June 30, 2017

SECANT WALL INTERIM REMEDIAL MEASURE (IRM) WORK PLAN

Halletts Point Building 2
Halletts Point Building 3
Site No. C241192
26-40 1st Street
Astoria, Queens, New York

Prepared for:

HALLETTS BUILDING 2 SPE LLC AND
HALLETTS BUILDING 3 SPE LLC
One Bryant Park
New York, New York 10036

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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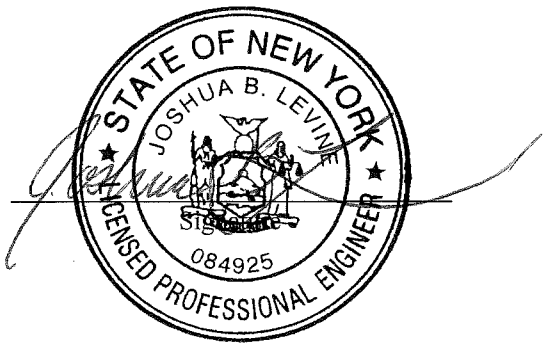
CERTIFICATION

I, Joshua B. Levine, certify that I am currently a NYS registered professional engineer and that this Interim Remedial Measure (IRM) Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and the BCP Agreement for the Site.



Joshua B. Levine, P.E.
NYS Professional Engineer #084925

June 30, 2017
Date

Signature

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) and Remedial Engineering, P.C. (Remedial Engineering) have prepared this Interim Remedial Measure (IRM) Work Plan (IRMWP) on behalf of Halletts Building 2 SPE LLC and Halletts Building 3 SPE LLC (Volunteers) to detail the scope of work for the secant wall installation at the Halletts Point Building 2 and the 26th Avenue street stub (Tax Block 916, Lot 10, and Tax Block 913, Lot 100, respectively); and Halletts Point Building 3 and the 27th Avenue street stub (Tax Block 916, Lot 1, and Tax Block 490, Lot 250, respectively), in Astoria, Queens, New York (Site). The Site address is collectively referred to as 26-40 1st Street, Astoria, New York. A Site Location Map is provided as Figure 1. The IRM will be the first phase of the overall remediation and redevelopment of the Site.

The Volunteers entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) with an effective date of March 27, 2017 to investigate and remediate the 2.98-acre Site. Unrestricted and Restricted Residential uses as defined in 6 New York Codes, Rules, and Regulations (NYCRR) Part 375-6 Environmental Remediation Programs are proposed for the Site. Currently, the Site is fenced and is being used as a construction staging area for the adjacent Building 1 site redevelopment. The Site buildings are being demolished in May- June 2017. The Site is located in an area zoned as Residential and Commercial. When the proposed development is completed, the Site usage will contain mixed-use development including housing, open space/esplanade, retail, and parking.

This IRMWP has been prepared in accordance with NYSDEC procedures set forth in the document titled DER-10 Technical Guidance for Site Investigation and Remediation, dated May 2010, and complies with all applicable Federal, State and local laws, regulations and requirements.

1.1 Objectives and Scope of the Secant Wall IRM Work Plan

The proposed Secant Wall IRM outlines the soil handling and disposal procedures resulting from the installation of a secant barrier wall around the perimeter of the Site. Prior to commencing installation of the secant barrier wall, site preparation activities consisting of a temporary guide wall installation, test pitting, and secant test piles will be completed.

A Community Air Monitoring Plan (CAMP), Health and Safety Plan (HASP) and Soil Erosion and Sediment Control Plan (SESCP) provided herein will apply to all of the work covered under this Secant Wall IRM. A separate Remedial Action Work Plan (RAWP) documenting the proposed site-wide remediation will be submitted to NYSDEC following completion of the Remedial Investigation in July 2017.

The soil and groundwater beneath the Site will be encapsulated by a concrete perimeter secant pile barrier wall and capped by a concrete building foundation equipped with a waterproof/vapor barrier. The perimeter barrier wall will extend from beneath the building foundation into the bedrock. The Site will be excavated to elevation -2.0' to accommodate the construction of the proposed building foundation and cellar areas, with greater depths in certain areas (elevator pits, mechanical pits, etc.) and as required for the construction of pile caps and footings. This Secant Wall IRM covers the secant pile barrier wall installation and the separate RAWP will address the future excavation and foundation construction.

It is anticipated that contaminated soil generated while constructing the secant wall barrier may be stockpiled onsite for a few days prior to transport and disposal.

A Site Plan including the location of the secant pile barrier wall is presented in Figure 2. The IRM is a component of the overall remedy for the Site. This will advance the BCP goals, but will not complete the investigation or remediation of the Site.

The remainder of this IRM Work Plan is organized as follows:

Section 2: Site Background

Section 3: Scope of Work

Section 4: Soils/Materials Management Plan

Section 5: Reporting

Section 6: IRM Work Plan Implementation Schedule

2.0 SITE BACKGROUND

Relevant Site background information is presented in this section.

2.1 Site Description and Setting

The Site limits include up to the approximate limits of the proposed bulkhead line and the waterfront esplanade area (within Block 490 Lot 250 and Block 913 Lot 100) encompassing an area of approximately 2.98 acres. Figure 2 present the location of the Site limits. A summary of the acreage is provided below.

- Portion of Block 490 Lot 250 (formerly 27th Avenue street stub) – 0.32 acres;
- Portion of Block 916 lot 1 – 1.02 acres;
- Portion of Block 916 10 – 1.48 acres; and
- Portion of Block 913 Lot 100 (formerly 26th Avenue street stub) – 0.16 acres.

Property Location	
Property Name:	Halletts Point Buildings 2 and 3
Property Address:	26-02 1st Street (Building 2 and 26th Avenue) 26-40 1st Street (Building 3 and 27th Avenue)
Property Town, County, State:	Astoria, Queens, New York
Property Tax Identification:	Tax Block 916, Lot 10, and Tax Block 913, Lot 100 (Building 2 and 26th Avenue); and Tax Block 916, Lot 1, and Tax Block 490, Lot 250 (Building 3 and 27th Avenue)
Property Topographic Quadrangle:	Central Park, New York
Nearest Intersection:	27th Avenue and 1st Street
Area Description:	The Site is located in an urban and developed area. The Site is bordered by Whitey Ford Field to the north, Block 490 Lot 1 to the south, the East River to the west, and 1st Avenue to the east. The surrounding properties are currently used for a combination of park space, high density residential housing, manufacturing and commercial. The nearest residential property is located southeast of the Site (diagonally across 1st Street and 27th Avenue).

A Site Location Map is included as Figure 1.

Property Information	
Property Acreage:	2.98 acres (total)
Property Shape:	Irregular
Property Use:	Lot 10 is occupied by New Line Structures, the general contractor for the redevelopment of the property located at 26-01 1st Street (Block 915, Lot 6); Lot 1 is vacant; Lot 250 is the 27th Avenue Street stub, occupied by Navillus Contracting, a general contracting and construction company, for automobile parking and equipment storage; and Lot 100 is the 26th Avenue Street stub, currently unoccupied land.
Improvements:	Lot 10 is improved with office space and storage of construction equipment with a yard utilizing for automobile parking.

2.1.1 Property Operations

According to the Phase I Environmental Site Assessment (ESA) prepared for the Volunteers by Roux Associates in 2017 (Roux Associates, 2017), the Site was historically occupied by various commercial, industrial, and utility establishments, including an apparent coal gasification plant, a coal-fired electric generating station, several stone cutting and polishing establishments, machine works, a lumber yard, a manufacturer of masonry building blocks, a manufacturer of hampers, and a scaffold manufacturer.

Roux Associates used a computerized environmental database and radius map report prepared by EDR to conduct a government records database search of properties of potential environmental concern within a maximum of one-mile radius of the Site, and to see if the Site was identified in any environmental databases.

When the proposed development is completed, the Site usage will contain mixed-use development including housing, open space/esplanade, retail, and parking.

The Site was identified in the following searched environmental databases:

1. The New York City E-Designation Environmental Review Program. An E-designation exists for Lots 1 and 10 of the Site. An E-Designation is a New York City Zoning Map designation that indicates the presence of an environmental requirement regarding potential hazardous materials contamination, air quality and/or noise attenuation on a particular tax lot. E-Designations are established by the Department of City Planning and City Council as part of a zoning change including a new development or change in use. An E-

Designation (i.e., environmental requirement) was assigned to Block 916, Lot 10 of the Site: E-309 for Window Wall Attenuation & Alternate Ventilation; Hazardous Materials; and Air Quality. Additionally, an E-Designation was assigned to Block 916, Lot 1 of the Site: E-309 for Window Wall Attenuation & Alternate Ventilation and Hazardous Materials. The E-Designations for Lot 1 and 10 became effective as of October 10, 2013. These environmental requirements must be satisfied under the administration of the New York City Office of Environmental Remediation (OER).

2. NYSDEC Spills. The property, identified as 26-02 1st Street (Lot 10), is associated with the NYSDEC Spill No. 9811649, which was assigned to the above address on December 16, 1998. The spill incident involved approximately 3 gallons of antifreeze to leak from a backhoe located in the street. No sewers or waterways were affected and the spill was declared closed by the NYSDEC on February 3, 2003. Based on the status of the spill and location in the street the spill is not considered an environmental concern.

   In addition, the property identified as Waterfront, located at 27th Avenue and 1st Street is associated with NYSDEC Spill #0203472, which was assigned during bulkhead construction on July 2, 2002. A tank was struck and leaked into the waterway. The spill was declared closed by the NYSDEC on March 7, 2003.

2.1.2 Utilities

Natural gas service and electric service are available to the entire Site from Consolidated Edison Corporation of New York (ConEd).

2.1.3 Topography

The grade at the Site is relatively flat. The elevation of the Site ranges from approximately 5 to 12 feet above mean sea level (amsl), as indicated by the EDR Radius Map Report and historic topographic maps.

2.1.4 Wetland Areas and Surface Water Bodies

The nearest regulated wetland is reportedly located outside of a one-mile radius from the Site and across the East River (Central Park). The nearest significant surface water body is the East River, which borders the Site to the west. The Site is located in a 100-year flood zone.

2.1.5 Soils

The geologic investigation during the 2014 RI concluded that Site soils are generally characterized by historic fill from ground surface to bedrock consisting of anthropogenic materials such as brick, concrete, ash, and coal with intermittent sandy and/or gravely silt and silty sand layers. Dark brown silt and organic peat is present in deeper soils, consistent with historical river deposits.

2.1.6 Underlying Bedrock Formation

The bedrock in the area of the Site is highly variable and consists primarily of metamorphic rock. In the direct vicinity of the Site, bedrock consists of Manhattan Formation (schist) underlain by the Inwood Formation (marble). This is consistent with what Roux Associates observed during the 2014 RI and consistent with the majority of results from previous reports. Bedrock was encountered at a depth of approximately 9 to 23 feet below land surface (bls).

2.1.7 Groundwater/Hydrogeology

Based on Roux Associates' understanding at the Site, groundwater flow at the Site is from east to west towards the East River. It is suspected that groundwater under the Site is tidally influenced in proximity to the East River, although a tidal study was not performed to confirm tidal influence.

2.1.8 Neighboring Properties

Review of neighboring properties from the Site and from public thoroughfares, and research of available information regarding the neighboring properties, was performed to identify evidence of environmental concerns that could adversely impact the Site. The areas surrounding the Site are urban and developed with commercial and retail buildings and multifamily residential buildings. General types of development surrounding the Site are:

Neighboring Properties	
North	Whitey Ford Ballfield; East River further north.
South	Navillus Contracting; Halletts Point Playground further south.
East	1st Street; 26-01 1st Street (Block 915, Lot 6) under construction further East.
West	East River.

2.2 Summary of Environmental Conditions

The following environmental reports were reviewed as part of the IRMWP.

- Phase I ESA performed by Property Solutions, Inc. (Property Solutions) on behalf of Halletts A Development Company, LLC, dated October 22, 2008.
- Limited Phase II Subsurface Investigation performed by Property Solutions, Inc. (Property Solutions) on behalf of Halletts A Development Company, LLC, dated October 22, 2008.

- Phase I ESA Updated Letter prepared by Property Solutions, Inc. (Property Solutions) on behalf of LEG Astoria, LLC, dated October 15, 2012.

- Remedial Investigation Report performed by Roux Associates, Inc. (Roux Associates) on behalf of a Confidential Investor, dated January, 2014.

- Phase I ESA performed by Roux Associates, Inc. on behalf of Halletts Astoria LLC, dated September 10, 2014.

- NYSDEC Brownfield Cleanup Program Application, Halletts Building 2 SPE LLC and Halletts Building 3 SPE LLC, November 4, 2016.

