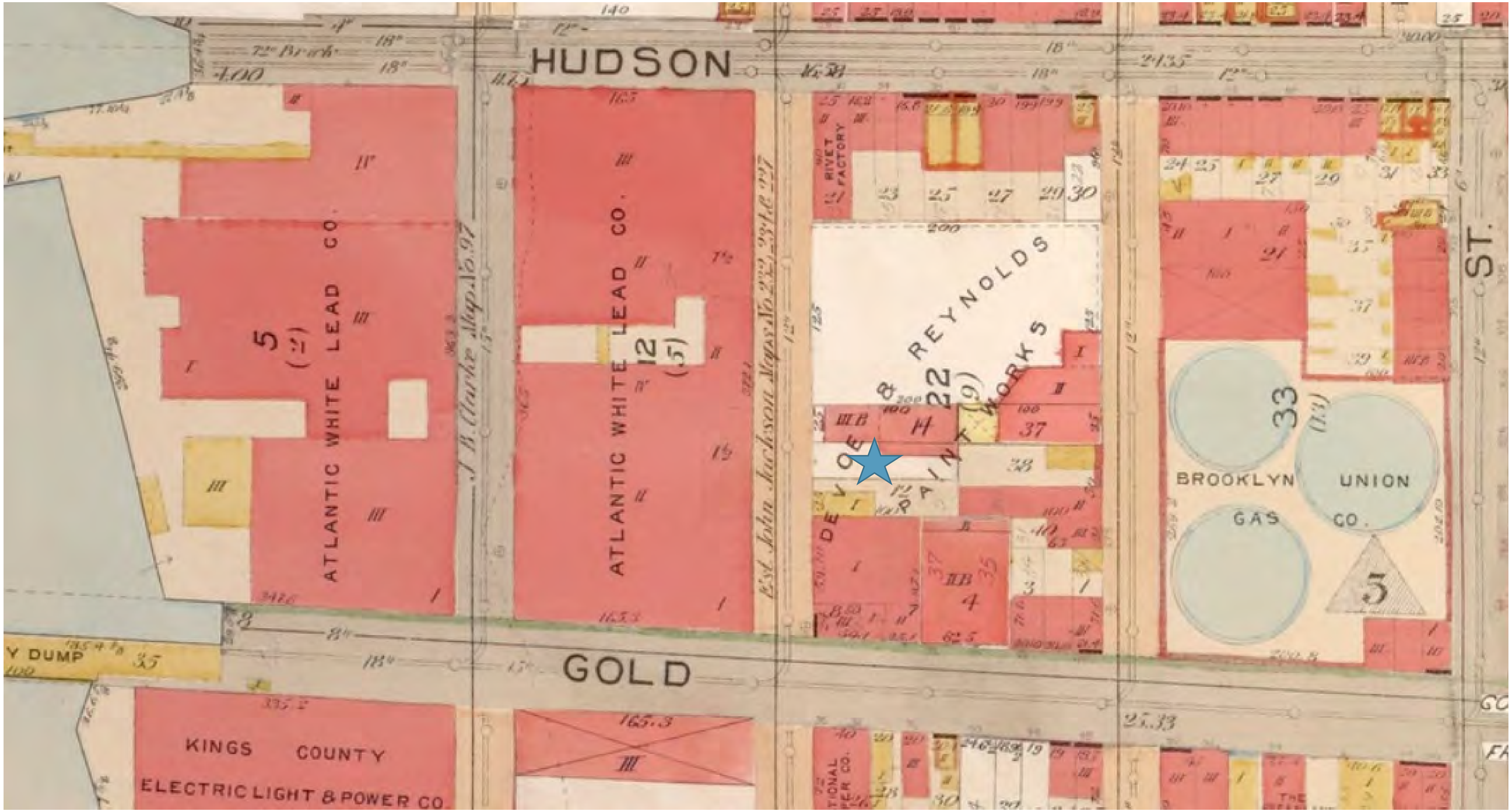
ANCHOR QEA

Exhibit E-6
1889 Topographic Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York



Lionel Pincus and Princess Firyal Map Division, The New York Public Library. "Brooklyn, Vol. 1, Double Page Plate No. 2; Part of Wards 2 & 5, Section 1; [Map bounded by Little St., Evans St., Hudson Ave., Navy St.; Including Concord St., Jay St., Marshall St.]" New York Public Library Digital Collections. Accessed August 28, 2021.
https://digitalcollections.nypl.org/items/64b4acd6-f0f6-4e40-e040-e00a18063442