- Phase I ESA performed by Roux Associates, Inc. on behalf of Halletts Building 2 SPE LLC and Halletts Building 3 SPE LLC, December 9, 2016.

Property Solutions 2008 Phase I ESA

Roux Associates reviewed a Phase I ESA prepared by Property Solutions on behalf of Halletts A Development Company, LLC, dated October 27, 2008. The 2008 Property Solutions Phase I ESA was reportedly conducted in accordance with the scope and limitations of ASTM Standard Practice E1527-05, USEPA standards and practices for AAI. The following RECs were identified by Property Solutions:

1. Review of fire insurance maps and a historic atlas revealed:
   - The Site is underlain with historic fill.
   - A "gas works" was historically located at Block 916 Lot 1, possibly extending onto Lot 10 of the Site.
   - A machine shop, associated with a coal-fired electric generating station, was historically located on Block 916, Lot 1 of the Site.
   - A repair shop, machine shop and an area occupied by machinists were historically located on adjoining Block 490, Lot 1.
   - "Lumber piles" were located on Block 916, Lot 10. "Wood dipping" was depicted on adjoining Block 490, Lot 11.

   Property Solutions recommended a Limited Phase II Subsurface Investigation to evaluate these areas.

2. Based on a 1988 city permit referenced in a report from 2007, fuel oil USTs may have been located at Block 916, Lot 10. However, no other records (i.e. fire insurance maps, database searches or FDNY records) revealed proof of fuel oil tanks.

Property Solutions recommended a geophysical survey be performed in the vicinity of the former boiler room.

3. A Tank Closure, dated February 26, 1998, documented removal of a registered 3,000 gallon #2 fuel oil UST and soil for the adjacent 27-02 1st Street property (Block 490, Lot 1). No further action was issued by the NYSDEC; however, closure activities did not evaluate potential impacts to groundwater and groundwater contamination was encountered in 1997.

   Property Solutions recommended that groundwater encountered during demolition or construction be sampled for laboratory analysis and be managed in accordance with the analytical results and applicable regulations. In addition, Property Solutions recommended a Limited Phase II Subsurface Investigation based on the delayed response of the closure report and reported presence of soil/groundwater contamination.

4. Floor drainage features were observed in the adjacent 27-02 1st Street property (Block 490, Lot 1). In addition, drums containing unidentified substances and various containers of waste oil were located throughout the Site.

   Property Solutions recommended a Limited Phase II Subsurface Investigation to evaluate these areas. In addition, a hazardous materials survey was recommended to ensure proper identified and disposal.

5. Staining was noted in the northern portion of Block 916, Lot 10, which appeared to be associated with lubricant oil leaks from machinery and vehicles.

   Property Solutions recommended a Limited Phase II Subsurface Investigation to evaluate this area.

<u>Property Solutions 2008 Phase II Subsurface Investigation</u>

Roux Associates reviewed a Phase II Subsurface Investigation performed by Property Solutions on behalf of Halletts A Development Company, LLC, dated October 22, 2008. The Phase II Subsurface Investigation was performed to determine the potential presence/absence of subsurface contamination in the areas of concern (AOC) outlined in the Property Solutions Phase I ESA. The following scope of work and determinations were made by Property Solutions based on the Phase II Subsurface Investigation:

1. AOC-F-01-Gas Works: Eight soil borings (SB-06, SB-08, SB-09, SB-10, SB-20, SB-21, SB-22 and SB-24) were installed in the area related to "gas works" determined by review of the fire insurance maps and a historic atlas. A total of 20 soil samples and one groundwater sample were analyzed for Volatile Organic Compounds (VOCs) Semi-volatile Organic Compounds (SVOCs) and Metals. Total xylenes were detected at a concentration above the NYSDEC Protection of Groundwater and Protection of Ecological Resources guidance. 1,2,4-trimethylbenzene was detected above Protection of Groundwater Soil Cleanup Objectives (SCOs). However, total xylenes and 1,2,4-

trimethylbenzene were detected below Restricted Residential SCOs. Numerous SVOCs were detected above Protection of Groundwater Protection of Ecological Resources SCOs. No metals were detected above respective Restricted Residential SCOs; however, several metals were detected above Protection of Ecological Resources SCOs. No PCBs or pesticides were detected above the NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs). Several VOCs (benzene, ethylbenzene, m&p-xylenes and toluene; naphthalene (only SVOC); and several metals were detected above their respective AWQSGVs.

Four additional soil borings were installed to delineate detections from the previous investigation. Four soil samples and one groundwater sample were analyzed for VOCs, SVOCs and metals. Naphthalene and ethylbenzene were the only VOCs detected above POW SCOs, from any soil samples. No VOCs were detected above Restricted Residential SCOs. Several SVOCs and metals were detected above respective guidance values. Naphthalene and several metals were the only detections above respective AWQSGVs.

2. AOC-F-02-Fill: Two soil borings were installed to delineate the presence of urban fill at the Site. Two soil samples were analyzed for VOCs, SVOCs, metals, pesticides, formaldehyde, phenolics and pH. Two additional samples were analyzed for SVOCs. Toluene was the only VOC detected. However, the results were lower than Restricted Residential SCOs; no VOCs were detected above Restricted Residential SCOs. Several SVOCs and metals were detected above respective guidance values. Naphthalene and several metals were the only detections above respective AWQSGVs.

   In addition, a test pit was dug to delineate the presence of urban fill at the Site. Three soil samples were analyzed for VOCs, SVOCs, metals, pesticides, PCBs and pH. One groundwater sample was analyzed for VOCs, SVOCs, metals, PCBs, pesticides, formaldehyde, TOC and phenols. No VOCs, PCBs and pesticides were detected in any of the soil samples. SVOCs were detected; however, known detected above Restricted Residential SCOs. Several metals were detected above respective AWQSGVs from the groundwater sample. Two additional test pits were dug; groundwater was not encountered in either test pit. Two soil samples were analyzed for SVOCs and metals. No SVOCs were detected above Restricted Residential SCOs. Several metals were detected above Protection of Ecological Resources SCOs and only chromium was detected above Protection of Groundwater SCOs.

3. AOC-F-03-Machine South: One soil boring was installed to investigate this AOC. One soil sample was analyzed for VOCs and only trichloroethene was detected (below Restricted Residential SCOs).

4. AOC-F-04-Machine North: One soil boring was installed to investigate this AOC. One soil sample was analyzed for VOCs and only toluene was detected (below Restricted Residential SCOs).

5. AOC-F-05-Drains: Five soil borings were installed to investigate this AOC. Five soil samples were analyzed for VOCs, metals and PCBs; and eight were analyzed for SVOCs. Several VOCs were detected below Restricted Residential SCOs. Several SVOCs were detected above respective Restricted Residential SCOs. Several metals were detected

above Protection of Groundwater and Protection of Ecological Resources SCOs, yet were below Restricted Residential SCOs. Only cobalt was detected above Restricted Residential SCOs.

One additional boring was installed and one sample was collected for Toxicity Characteristic Leaching Procedure (TCLP) waste characterization and Resource Conservation and Recovery Act (RCRA) characterization. According to the lab results, the sample was considered non-hazardous.

6. AOC-F-06-Staining: One soil boring was installed to investigate this AOC. One soil sample was analyzed for VOCs, SVOCs, metals, pesticides, formaldehyde, phenolics and pH. VOCs, phenolics and pesticides were not detected. Formaldehyde was detected; however, there is no NYSDEC standard or SCO. Several SVOCs and chromium (only metal) were detected, however all below respective Restricted Residential SCOs.

   In addition, a test pit was dug in this area of the Site. Three soil samples were analyzed for VOCs, SVOCs, metals, pesticides, PCBs and pH. One groundwater sample was analyzed for VOCs, SVOCs, metals, PCBs and pesticides. VOCs, PCBs and pesticides were not detected in any of the soil samples. SVOCs were detected, but were below Restricted Residential SCOs. No VOCs, SVOCs, pesticides or PCBs were detected in the groundwater sample. Several metals were detected above respective AWQSGVs.

7. AOC-F-07-Boiler-UST-01: One soil boring was installed to investigate this AOC. One soil sample was analyzed for VOCs, SVOCs and New York Spills Technology and Remediation Series (STARS) VOCs/SVOCs. No VOCs or STARS VOCs were detected. Several SVOCS were detected, but were below Restricted Residential SCOs.

8. AOC-F-08-Boiler-UST-02: Two soil borings were installed to investigate this AOC. One soil sample was analyzed for VOCs, SVOCs and STARS VOCs/SVOCs. No VOCs or STARS VOCs were detected. Several SVOCS were detected, but were below Restricted Residential SCOs.

9. AOC-F-09-Lumber: One soil boring was installed to investigate this AOC. One soil sample was analyzed for VOCs, SVOCs, metals, pesticides, formaldehyde, phenolics and pH. According to Property Solutions, soil sample results for this sample overlap samples collected correlating to AOC-F-02-Fill.

   In addition, a two test pits were dug in this area of the Site. Three soil samples were analyzed for VOCs, SVOCs, metals, pesticides, PCBs and pH. No VOCs, SVOCs, PCBs or pesticides were detected in any of the soil samples. Several metals were detected above Protection of Ecological Resources SCOs and only chromium was detected above Protection of Groundwater SCOs.

10. AOC-F-10-Sediment and Surface Water: One surface water sample was collected from along the shoreline of the East River. Due to the presence of large rocks along the bank of the East River, a sediment sample could not be collected. The surface water sample was analyzed for VOCs, SVOCs, metals, PCBs, pesticides, formaldehyde, TOC and phenols.

VOCs, SVOCs, PCBs, pesticides, formaldehyde and phenols were non-detect. Copper was detected above NYSDEC Protection of Fish Propagation for saline waters.

VOC detections (AOC-F-01) may be related to a possible release associated with historic operations or from an upgradient property. Metal detections were likely due to turbidity and/or background concentrations. Property Solutions recommended site wide soil characterization to meet requirements for the New York State Brownfields Cleanup Program (BCP).

Property Solutions 2012 Phase I ESA Update

Roux Associates reviewed a Phase I ESA Update prepared by Property Solutions on behalf of LEG Astoria, LLC, dated October 15, 2012. The Phase I ESA Update was designed to provide an update on the environmental condition of the Site as of October 15, 2012 and to address property operations and any areas of concern associated with operations that occurred since their original 2008 Phase I ESA, as well as to perform a review of regulatory records and updated environmental database report. Additional AOCs included numerous containers and drums of various materials possibly stored inappropriately, unlabeled or in poor condition (AOC-11). AOC-12 includes staining from a makeshift oil transfer station. AOC-12 was denoted for unidentified sumps and pits.

Roux Associates' 2014 Remedial Investigation Report

In November-December 2013, Roux Associates performed a Remedial Investigation at the Site. A total of 16 soil borings, eight groundwater monitoring wells and 14 sub-slab soil vapor points were installed and sampled throughout the Site. Several soil, groundwater, and soil vapor exceedances of respective guidance were encountered and are discussed briefly below.

Soil

1. No VOCs were detected above Restricted Residential SCOs in any soil samples collected.
2. Several SVOCs (mostly polyaromatic hydrocarbons (PAHs) were detected.
3. The detection of metals in the subsurface soil is typical of urban and industrialized areas.
4. No pesticides or PCBs were detected above Restricted Residential SCOs in any soil samples collected.

Groundwater

1. No VOCs were detected above AWQSGVs in any groundwater samples collected.

2. No SVOCs were detected above AWQSGVs in any groundwater samples collected.

3. Several metals were detected above AWQSGVs in both filtered and unfiltered samples. This is indicative of saltwater intrusion from the East River which is tidal influenced. In addition, Antimony was detected above AWQSGVs.

4. No PCBs were detected above AWQSGVs in any groundwater samples collected.

5. Pesticides were detected in two groundwater samples collected.

Soil Vapor

1. Petroleum-related VOCs and chlorinated VOCs were detected in several soil vapor samples throughout the Site.

Roux Associates 2014 Phase I ESA

Roux Associates reviewed the previous Phase I ESA prepared by Roux Associates on behalf of Halletts Astoria LLC, dated September 10, 2014. The Phase I ESA was conducted in accordance with the scope and limitations of ASTM Standard Practice E1527-13, USEPA standards and practices for AAI. The following RECs were identified by Roux Associates:

1. According to reviewed historical records, an E-Designation (i.e., environmental requirement/restriction) was assigned to the Site for Hazardous Materials; Window Wall Attenuation & Alternate Ventilation (Noise); and Air Quality. According to the EDR Radius Report Site Identification E-309 was assigned as of October 10, 2013. These environmental requirements must be satisfied under the administration of the New York City Office of Environmental Remediation (OER).

2. Former Site Usage: Tisdale Lumber Co occupied the Site from as early as 1928 until 1948. According to previous reports and Certified Sanborn maps, the storage of "dipped wood" occurred on-site. Historic wood dipping operations were commonly associated with the applications of creosote and other preservatives containing hazardous substances. In addition, coal storage occurred in the southwest corner of the Site

3. Adjacent Property Past Usage: Several adjacent properties were listed in numerous databases as reported in the EDR Radius Report.

4. According to Property Solutions Phase II Subsurface Investigation Report, groundwater at the Site was impacted with VOCs, SVOCs and Metals. During Roux Associates' 2014 Remedial Investigation, subsurface soil, soil vapor and groundwater impacts were detected.

The following historical recognized environmental conditions (HRECs) in connection with the Site were identified as a result of the completion of this Phase I ESA:

1. Adjacent Property: Spill No. 9700450 was assigned to 27-02 1st Street on April 8, 1997 regarding soil contamination encountered during drilling activities. The spill was declared closed on March 3, 1998; no details regarding spill remediation available.

Although not technically defined as RECs, the following is a list of potential environmental concerns at the Site that could potentially impact subsurface conditions at the Site:

1. Based on information from previous investigations, the Site is underlain by historical urban fill material from an unknown origin.

2. Any subsurface materials encountered should be handled and/or disposed according to all applicable regulations.

3. Any suspected lead-based paint or asbestos-containing materials should be properly managed if the materials are to be disturbed during future redevelopment activities.

Roux Associates 2016 Brownfields Cleanup Program Application

Roux Associates submitted a BCP Application to NYSDEC for the subject Site on November 4, 2016. The BCP Application was deemed complete by NYSDEC on November 22, 2016 and the 30-day BCP Application public comment period commenced on November 30, 2016. The Volunteers were accepted into the BCP on January 31, 2017, and the Site was assigned Site Number C241192. The executed BCA is dated March 27, 2017.

Roux Associates 2016 Phase I ESA

Roux Associates performed a Phase I ESA for the Volunteers in December 2016. The following RECs in connection with the Site were identified as a result of the completion of the Phase I ESA:

1. According to reviewed historical records, an E-Designation (i.e., environmental requirement/restriction) was assigned to the Site for Hazardous Materials; Window Wall Attenuation & Alternate Ventilation (Noise); and Air Quality. According to the EDR Radius Report Site Identification E-309 was assigned as of October 10, 2013. These environmental requirements must be satisfied under the administration of the New York City Office of Environmental Remediation (OER).

2. Former Site Usage: Tisdale Lumber Co occupied the Site from as early as 1928 until 1948. According to previous reports and Certified Sanborn maps, the storage of "dipped wood" occurred on-site. Historic wood dipping operations were commonly associated with the applications of creosote and other preservatives containing hazardous substances. In addition, coal storage occurred in the southwest corner of the Site.

3. Adjacent Property Past Usage: Several adjacent properties were listed in numerous databases as reported in the EDR Radius Report.

4. According to Property Solutions 2008 Phase II Subsurface Investigation Report, groundwater at the Site was impacted with VOCs, SVOCs and Metals. During Roux Associates' 2014 Remedial Investigation, subsurface soil, soil vapor and groundwater impacts were also detected.

The following historical recognized environmental conditions (HRECs) in connection with the Site were identified as a result of the completion of this Phase I ESA:

1. Adjacent Property: Spill No. 9700450 was assigned to 27-02 1st Street on April 8, 1997 regarding soil contamination encountered during drilling activities. The spill was declared closed on March 3, 1998; no details regarding spill remediation available.

Although not technically defined as RECs, the following is a list of potential environmental concerns at the Site that could potentially impact subsurface conditions at the Site:

1. Based on information from previous investigations, the Site is underlain by historical urban fill material from an unknown origin.

2. Any subsurface materials encountered should be handled and/or disposed according to all applicable regulations.

2.2.1 Soil

Soil Detections in Excess of Part 375 of Restricted Residential Use SCOs during the 2014 RI are presented as Plate 2 of the RIWP. A summary of VOCs, SVOCs, metals, PCBs, pesticides, and TCLP metals in soil during the 2014 RI are provided as Tables 1 through 7 of the RIWP. SVOC contamination is present throughout the Site with the highest concentrations located within the western property extent and within the center of Block 916 Lot 1. Common SVOCs that were detected in exceedance of the NYSDEC Part 375 Restricted Residential SCOs include the following:

SB-FN-07/15-17 (Lot 1):

- benzo[a]anthracene (maximum of 230,000 µg/kg)
- benzo[a]pyrene (maximum of 94,000 µg/kg)
- benzo[b]fluoranthene (maximum of 88,000 µg/kg)
- benzo[k]fluoranthene (maximum of 28,000 µg/kg)

- dibenzo[a,h]anthracene (maximum of 25,000 µg/kg)
- indeno[1,2,3-c,d]pyrene (maximum of 30,000 µg/kg)

0663-SB-04/2-4 (Lot 10):

- benzo[a]anthracene (maximum of 76,000 µg/kg)
- benzo[a]pyrene (maximum of 59,000 µg/kg)
- benzo[b]flouranthene (maximum of 76,000 µg/kg)
- indeno[1,2,3-c,d]pyrene (maximum of 27.000 µg/kg

Polycyclic aromatic hydrocarbons (PAHs) were detected above the Restricted Residential SCOs in most of the borings.

Isolated exceedances of the Restricted Residential SCOs for metals (arsenic, chromium, lead and mercury) were detected mostly in shallow soils, 0-2 feet below land surface (ft-bls), at various locations throughout the Site. Mercury was the most common metal detected with a maximum concentration of 2.96 mg/kg detected within Block 916 Lot 1 near southeastern boundary at location 1167-SB-20 (4-6 ft-bls) and 1.28 mg/kg detected within Block 916 Lot 10 near the northwestern boundary at location 0063-TP-03 at 5.5 to 6 ft-bls.

2.2.2 Groundwater

Groundwater Detections in Excess of AWQSGVs during the 2014 RI are presented as Plate 3 of the RIWP. A summary of VOCs, SVOCs, metals, PCBs, and pesticides in groundwater during the 2014 RI are provided as Tables 8 through 12 of the RIWP. VOCs were detected at concentrations above AWQSGVs in two monitoring wells located downgradient of the former manufactured gas tanks. VOCs of concern include the following:

- benzene (maximum of 8.1 µg/L in MW-FN-05);
- ethylbenzene (7 µg/L in MW-FN-05);
- m+p-xylene (6.2 µg/L in MW-FN-05);
- naphthalene (72 µg/L in MW-FN-05); and
- toluene (5.7 µg/L in MW-FN-05).

SVOCs were detected in groundwater throughout block 916 lot 1 above the AWQSGVs with the highest concentrations detected downgradient of the former MGP. A few of the common compounds of concern included the following:

- benzo[a]anthracene (maximum of 0.32 µg/L in MW-FN-05);
- benzo[a]pyrene (maximum of 0.21 µg/L in MW-FN-08); and
- benzo[b]fluoranthene (maximum of 0.26 µg/L in MW-FN-08).

Several metals including iron, manganese, selenium, and sodium were detected at concentrations above AWQSGVs in both filtered and unfiltered groundwater samples throughout the Site. Lead was detected above AWQSGVs in unfiltered samples only MW-FN-01 and MW-FN-07. Antimony was detected in filtered samples in MW-FN-06 (4.8 µg/L). Thallium was detected above AWQSGVs in filtered samples collected in 2008 from location 1167-SB-08 (5 µg/L); and in downgradient filtered samples collected in 2013 at MW-FN-06 (0.76J µg/L).

Dieldrin was the only pesticide detected in groundwater at concentrations above AWQSGVs. Dieldrin exceedances were located along the western boundary within block 916 lot 1 at MW-FN-06 (0.023 µg/L) and MW-FN-08 (0.015 µg/L).

2.2.3 Soil Vapor

Soil Vapor Detections during the 2014 RI are presented as Plate 4 of the RIWP. A summary of VOCs in soil vapor from the 2014 RI is provided as Table 13 of the RIWP. All soil vapor samples contained low-level detections of both petroleum-related VOCs and chlorinated VOCs. Tetrachloroethene (PERC) is the prominent chlorinated VOC of concern detected throughout block 916 lots 1 and 10. The concentrations of detected PERC range between 50.9 µg/m^3 in SV-FN-04 and 8.34 µg/m^3 in SV-FN-10. Trichlorofluoromethane (Freon-11) and 1,1,1-trichloroehtane were also detected throughout the Site with the highest concentrations detected within the center of lot 1 at location SV-FN-04 at concentrations of 25.3 µg/mg3 and 220 µg/mg3, respectively. Plate 4 shows the soil vapor sample locations and all detected concentrations of VOCs. No indoor air samples were collected.

3.0 SCOPE OF WORK

The scope of work for the IRM consists of the following tasks:

- Obtain all necessary permits, insurance, bonds, and licenses to complete all work and pay all necessary fees for the permits obtained;
- Verification of utility locations;
- Site mobilization and Site preparation;
- Provision of all temporary facilities and utilities;
- Provision of site security measures;
- Provision of health and safety services for the contractors' employees in accordance with the CHASP;
- Setup and maintenance of all traffic control measures;
- Setup and maintenance of decontamination areas, staging areas (if required), erosion control measures, and dust control measures;
- Construct facilities for collection, storage, and management of pumped groundwater and runoff;
- Construction and maintenance (during construction) of signs and perimeter fencing;
- Protection of work areas using temporary fencing or other security measures to prevent unauthorized access;
- Existing concrete slab demolition and off-site disposal of concrete construction and demolition (C&D) debris.
- Grading/Leveling Site and off-site disposal of limited surficial soil (estimated 1,000 cubic yards (CY)) to prepare for Guide Wall and Secant Wall construction.
- Excavation, dewatering and stabilization of concrete slabs and soil as required for construction of the secant barrier wall, guide wall, installation of piles, caissons, etc. for the proposed building;
- Offsite transportation and disposal of excavated soil in accordance with all applicable federal, state and local regulations;
- Soil sampling (waste characterization) prior to disposal; and
- Documentation.

Implementation of the IRM will be in accordance with the Soils/Materials Management Plan (SoMP) included in Section 4 of this IRM Work Plan.

3.1 Health and Safety

All construction activities will be performed in a manner consistent with 29 CFR 1910 and 1926. The Site-specific CHASP defines that all site workers conducting activities within the exclusion zone will be required to have 40-hour Hazardous Waste Operation Worker (HAZWOPER) training in accordance with the referenced regulations. This CHASP will be used to protect all personnel working on the Site, as well as any site visitors. The CHASP will be readily available during the work. During all phases of site work, the various contractors shall monitor site conditions and worker activities and enforce all provisions of the CHASP. This will include monitoring for general site conditions, safety hazards, and the air monitoring to be performed by Roux Associates. Specifically, monitoring and safety inspections will be performed to verify that all requirements of the Occupational Safety and Health Administration as outlined in 29 CFR Parts 1910 and 1926 are adhered to.

3.2 Community Air Monitoring Program

The CAMP is established to provide an added level of health and safety protection for the community surrounding the Site. Roux Associates will be responsible for implementing the CAMP during all intrusive work activities or when the concrete slabs are removed, whichever comes first, until the final remedy has been completed (not only during the IRM period) at the Site. General CAMP provisions require continuous air monitoring at the Site's downwind perimeter for VOCs and particulates.

3.3 Quality Assurance/Quality Control

Quality assurance/quality control procedures for all construction activities associated with the secant wall installation will be established in the Construction Quality Assurance Plan (CQAP), which is further described in Appendix A.

3.4 Erosion and Sediment Control Measures and Storm Water Management

All necessary measures to temporarily control erosion will be employed and will comply with all requirements of the specifications and the requirements in the New York Guidelines for Urban

Erosion and Sediment Control. The soil and sediment control plan (SESCP) will also identify appropriate contingency measures that may be implemented by the Contractor to minimize erosion and sedimentation including soil stockpiling, dust control, and maintenance of any erosion control measures (i.e., hay bales and silt fence). The SESCP is further described in Appendix B.

Dust control will be implemented while the concrete slabs are removed and until the final remedy has been completed, not only during the IRM period. Dust control measures are further described in Section 4.13.2 and in the SESCP.

3.5 Mobilization and Site Preparation

A project kick-off meeting will be conducted with NYSDEC, the Volunteer, Roux Associates/Remedial Engineering and the selected Contractor prior to the commencement of any intrusive activities, if requested by NYSDEC. The Contractor will supply any labor (HAZWOPER Certified in accordance with OSHA 1910.120) and materials required for the implementation of the IRM scope of work. In addition, necessary permits, insurance, bonds, and licenses required to complete the work will be obtained and fees necessary to obtain these permits will be paid. Mobilization and Site preparation activities include:

1. Mobilization of equipment and materials.
2. Implementation of traffic control measures.
3. Work zone demarcation.
4. Utility location identification and demarcation.
5. Utility relocation or removal, if necessary.
6. Installation of erosion control devices.
7. Existing concrete slab demolition and off-site disposal of concrete C&D debris.
8. Grading/Leveling Site and off-site disposal of limited surficial soil (estimated 1,000 CY) to prepare for Guide Wall and Secant Wall construction.
9. Installation of perimeter air monitoring system.
10. Installation of sanitary facility of onsite workers.
11. Installation of temporary facilities.