★ = Approximate Site location

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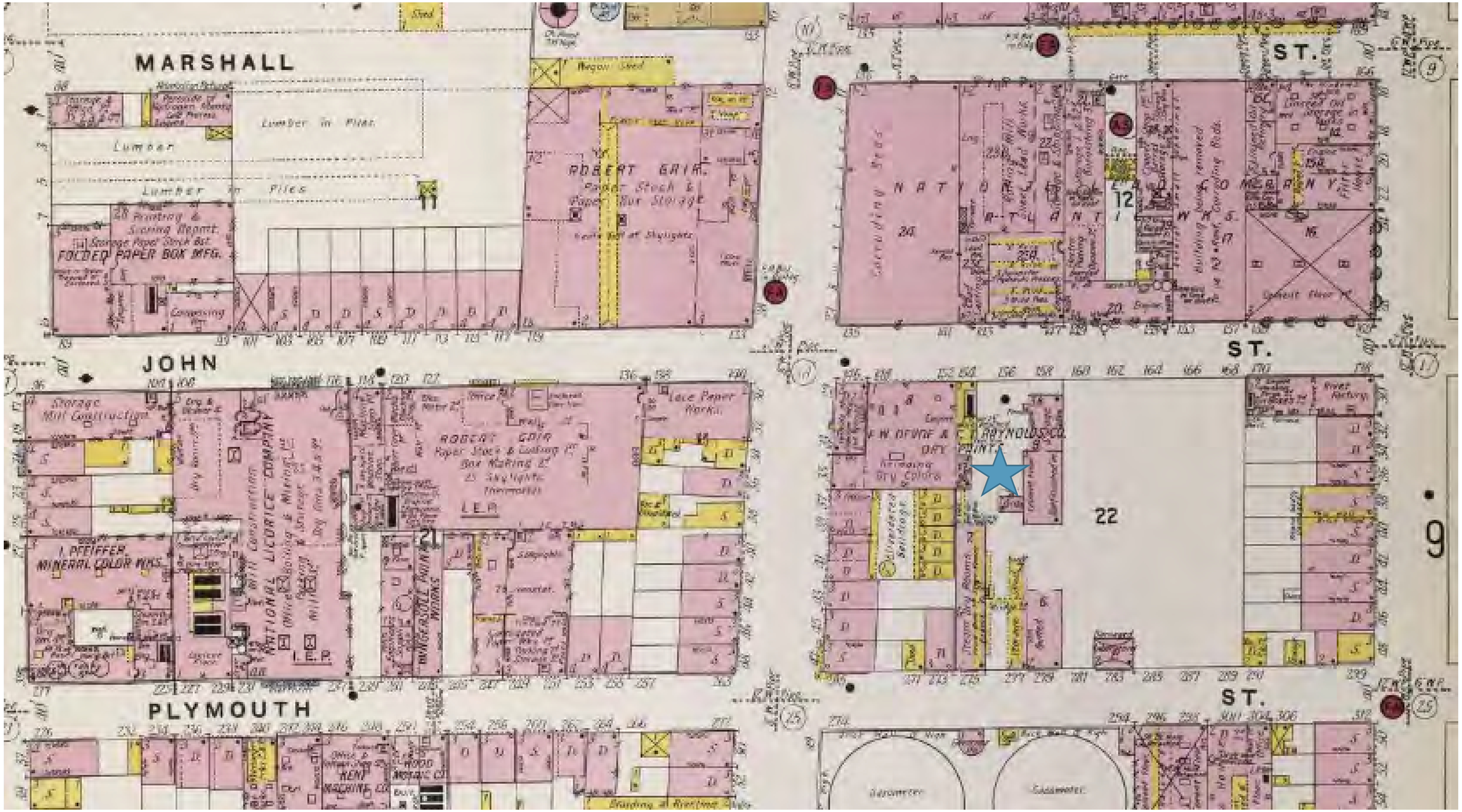
Exhibit E-7
1903 – 1907 City Atlas Map by E.B. Hyde,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York



Source: *Sanborn Fire Insurance Map from Brooklyn, Kings County, New York*. Sanborn Map Company, to 1908 Vol. 2, 1904. Map. https://www.loc.gov/item/sanborn05791_014/.