12. Installation of decontamination facilities.

3.6 Guide Wall Construction

Prior to constructing the secant barrier wall, a concrete guide wall will be constructed in order to ensure stability of the secant wall drilling equipment, to control tolerances and to achieve the correct center-to-center pile spacing in the secant wall.

In order to construct the guide wall, a trench will be excavated along the Site perimeter. Any utilities present that could interfere with the construction of the secant barrier wall will be removed or relocated. The guide wall will consist of two continuous cast-in-place reinforced concrete structures located directly inside and outside of the secant barrier wall. The guide wall will be supported with wood struts.

Site wide grading and leveling will be performed after the existing concrete slab is removed to prepare for guide wall construction. This will consist of grading with heavy equipment and may include soil stockpiling, characterization and off-site disposal of an estimated 1,000 CY to level the Site.

Soil resulting from guide wall trenching and site preparation leveling/grading will be managed in accordance with Section 4 below.

3.7 Secant Barrier Wall Construction

The perimeter secant barrier wall to be installed as shown in Appendix C and on Figure 2. The secant barrier wall will be comprised of primary and secondary test piles, each of which involve drilling a 40-inch diameter borehole to bedrock (bedrock varies from 5 to 20 ft below grade). The boreholes will be completed as secant piles in accordance with Figure 2. During pile installation, equipment performance will be evaluated, pile alignment and dimensions will be verified, and concrete mixes will be confirmed. Then secant piles will be drilled through temporary steel casing rotated into the ground using the rotary drive of a drill rig. Temporary steel casing will be drilled using traditional drill tooling for removal of overburden soil. Excavation will not proceed beyond the bottom of the casing unless drilling in competent bedrock. The casing should be firmly seated on bedrock to mitigate infiltration of soil and water prior to concrete placement. Upon reaching

bedrock, or completing rock socket development, the surface at the bottom of the element should be thoroughly cleaned with a clean-out bucket or equivalent tooling to provide firm sound contact with the bedrock. All secant piles should be drilled plumb to within 1% of vertical. Secant piles should be firmly seated or socketed as indicated on the detailed drawings. All concrete shall be placed by tremie method. A minimum concrete head of 15 feet should be maintained when extracting temporary casing. Secondary secant piles should contain a full length core beam centered within the pile. Secant piles should form a contiguous wall with a 6-inch minimum overlap between adjacent piles.

The construction sequence for the secant pile wall is described below:

- Installation of the concrete guide wall
- Construction of the primary piles
- Installation of the temporary segmental casing into the silty-clay unit
- Construction of the secondary piles
- Installation of the temporary segmental casing through the overburden materials to bedrock
- Seating of casing on bedrock
- Cleaning bottom of secant pile
- Concrete placement
- Casing removal

4.0 SOIL/MATERIALS MANAGEMENT PLAN

The following sections provide the SoMP to be implemented during the IRM.

4.1 Soil Screening Methods

Visual, olfactory and photoionization detector (PID) soil screening and assessment will be performed during excavation/drilling activities under the supervision of Roux Associates/Remedial Engineering personnel.

4.2 Stockpile Methods

Soil excavated from secant wall installation operations and from grading/leveling activities of the Site will be stockpiled on, and covered with, polyethylene sheeting. Stockpiles will be used only when necessary, and will be removed as soon as practicable. While stockpiles are in place, they will be routinely inspected, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. Excavated soils will be stockpiled on, at minimum, double layers of 6-mil minimum poly-sheeting, will be kept covered at all times (except when material is being added or removed) with appropriately anchored polyethylene sheeting, and will be routinely inspected. Broken or ripped sheeting will be promptly replaced.

Stockpile activities will be compliant with applicable laws and regulations. Stockpiles of excavated soils and other materials will be located a minimum of 20 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles as needed, except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

4.3 Characterization of Excavated Materials

Soil/fill or other excavated media that will be transported off-Site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations.

4.4 Materials Excavation and Load Out

Roux Associates/Remedial Engineering will oversee all invasive work and the excavation and load-out of all excavated material.

The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. Support of excavation will be provided based upon Site conditions and local regulations.

The presence of easements on the Site has been investigated. It has been determined that no risk or impediment to the planned work under this IRM Work Plan is posed by easements on the Site. The presence of utilities within/adjacent to the proposed work area will be investigated prior to the work in order to determine if there are any impediments to the proposed scope of work. NYSDEC will be notified of any changes required to the scope of work based on the geophysical survey.

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

Loaded outbound trucks will be inspected by Roux Associates/Remedial Engineering and cleaned if necessary before leaving the Site.

Locations where vehicles enter or exit the Site shall be inspected daily for evidence of off-Site sediment tracking. All egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during the implementation of the IRM. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Mechanical processing of historical fill and contaminated soil on-Site is prohibited.

4.5 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. The proposed inbound truck route to the Site is shown in Figure 3.

These are the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. To the extent possible, trucks loaded with Site materials will travel to/from the Site using these approved truck routes.

Trucks will avoid stopping and idling in the neighborhood outside the project Site, to the extent practicable. Queuing of trucks will be performed on-Site, when possible, in order to minimize off Site disturbance. Off-Site queuing will be minimized.

Egress points for truck and equipment transport from the Site will be kept clean of dirt and other materials during the IRM implementation.

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

4.6 Materials Disposal Off-Site

All soil/fill/solid waste excavated and removed from the site will be disposed of in accordance with regulatory requirements based on the levels of contamination found to be present in waste characterization samples collected.

The following documentation will be obtained and reported for each disposal location used in this project to demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter or facility-specific waste profile/application from Roux Associates/Remedial Engineering or the Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter/profile/application will state that material to be disposed is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of the Roux Associates/Remedial Engineering or the Volunteer. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and (2) a letter from all receiving

facilities stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the completion report.

The completion report will include an accounting of the destination of all material removed from the Site during this IRM. This information will also be presented in a tabular form in the completion report.

A Bill of Lading system or equivalent will be used for off-Site movement of non-hazardous wastes and contaminated soils. This information will be reported in the completion report.

Hazardous wastes (if any) derived from on-Site will be stored, transported, and disposed of in compliance with applicable local, State, and Federal regulations.

Appropriately licensed haulers will be used for material removed from this Site and will be in compliance with all applicable local, State and Federal regulations.

Waste characterization will be performed for off-Site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

4.7 Materials Reuse On-Site

No material is anticipated to be reused onsite during construction activities related to the secant wall installation.

4.8 Fluids Management

All liquids to be removed from the Site will be handled, transported and disposed in accordance with applicable laws and regulations.

Two separate water disposal options may be used based on site conditions and the quantity of water generated from construction activities, including dewatering and/or decontamination as discussed below.

Storage and Offsite Disposal: Any water generated during construction of the secant barrier wall will be collected in the guide wall trench and pumped into onsite water storage tanks where it will be containerized pending characterization and transport for offsite disposal. Roux Associates will collect and analyze waste characterization samples from the containerized water as prescribed by the Contractor. Based on the results, Contractor will arrange transport and offsite disposal of all containerized water.

Wastewater Treatment: if significant quantities of wastewater are generated during construction of the secant wall, it may be processed through an onsite wastewater treatment system and discharged under permit to the NYSDEC (if discharged to an outfall) and/or NYCDEP (if discharged to the storm sewer). Based upon experience at similar sites, the treatment system may include a settling tank, bag filters, sand filter and carbon filter vessels. Effluent from the treatment system will be sampled and analyzed for the discharge parameters stipulated in the permit prior to discharge and on a regular basis during operation in accordance with the permit requirements. All treated water will only be discharged after receiving regulatory approval to do so.

4.9 Backfill from Off-Site Sources

No backfill material is anticipated to be imported to the Site during construction activities related to the secant wall installation.

4.10 Stormwater Pollution Prevention

Applicable laws and regulations pertaining to stormwater pollution prevention will be addressed during construction of the secant barrier wall. Erosion and sediment control measures (silt fences and/or barriers, and/or hay bale checks) will be installed, as appropriate, around the entire perimeter of the remedial construction area and inspected once a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs to erosion and sediment controls shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence anchor will be repaired immediately

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

4.11 Contingency Plan

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during implementation of the IRM.

If underground tanks or other previously unidentified contaminant sources are found during on-Site remedial excavation, sampling will be performed on potentially contaminated source material and surrounding soils and reported to NYSDEC. Chemical analytical work will be for full suite of parameters (TCL VOCs, TCL SVOCs, TAL metals, TCL PCBs, pesticides and herbicides). These analyses will not be limited to CP-51 parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

Identification of unknown or unexpected contaminated media identified by screening during invasive Site work will be promptly communicated by phone to NYSDEC's Project Manager. These findings will be also included in daily and periodic electronic media reports.

4.12 Community Air Monitoring Plan

CAMP will be implemented during all ground intrusive activities which include drilling/secant wall installation. The CAMP will be performed in accordance with the CHASP (Appendix D) and will include the real-time monitoring of volatile organic compounds (VOCs) and particulates at the upwind and downwind perimeter of the designated work area. Should monitoring results exceed action levels as noted in the CAMP, work will immediately be stopped and efforts will be made to mitigate/eliminate the exceedance.

4.13 Odor, Dust and Nuisance Control Plan

4.13.1 Odor Control Plan

Odor controls will be employed to prevent on- and off-Site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of odor suppressants to cover exposed odorous soils. If nuisance odors develop and cannot otherwise be controlled, additional means to eliminate them

will include: (d) direct load-out of soils to trucks for off-Site disposal; and (e) use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, the source of odors will be identified and corrected. If necessary, to identify or correct a nuisance odor source, work will be temporarily halted and will not resume until such nuisance odors have been identified and abated. NYSDEC will be notified of all odor complaint events.

4.13.2 Dust Control Plan

Dust control will be implemented while the concrete slabs are removed and until the final remedy has been completed, not only during the IRM period. Techniques implemented to control dust will include, but not be limited to, one or more of the following measures listed in the SESCP (Appendix B):

- Applying water on the ground surface;
- Misting equipment and excavation faces;
- Spraying water (using atomizer) on buckets during excavation and dumping;
- Use of properly anchored tarps to cover stockpiles;
- Exercising extra care during dry and high-wind periods;
- Hauling materials in covered trucks or containers; and
- Covering excavated areas and material with vapor suppression foam or other suitable cover after excavation activity ceases.

Dust monitoring and control at the work locations will be performed by the Contractor. Perimeter monitoring of the Site will be performed by Roux Associates. The Contractor will maintain all excavations, stockpiles, access roads, and all other work areas to minimize dust, which would cause a hazard or nuisance to others. The Contractor will monitor dust in accordance with the requirements of the Site's HASP. Roux Associates will monitor dust at the Site's perimeter in accordance with the Community Air Monitoring Plan (CAMP) for the Site.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will

not resume until all nuisance dust emissions have been abated. NYSDEC will be notified of all dust complaint events.

4.13.3 Other Nuisances

Noise control will be exercised during the remedial program. All remedial work will conform, at a minimum, to NYC noise control standards.

5.0 REPORTING

5.1 Daily Reporting during Site Activities

Daily activity reports will be maintained by the various contractors for all remedial/construction activities. Roux Associates will manage specific project records to facilitate preparing the Final Engineering Report documenting completion of remediation activities. Reports will include:

- The date
- The weather
- Personnel
- Major equipment onsite
- Work activities
- Future work activities

5.2 Final Engineering Report (Completion Report)

Detailed information regarding the IRM (e.g., general description of the construction activities, waste disposal documentation, photos, etc.) will be included in the completion report. This final engineering report will be certified by a Professional Engineer licensed in the State of New York that the work was performed in accordance with the approved IRM and any approved changes.

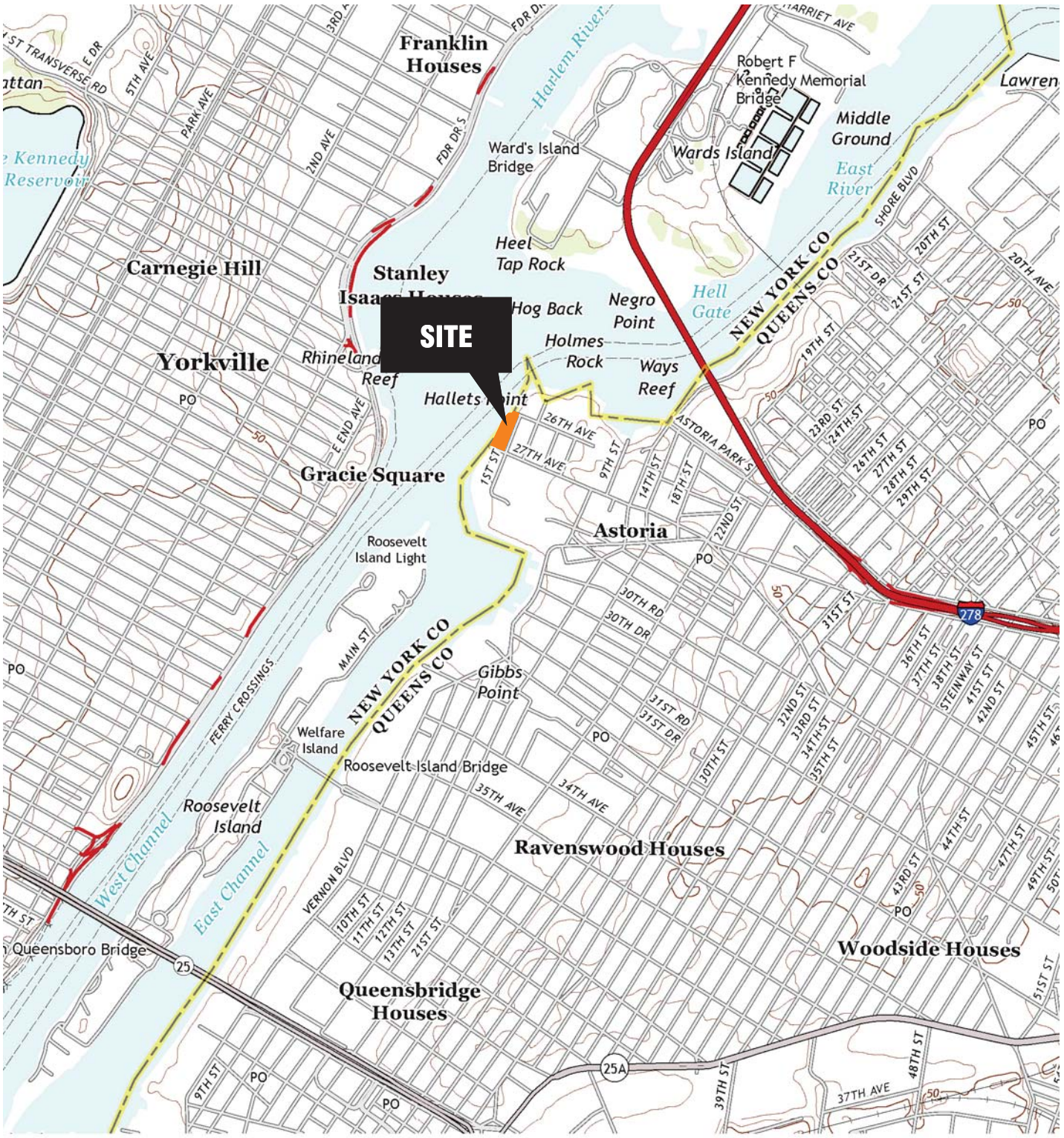
6.0 IRM IMPLEMENTATION SCHEDULE

This IRM Work Plan is anticipated to begin in the summer 2017 and will require approximately twelve weeks to complete. It is anticipated that the actual onsite duration of major remedial construction tasks will be completed as follows (timeframes are not necessarily consecutive):

- Site Mobilization and Preparation ..... four weeks
- Secant wall installation ..... eight weeks

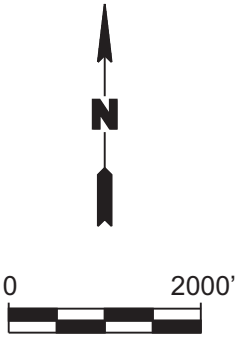
FIGURES

1. Site Location Map
2. Site Plan
3. Proposed Truck Route



QUADRANGLE LOCATION

SOURCE:
USGS; 2013, Central Park, NY-NJ
7.5 Minute Topographic Quadrangle



Title:

SITE LOCATION MAP

BUILDINGS 2 AND 3 - BCP SITE NO. C24119
26-40 1ST STREET, ASTORIA, NEW YORK
SECANT WALL IRM

Prepared for:
HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial Engineering, P.C. ENVIRONMENTAL ENGINEERS	Compiled by: K.S.	Date: 17MAY17	FIGURE 1
	Prepared by: G.M.	Scale: AS SHOWN	
	Project Mgr.: K.S.	Project No.: 1338.0010Y008	
	File: 1338.0010Y159.01.CDR		

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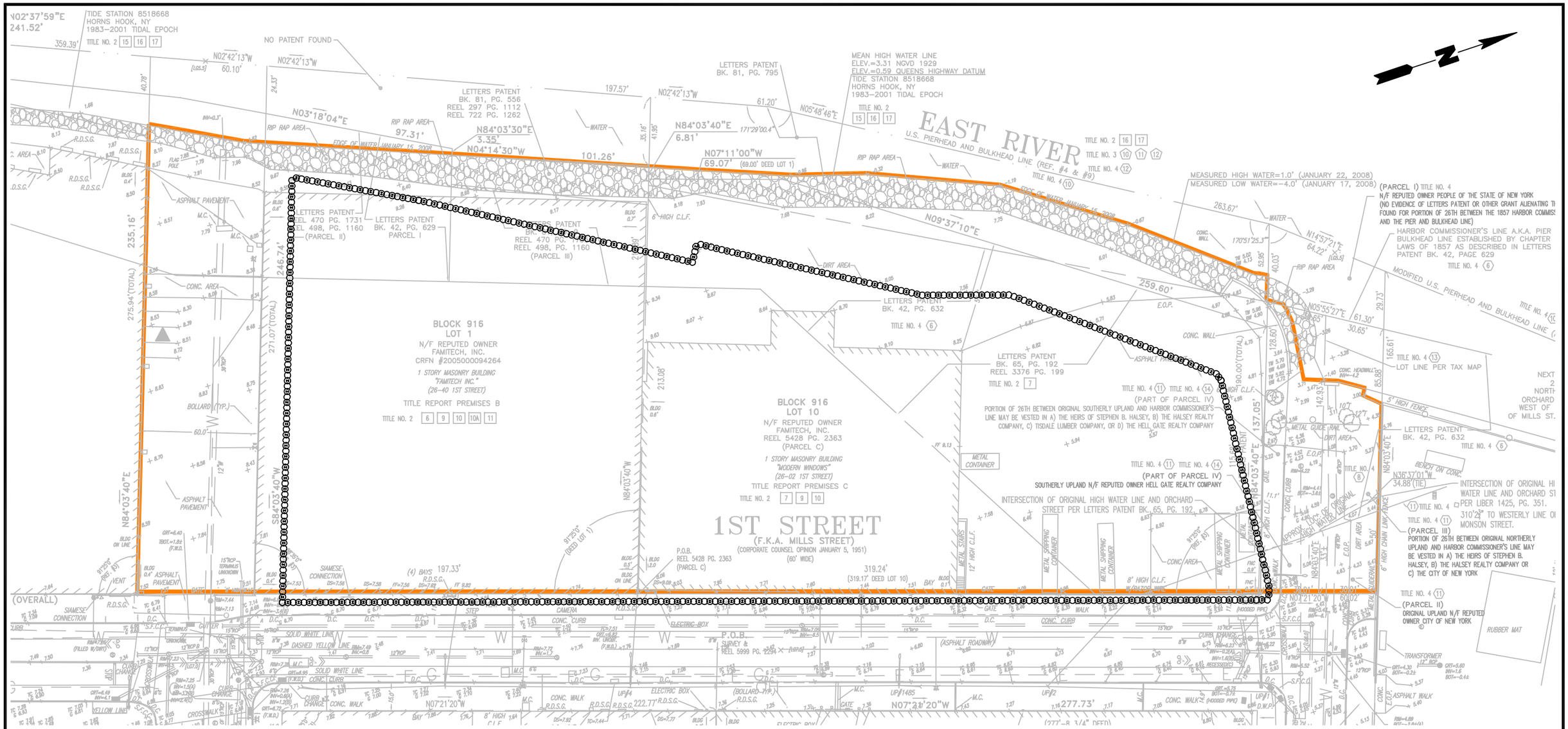

LEGEND

BCP SITE BOUNDARY

SECANT WALL

NOTES

1. ELEVATIONS ARE BASED UPON BOROUGH OF QUEENS HIGHWAY DATUM.
2. SURVEY BASE MAP SOURCED FROM CONTROL POINT ASSOCIATES, INC. FILE C08003.01, DRAWING V–001.1 REVISION 2, DATED 4/9/12.

50' 0 50'

Title:

EXISTING SITE PLAN WITH PROPOSED SECANT WALL

BUILDINGS 2 AND 3 – BCP SITE NO. C241192
26–40 1ST STREET, ASTORIA, NEW YORK
SECANT WALL IRM

Prepared For:
HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial
REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: M.L.	Date: 17MAY17	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	2
Project Mgr: K.S.	Project: 1338.0010Y008	
File: 1338.0010Y159.02.DWG		

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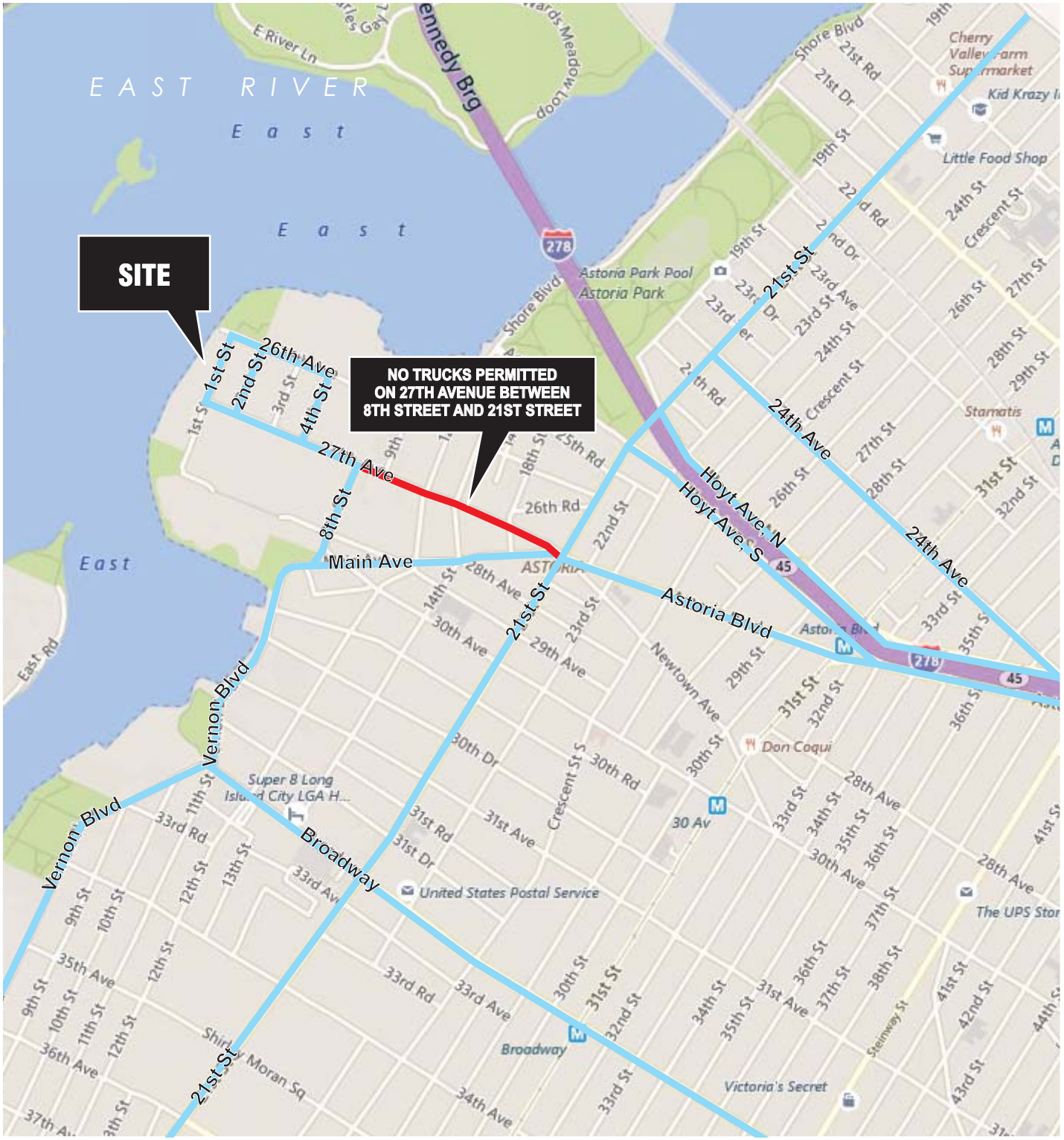