★ = Approximate Site location

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ANCHOR QEA

Exhibit E-8
1904 Sanborn Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York

Source: Lionel Pincus and Princess Firyal Map Division, The New York Public Library. "Brooklyn, Vol. 1, Double Page Plate No. 1; Part of Wards 1, 2, 4 & 5, Section 1; [Map bounded by East River, Gold St., Hudson Ave., Little St.; Including Navy St., Johnson St., Pierrepont St.]; Sub Plan No. 1; [Map bounded by Hudson Ave., East River, U.S. Navy Yard; Including Little St., Marshall St.]" New York Public Library Digital Collections. Accessed August 28, 2021. https://digitalcollections.nypl.org/items/6c05633e-3bde-b9cf-e040-e00a18063bc7

★ = Approximate Site location

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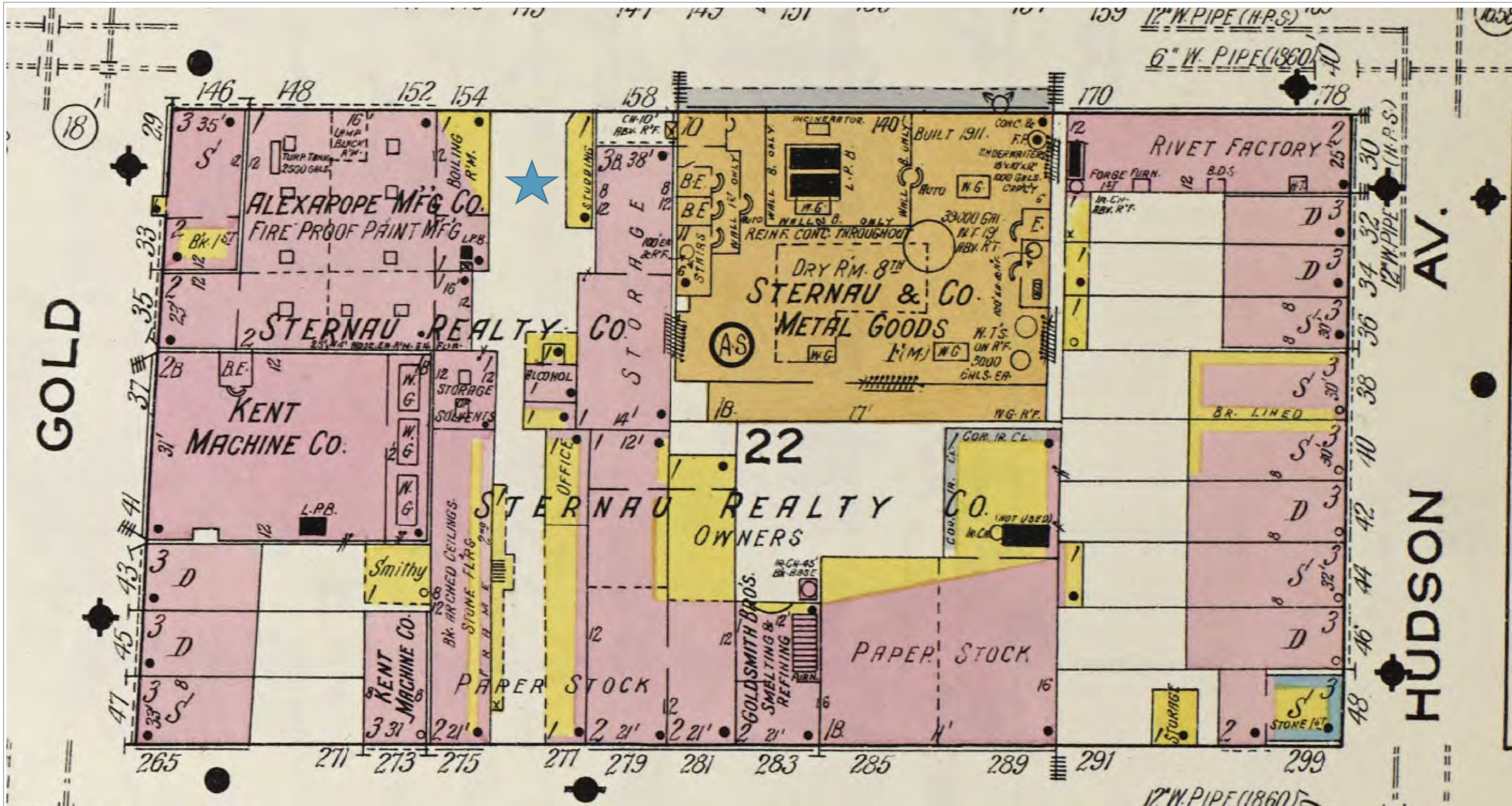
Exhibit E-9
1916 City Atlas Map by E.B. Hyde
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York



Source: *Sanborn Fire Insurance Map from Brooklyn, Kings County, New York*. Sanborn Map Company, to 1933 Vol. 2, 1915. Map. https://www.loc.gov/item/sanborn05791_033/.