N

1,000 FT

Title:

TRUCK ROUTE MAP

BUILDINGS 2 AND 3 - BCP SITE NO. C24119
26-40 1ST STREET, ASTORIA, NEW YORK
SECANT WALL IRM

Prepared for:
HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial
Remedial Engineering, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: V.S.	Date: 17MAY17	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	3
Project Mgr.: W.S.	Project No.: 1338.0010Y000	
File: 1338.0010Y159.03.CDR		

\1338Y\0010Y\159\1338.0010Y159.03.CDR

APPENDICES

A. Construction Quality Assurance Plan (CQAP)

B. Soil Erosion and Sediment Control Plan (SESCP0

C. Secant Barrier Wall Design Drawings

D. Construction Health and Safety Plan (CHASP)

APPENDIX A

Construction Quality Assurance Plan (CQAP)

May 17, 2017

CONSTRUCTION QUALITY ASSURANCE PLAN

Halletts Point Building 2
Halletts Point Building 3
Site No. C241192
26-40 1st Street
Astoria, Queens, New York

Prepared for:

HALLETTS BUILDING 2 SPE LLC AND
HALLETTS BUILDING 3 SPE LLC
One Bryant Park
New York, New York 10036

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

TABLE OF CONTENTS

FIGURE

APPENDICES

1.0 INTRODUCTION

The Construction Quality Assurance Plan (CQAP) has been prepared in accordance with the Interim Remedial Measure (IRM) for Halletts Building 2 SPE LLC and Halletts Building 3 SPE LLC, located at 26-40 1st Street, Astoria, New York, New York (Site). The CQAP describes the site-specific construction quality assurance and control measures that will be performed during remediation and related construction activities that will be implemented at the Site in accordance with the IRM. The CQAP includes a program for construction observation and testing to verify performance of the remedial construction in accordance with the design specifications. General construction-related Quality Assurance/Quality Control (QA/QC) (e.g., load testing, concrete testing, construction material verification, etc.) will be managed via the overall site development quality control program being implemented by the General Contractor and the Owner and is not a component of this CQAP.

In general, the work to be addressed by this CQAP consists of the secant wall installation and proper management/disposal of impacted soils for the proposed building to be constructed at the Site.

The General Contractor will be the overall construction manager for the project. The General Contractor will manage the work using a team of companies (subcontractors) with specific expertise in the respective tasks comprising the project. Roux Associates, Inc. and their affiliated engineering company Remedial Engineering, P.C., (collectively referred to as Roux Associates) will verify that the overall remedy construction is completed in accordance with the IRM and will conduct perimeter air monitoring in accordance with the Site's Community Air Monitoring Plan (CAMP). The Pilings Contractor will be responsible for all pile driving and secant wall installation. More details of the organizational structure are provided in Section 2.0.

The work to be performed includes:

- Mobilization and site preparation;
- Provision of site security measures;
- Setup and maintenance of all traffic control measures;
- Construction of temporary stormwater and soil erosion and sediment control measures;
- Installation of decontamination facilities;

- Vapor, odor, and dust controls;
- Community air monitoring;
- Site health and safety monitoring;
- Installation of secant barrier wall and foundation piles;
- Sampling and waste characterization analysis of excavated materials;
- Soil stabilization; and
- Offsite transport and disposal of excavated material.

The CQAP includes the following components:

- Section 2.0: Organization/Personnel
- Section 3.0: Submittals
- Section 4.0: Construction Quality Control Testing
- Section 5.0: Project Coordination
- Section 6.0: Recordkeeping/Reporting

The Owner or the Owner's designated representative will provide independent monitoring and verification of compliance with all construction and CQAP requirements. Any concerns will be communicated to the General Contractor.

2.0 ORGANIZATION/PERSONNEL

It is the responsibility of the General Contractor to manage the construction project team such that the Site remedial construction is completed in accordance with the design criteria, construction drawings, and contract documents. Roux Associates will assist the General Contractor in the review of quality control measures to insure compliance with the IRM.

The work scope can be segregated into six components:

1. Overall site health and safety;
2. Secant guide wall construction; and
3. Secant barrier wall construction.

It will be the responsibility of the General Contractor to provide quality assurance related to the foundation construction to be performed by the Foundation Contractor and Pilings Contractor. With the exception of water management, vapor barrier and secant wall installation, and environmental health and safety (IRM requirements), QA/QC for the structural component (e.g., piles, caissons, secant wall strength, etc.) of the foundation construction will not be addressed in this CQAP.

An organizational chart for the CQAP is provided in Figure 2.

2.1 Urban Atelier Group - General Contractor/Construction Manager

Gavin Schiraldo, Project Quality Assurance Manager/Site Safety Compliance Manager

Urban Atelier Group has been contracted by Halletts Building 2 SPE LLC and Halletts Building 3 SPE LLC, the developers of the Site, as the General Contractor and Construction Manager for the entire project and, as such, will be responsible for the quality assurance of all of the tasks being implemented. The role of Project Quality Assurance Manager & Site Safety Compliance Manager will be filled when the project is initiated. The person who fills this role will be briefed daily by the task-specific QA/QC personnel and insure that all components of the site activities are conducted according to the remediation guidelines and the design specifications. He will be responsible for verifying that the daily site activities, both environmental and construction-related, are in compliance with all of the safety requirements and regulations governing site activities.

Urban Atelier Group will be serving in the role of Site Construction Health and Safety Officer (SCHSO). The SCHSO will be responsible for daily enforcement of the construction-related health and safety requirements as defined by the Site-specific Construction Health and Safety Plan (CHASP) and dictated by site conditions and for all construction and heavy equipment related safety matters during the remediation/foundation construction. The SCHSO will be responsible to initiate all daily safety briefings and weekly safety meetings to insure compliance with the CHASP. The role of the SCHSO is further defined in the CHASP. Both the Site Environmental Health and Safety Officer (Roux Associates) and the Construction Health and Safety Officer (Urban Atelier Group) will report all health and safety related issues to the Project Quality Assurance Manager & Site Safety Compliance Manager**.**

Finally, Urban Atelier Group will provide survey control to verify the limits of excavation. A New York State-licensed surveyor will survey all final excavation depths for soil quantity verification, as well as verification of the necessary foundation depths. This data will be provided to Roux Associates for inclusion in the Remedial Action Completion Report.

2.2 Roux Associates, Inc. – IRM and Environmental Monitoring Compliance

Joshua Levine, P.E., Remediation Engineer/Quality Assurance Officer
Laura Jensen, Quality Control Project Manager

Roux Associates has been contracted by Halletts Building 2 SPE LLC and Halletts Building 3 SPE LLC to be responsible for assuring compliance with the IRM and to perform all necessary environmental monitoring. Joshua Levine, a licensed professional engineer in the State of New York, will be the Remediation Engineer in charge of verification that all remediation construction is being conducted in accordance with the provisions of the IRM. Laura Jensen will act as the project manager (PM) for Roux Associates and will provide review of quality control measures implemented by the contractors to insure compliance with the Site's remedial objectives. Roux Associates will confirm that all site activities conform to and follow the provisions of the environmental components of the CHASP, the CAMP, the Soil Erosion and Sediment Control Plan (SESCP), and the Site Operations Plan (SOP). All onsite quality control persons identified in the CQAP will provide daily briefings and/or reports to Roux Associates identifying the tasks completed, the remedial measures achieved, and any other issues of concern. Additionally,

Joshua Levine will be responsible for certifying that the remedial construction was completed in conformance with the approved IRM and/or NYSDEC-approved field changes.

Roux Associates will be serving in the role of Site Environmental Health and Safety Officer (SEHSO) and implementing the Site's CAMP. The SEHSO will conduct all air monitoring within the intrusive work area and maintain all health and safety-related training and medical surveillance documentation for the site workers. The role of the SEHSO is further defined in the CHASP. In accordance with the CAMP, daily monitoring of the upwind and downwind perimeter will be conducted to insure both the protection of the site workers and surrounding community. Roux Associates will provide ambient air quality monitoring for total volatile organic compounds (VOCs) and airborne particulates during all intrusive Site activities. CAMP monitoring data will be reported to the PM and the SCHSO daily. Action level exceedances will be reported to the PM and/or SCHSO immediately. Exceedances of VOC Action Levels must be reported to the NYSDEC and New York State Department of Health (NYSDOH) within 24 hours.

Roux Associates will also be responsible for collection and analysis of waste characterization samples for all soil and water being disposed of as part of the secant wall installation and construction at the Site. Roux Associates will insure proper handling and shipment of the samples to the designated laboratory, Alpha Analytical (Alpha).

2.3 To Be Determined – Foundation Construction Contractor

A Foundation Contractor will be contracted by Urban Atelier Group to construct the foundation slab, guide wall used for installing the secant barrier wall, establish the site environmental controls, manage and properly dispose of soil required to be excavated to facilitate foundation installation. The Foundation Construction Project Manager, will be responsible for the remediation quality controls related to disposal of soil. It falls within this role to establish and maintain site controls to insure avoidance of the spread of any impacted material that may be encountered during pile drilling and limit the exposure of the site workers to VOCs and particulates that may be produced from such material. He will insure that all necessary vapor and particulate suppression techniques and controls are implemented in coordination with the real-time Site health and safety air monitoring being conducted by Roux Associates. He will also

be responsible for managing all phases of the offsite disposal of impacted soil. He will insure proper packaging and shipment of all impacted materials to the designated facility. The Foundation Contractor's Project Manager will also be responsible for overseeing compliance with the project specifications, schedule, survey controls, and reviewing, submitting and coordinating shop drawing submittals to Urban Atelier Group, Roux Associates, and the Owner's representative, as appropriate.

The Foundation Contractor will implement all necessary quality controls measures and provide the necessary quality control documents in order for Remedial Engineering to be able to certify that the secant wall will act as effective engineering controls, as required by the remedial objectives outlined in the IRM. This will include, but not be limited to, materials specification submittals, manufacturer-approved installer certifications, and installation inspection records.

2.4 Environmental Laboratory

The need for an environmental laboratory is specific to soil waste characterization analysis and construction water disposal analysis. The potential also exists for chemical specific air sampling and analysis. Alpha, located in Edison, New Jersey, will be contracted by Roux Associates for all remediation construction-related analytical requirements. Alpha is a NYSDOH Environmental Laboratory Approval Program (ELAP) and New Jersey Department of Environmental Protection (NJDEP). All results will be reported in electronic format and be made available to Urban Atelier Group, the Foundation Contractor and Roux Associates using analytical turnaround times as short as two days for quality assurance purposes.

2.5 Surveying Firm

Control Point, a New York State-licensed surveying firm, will be subcontracted by Urban Atelier Group to provide lines, grades, boundaries, benchmarks, as-built drawings, and any other survey work required for the proper execution and documentation of the work as required by the specifications.

2.6 Designated Soil Disposal Facility

All soils excavated from the Site will be transported by permitted transportation contractors (arranged by the Foundation Contractor) to designated disposal facilities approved to receive historic fill, as well as historic fill that contains petroleum and/or MGP residues.

3.0 SUBMITTALS

Submittals will be made to Urban Atelier Group and Roux Associates in a timely manner for review and approval prior to use. All submittals must be provided electronically. Hard copies may be provided in addition to the electronic deliverables.

A Submittal Register will be developed and maintained, which details submittal requirements for this Project. The Submittal Register will track the dates of submission, action taken, and date of return. The Submittal Register will be used to control and track all required submittals. Data that will be provided in the Submittal Log will include:

- Submittal identification number;
- Name of company and individual preparing the submittal;
- Description of shop drawings and submittal;
- Date of submittal;
- Submittal return date;
- Action taken; and
- Re-submittal (if necessary).

Submittals will be made as specified in the Contract Specifications.

The IRM requires formal submittals of the CHASP, SESCP, CAMP, SOP, and this CQAP. These will all be submitted to the NYSDEC for approval prior to initiating the work. Copies of all submittals will be maintained onsite for reference by the project managers, project team, and NYSDEC and NYSDOH.

The following additional quality control submittals will be required by the identified contractor.

3.1 Waste Transporter Qualifications

The Foundation Contractor shall submit a qualifications package for each vendor contracted to transport waste from the Site to the designated soil disposal facilities. The package shall include proof of insurance and all current necessary waste transport permits for the waste type(s) being transported.

3.2 Environmental Laboratories

Roux Associates shall provide formal laboratory qualifications and QA/QC information packages for Alpha and any other analytical laboratories proposed for the project to the NYSDEC or disposal facilities, as required.

4.0 CONSTRUCTION QUALITY CONTROL TESTING

Implementation of quality control testing and measurement will be performed by the contractors conducting the specific site tasks. Roux Associates will be responsible for verifying that all quality control testing has been conducted in compliance with the IRM and as specified herein.

Prior to initial quality control testing procedures:

1. Verify that the testing procedures are within the manufacturer's recommendations.
2. Verify that the facilities and testing equipment are available and comply with testing standards.
3. Check testing instrument calibrations against certified standards.
4. Verify the recording forms, including all the test documentation requirements have been prepared.

Qualifications of all independent environmental testing firms and laboratories will be submitted to Roux Associates and Urban Atelier Group for approval prior to any quality control testing and/or lab analysis as an obligation of this CQAP.

Specific task-driven testing/certification obligations are as follows:

- A New York State-licensed surveyor will conduct all of the necessary measurements and provide associated documentation to verify that the secant wall installation limits are achieved.
- Concrete mix testing will be performed in the field by Underpinning in accordance with the SOP requirements. All results will be recorded and submitted to Urban Atelier Group for review each day.
- All excavated soil will require waste characterization analyses prior to disposal. Excavated soil from secant wall installation will be stockpiled and sampled prior to waste transport and disposal. Waste characterization analysis parameters and frequency are determined by the waste disposal facility's acceptance requirements. All excavated soils will be tested in accordance with the soil disposal facility's analytical acceptance requirements. Results will be provided to the disposal facility for review.
- The CAMP requires continuous real-time monitoring of VOCs and particulates during all intrusive site activities. This monitoring equipment will be inspected periodically throughout each day to check and manually record the concentrations of VOCs and particulates and to ensure that the equipment is working properly. The equipment will be repaired, recalibrated, or replaced, as necessary. The periodic measurements will be used to identify any potential risks of offsite migration and potential onsite exposure risks to onsite

workers. This monitoring data will be collected and logged for review daily by Roux Associates and made available for regulatory agency review. Action Limit Reports will be completed to document any and all action level exceedances, as defined in the CAMP.

All testing data will be managed in accordance with Section 5.0 and will be included in the Final Engineering Report to be prepared by Remedial Engineering and Roux Associates upon completion of all remedial objectives defined in the IRM.

5.0 PROJECT COORDINATION

A weekly progress meeting will be conducted to assess the prior week's progress, overall progress to date, quality control requirements, environmental and construction health and safety requirements, and future progress expectations. All parties defined in Section 2.0, and possibly regulatory agency representatives, will be in attendance. This will provide the opportunity for all site tasks to be integrated and discussed collectively and provide for coordination of all site activities to maintain the overall construction schedule (Appendix A). The construction schedule may be modified, if necessary, based on the weekly project progress. Weekly meeting summaries will be distributed and maintained as part of the permanent project record. Routine task meetings will also be conducted on an as-needed basis to insure proper communication between the contractors, tradesman, and supervisory personnel.

6.0 RECORDKEEPING/REPORTS

A tracking system will be created for all project-related contract deliverables. The tracking system will include a unique filing and document numbering system, secure record storage system, and provide for maintaining the appropriate project forms, including:

- document log books;
- drawings;
- specifications;
- addenda;
- contracts;
- written field orders and/or instructions;
- daily activity reports;
- field test records;
- photographs;
- manifest and/or bills of lading;
- safety and accident reports; and
- community air monitoring reports.

Daily activity reports will be maintained by the various contractors for all construction activities. Daily activity reports will include:

- the date;
- the weather;
- personnel;
- major Equipment onsite;
- work activities; and
- future work activities.

Daily activity reports will be submitted to Urban Atelier Group and Roux Associates electronically prior to the contractor leaving the Site.

In addition, Community Air Monitoring reports will be generated on a daily basis and maintained onsite.

Comprehensive daily activity reports and other above-referenced forms and documents will be included in the Final Engineering Report.

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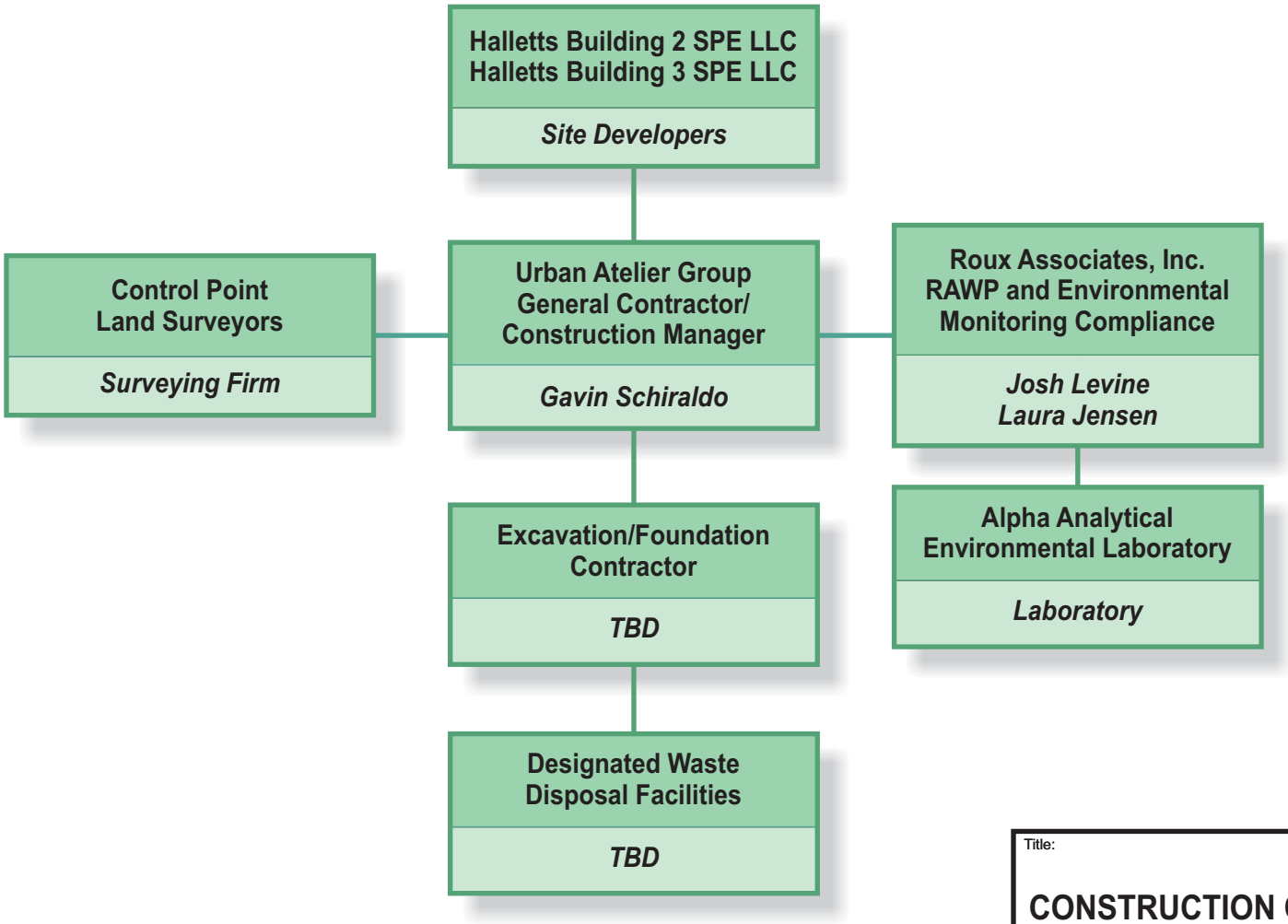


Title:

CONSTRUCTION QUALITY ASSURANCE ORGANIZATION CHART

BUILDINGS 2 AND 3 - BCP SITE NO. C24119
26-40 1ST STREET, ASTORIA, NEW YORK

Prepared for: HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial
Remedial Engineering, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: M.L.	Date: 17MAY17
Prepared by: G.M.	Scale: AS SHOWN
Project Mgr.: K.S.	Project No.: 1338.0010Y008
File: 1338.0010Y162.01.CDR	

FIGURE
1

APPENDIX B

Soil Erosion and Sediment Control Plan (SESCP)

May 17, 2017

SECANT WALL SOIL EROSION AND SEDIMENT CONTROL PLAN

Halletts Point Building 2
Halletts Point Building 3
Site No. C241192
26-40 1st Street
Astoria, Queens, New York

Prepared for:

HALLETTS BUILDING 2 SPE LLC AND
HALLETTS BUILDING 3 SPE LLC
One Bryant Park
New York, New York 10036

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

TABLE OF CONTENTS

PLATE

1.0 INTRODUCTION

This Soil Erosion and Sediment Control Plan identifies measures that may be implemented by the foundation construction contractors that will include the Foundation Contractor and the Piles and Secant Wall Contractor (collectively referred to as the Contractor for the purposes of this plan) to minimize erosion and sedimentation during secant wall installation, remediation, construction, and foundation installation activities at 26-40 1st Street, Astoria, New York, New York (Site).

The primary objective of temporary soil erosion and sediment control measures is to control soil erosion to the maximum extent practicable, commensurate with reasonable and economical construction practices. All temporary soil erosion and sedimentation control measures will be in place prior to any construction operations and will be maintained until construction is complete and the disturbed areas stabilized. Plate 1 shows a Site Plan identifying the soil erosion and sediment control locations.

The Contractor will take all necessary measures to temporarily control erosion and will comply with all requirements specified herein and in the New York Guidelines for Urban Erosion and Sediment Control.

2.0 SOIL EROSION AND SEDIMENT CONTROL MEASURES

Temporary erosion and sedimentation control will be accomplished by silt fences, hay bales, stone cover material, dust control and stockpile management. If determined necessary, ditches, berms, dikes, dams, sediment collection pits, or basins will be constructed. The surface areas of erodible material exposed by clearing and grubbing will be kept to a minimum. All materials and methods of construction will be in accordance with all applicable state and local standards. Below is a description of each of the erosion and sediment control measures.

2.1 Surface Water Control

The rate of runoff from the construction Site will be mechanically retarded and controlled, if necessary. This includes construction of diversion ditches, benches, and berms, to retard and divert runoff to protected drainage courses.

Temporary diversion ditches and berms will be created, as necessary, to prevent storm runoff from entering the Site's sewer catch basins, drop inlets, and existing excavations.

2.2 Silt Fence/Hay Bales

Hay bales and/or silt fencing shall be placed at locations upgradient of excavation areas to minimize water flow and soil from entering excavations, and downgradient of excavation areas to prevent soil in the excavations from migrating to other areas (Plate 1).

2.2.1 Silt Fence

The Contractor anticipates using prefabricated silt fence. The erosion control silt fence will be installed along the East River and the northern and southern extents of the site. In cases of severe silt fence loading, the Contractor may elect to erect wire backed silt fence. In either case, the fences will meet the general material and construction specifications described below.

Material

The silt fence fabric will be a woven polypropylene geotextile manufactured for such purposes. The fabric shall have a minimum permeability of 02 centimeters per second (ASTM D 4991) and a maximum Apparent Opening Size of 0.25 mm (ASTM D 4751). Fence posts shall be either

metal or wood and of sufficient thickness to permit driving into the ground to a depth of at least 18 inches, and to resist the lateral forces of silt and water accumulation.

Construction

Silt fence posts will be driven to at least eighteen inches below grade, with at least two feet protruding aboveground. The posts will be either steel or wood, spaced no more than eight feet apart. An anchor trench will be excavated along the upslope side of the fence line, if possible. The geotextile will be attached to the posts with double stitching of heavy-duty cord or prefabricated clips, and embedded in the anchor trench below original grade. To the extent practicable, the anchor trench shall be backfilled to secure the geotextile in the trench (Plate 1).

2.2.2 Hay Bales

Hay bales will be placed as needed. The main function of the hay bale is to reduce runoff velocity and effect deposition of the sediment. The anticipated design life for hay bale check dams is three to six months.

Hay bales will be placed in a row with ends tightly butted. Each bale will be anchored in place, to the extent practicable, by two stakes driven through each bale. The first stake in each bale shall be driven toward the previously laid bale to force the bales together. Where the slope is five percent or greater and at outlets of surface ditches, two rows of hay bales with staggered ends will be provided. Bales will be straw or hay securely tied. Anchor stakes shall be wood or steel reinforcement bar. Anchor stakes will be of sufficient length to securely anchor each bale (Plate 1). Hay bales that become excessively clogged with sediment will be replaced with new bales.