★ = Approximate Site location

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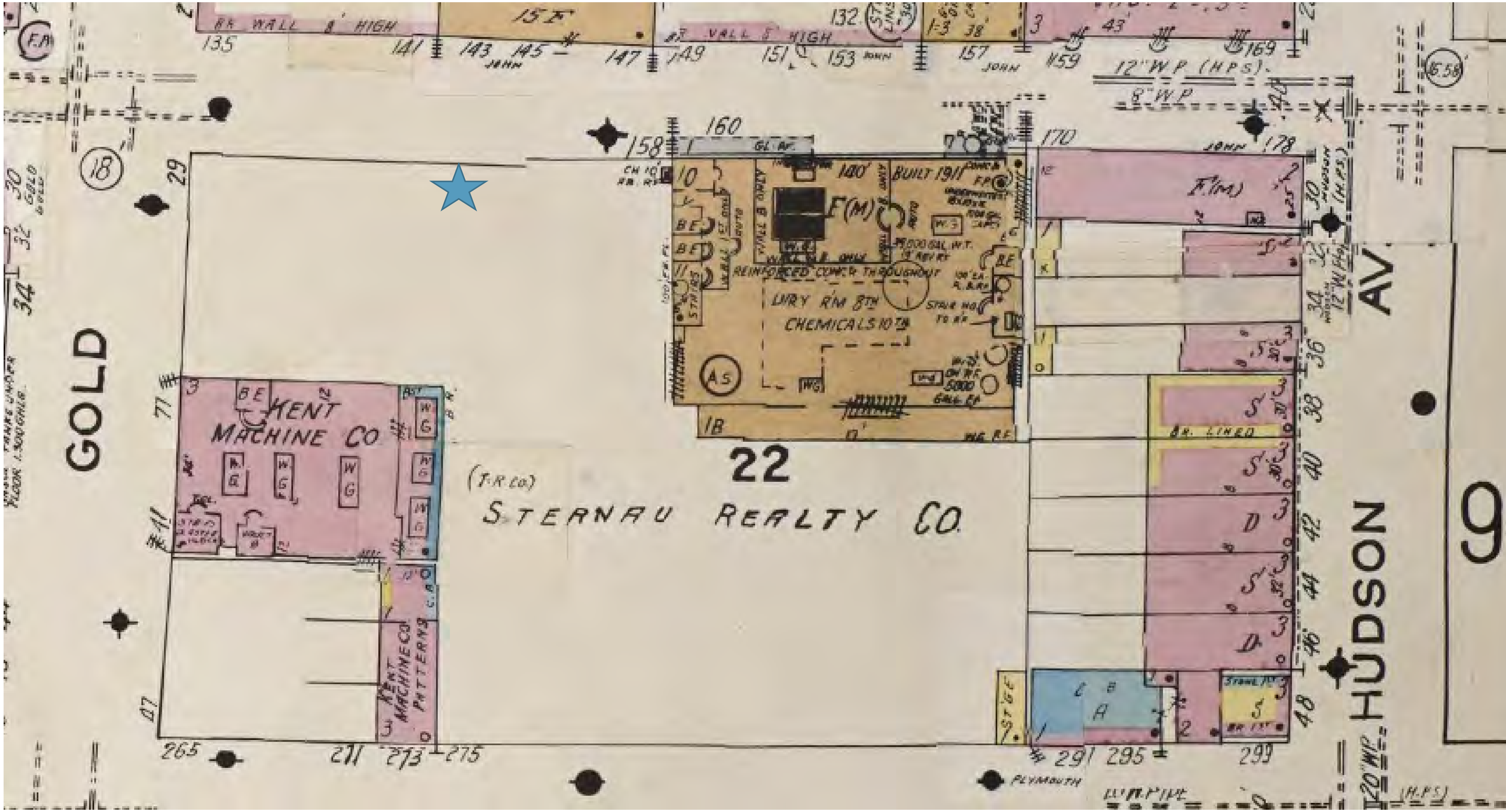
ANCHOR QEA

Exhibit E-10

1933 Sanborn Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York



Source: *Sanborn Fire Insurance Map from Brooklyn, Kings County, New York*. Sanborn Map Company, Vol. 2, - Nov 1950, 1950. Map. https://www.loc.gov/item/sanborn05791_060/.

★ = Approximate Site location

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ANCHOR QEA

Exhibit E-11

1950 Sanborn Map,
Consolidated Edison Company of New York, Inc.
164 John Street, Brooklyn, New York