2.3 Stabilized Construction Entrance

Stabilized construction entrances will be installed for remediation traffic entering and exiting the Site to minimize the amount of Site soils tracked onto public roadways. At a minimum, the stabilized construction entrance will include a 6-inch layer of crushed stone underlain by geotextile (Plate 1). It is anticipated that trucks will enter/exit from both the northern and southern ends of 1st Street at various stages of the work (Plate 1).

2.4 Soil Stockpiling/Staging Area

It is anticipated that stockpiles will be present onsite. In the event soil is temporarily stockpiled at the Site, methods to control stormwater runoff, such as covers and berms will be implemented. All excavated soil will be staged/managed onsite within the excavation footprint. Soil staging areas will be dynamic within the excavation area in order to accommodate the soil removal across the Site area.

2.5 Dust Control

The Contractor is responsible for dust (airborne particulate matter) control at the Site, in accordance with the New York State Department of Health (NYSDOH) Community Air Monitoring Protocol and all Federal, State and local requirements. Dust monitoring and control at the work locations will be performed by the Contractor. Perimeter monitoring of the Site will be performed by Roux Associates, Inc. (Roux Associates). The Contractor will maintain all excavations, stockpiles, access roads, and all other work areas to minimize dust, which would cause a hazard or nuisance to others. The Contractor will monitor dust in accordance with the requirements of the Site's HASP. Roux Associates will monitor dust at the Site's perimeter in accordance with the Community Air Monitoring Plan (CAMP) for the Site. Based on the results of the monitoring, the Contractor will implement the necessary measures to control dust to levels indicated in the Site's HASP and CAMP, including but not limited to, one or more of the following measures:

- Applying water on the haul roads;
- Misting equipment and excavation faces;
- Spraying water (using atomizer) on buckets during excavation and dumping;
- Hauling materials in covered trucks or containers; and
- Covering excavated areas and material with vapor suppression foam or other suitable cover after excavation activity ceases.

2.6 Work Stoppage/Changes

In the event that adverse weather conditions affect the proper performance of existing erosion and sediment control measures, work should be stopped until appropriate modifications are made.

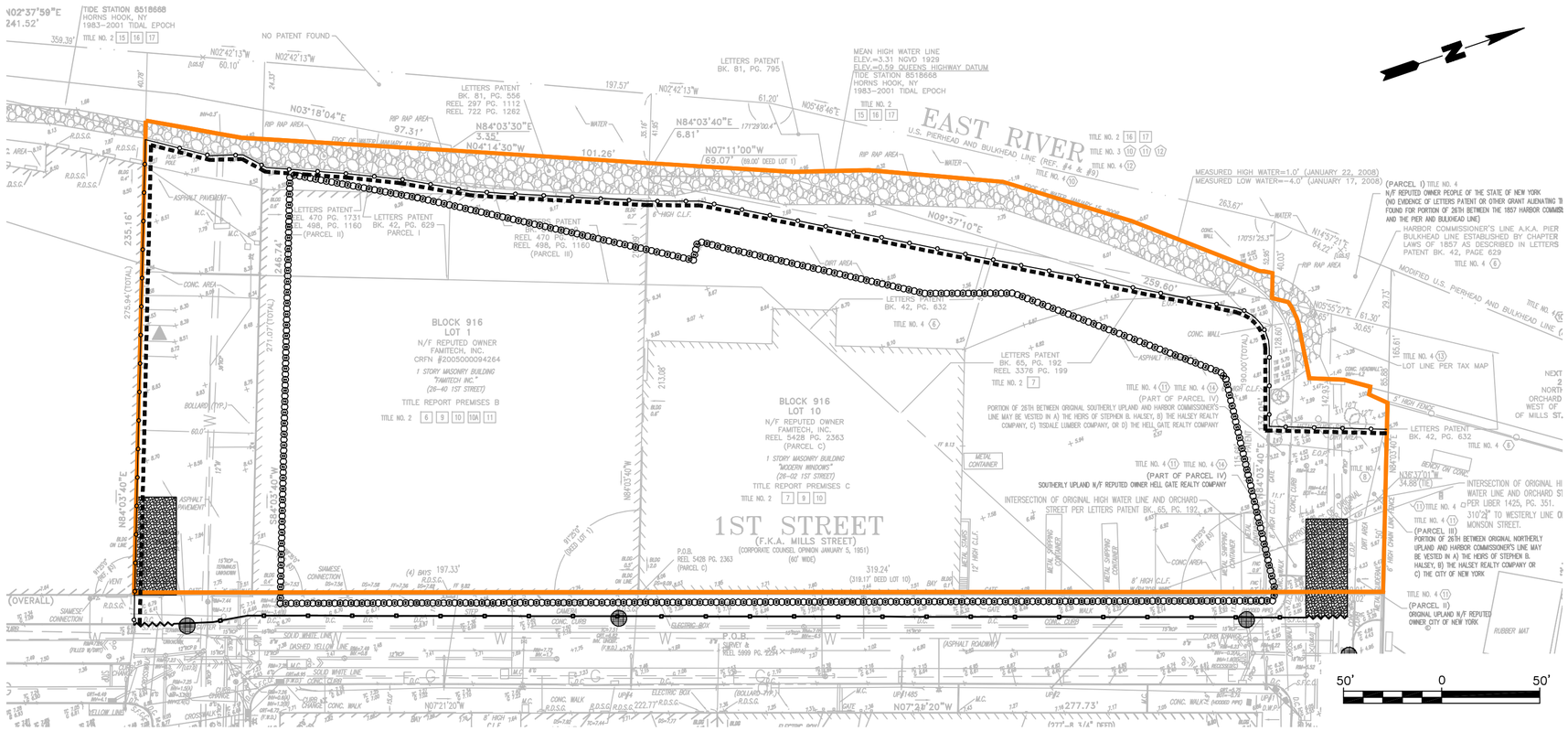
3.0 MAINTENANCE

The Contractor will inspect erosion control devices on a regular basis, and replace them as necessary. The inspections will check for tears, breaks or clogging of barriers. The inspections will also look at the adequacy of erosion controls. Problems will be reported to the Site Project Manager, and promptly corrected.

The need for any additional erosion control measures will be determined by Roux Associates during construction on an as-needed basis, and shall be implemented and maintained by the Contractor. Inspection of temporary erosion control measures by the Contractor will be frequent and repair or replacement will be made promptly, as needed or directed by Roux Associates. Each inspection or corrective action will be noted in the daily report.

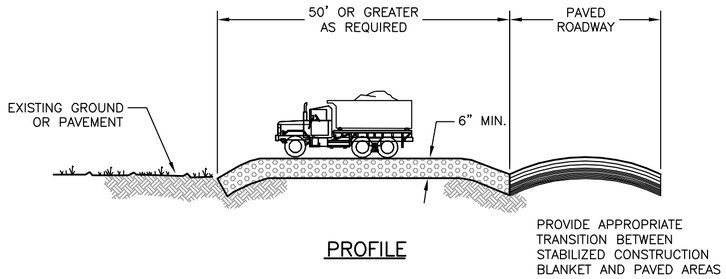
4.0 SITE RESTORATION

The Contractor will remove all temporary soil erosion and sediment control measures at the completion of the remediation/foundation construction component of the project, unless installed measures are deemed necessary for the future construction phases. All disturbed areas will be graded as necessary to facilitate proper drainage.



LEGEND

- BCP SITE BOUNDARY
- SILT FENCE / HAY BALES
- CONSTRUCTION FENCE
- CONSTRUCTION GATE
- INLET PROTECTION
- SECANT WALL

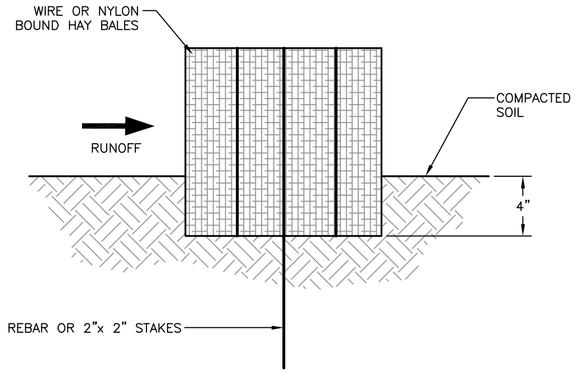


PROFILE

PROVIDE APPROPRIATE TRANSITION BETWEEN STABILIZED CONSTRUCTION BLANKET AND PAVED AREAS

CONSTRUCTION ENTRANCE NOTES

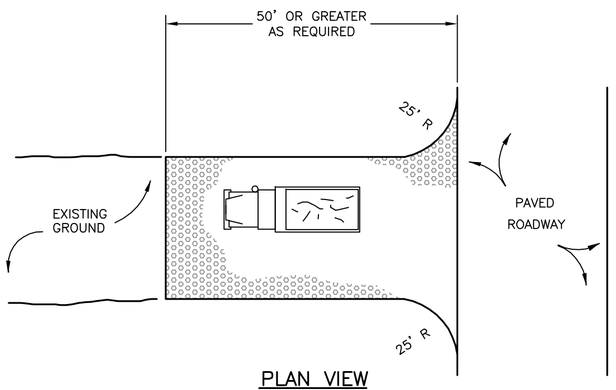
1. CONTRACTOR SHALL INSTALL STABILIZED CONSTRUCTION ENTRANCE AT EACH ACCESS POINT TO THE SITE, OR NECESSARY FOR THE WORK.
2. STONE SIZE SHALL BE COARSE AGGREEGATE (STONE SIZE 2" TO 3").
3. NON-WOVEN GEOTEXTILE - PLACE OVER ENTIRE ARE PRIOR TO PLACING OF STONE.
4. MAINTENANCE - THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOWING OF SOIL ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR AND/OR CLEANOUT OF ANY MEASURES USED TO TRAP SOIL.



③ HAY BALE DETAIL
NOT TO SCALE

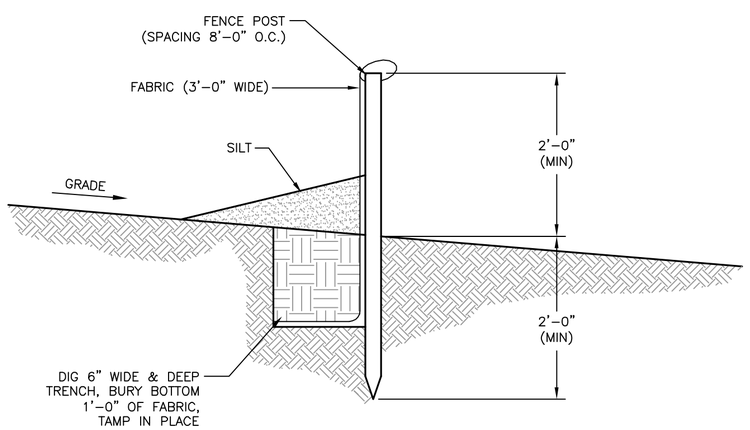
HAY BALE NOTES

1. WHERE HAY BALES AND SILT FENCES ARE REQUIRED TOGETHER, THE HAY BALES SHALL BE LOCATED UPGRADIENT OF SILT FENCE.
2. REBAR OR STAKES SHALL BE EMBEDDED 2'-0" IN GROUND, TWO PLACES IN EACH HAY BALE.



PLAN VIEW

① STABILIZED CONSTRUCTION ENTRANCE DETAIL
NOT TO SCALE



② SILT FENCE DETAIL
NOT TO SCALE

Title:

EROSION CONTROL PLAN AND DETAILS

BUILDINGS 2 AND 3 - BCP SITE NO. C241192
26-40 1ST STREET, ASTORIA, NEW YORK

Prepared For:
HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial
REMEDIAL ENGINEERING, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: L.J.	Date: 17MAY17	PLATE
Prepared by: G.M.	Scale: AS SHOWN	1
Project Mgr: K.S.	Project: 1338.0010Y000	
File: 1338.0010Y161.01.DWG		

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APPENDIX C

Secant Barrier Wall Design Drawings

GENERAL NOTES

1. ALL ELEVATIONS SHOWN ON THE CONTRACT DRAWINGS ARE REFERENCED TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).

   DATUM CONVERSIONS:
   NGVD29 = NAVD88 + 1.1'
   BPQD = NAVD88 – 1.625' (PER FEMA)
   BPQD = NAVD88 – 1.4' (PER PROJECT SURVEYOR)

2. ALL WORK SHALL COMPLY WITH THE REQUIREMENTS OUTLINED ON THE CONTRACT DRAWINGS AND AS INDICATED IN THE PROJECT SPECIFICATIONS.
3. ALL WORK SHALL COMPLY WITH THE REQUIREMENTS OF THE 2014 NEW YORK CITY BUILDING CODE AND THE REQUIREMENTS OF ALL OTHER AGENCIES HAVING JURISDICTION.
4. THE WORK SHOWN IN THESE DRAWINGS SHALL BE EXECUTED IN CONJUNCTION WITH THOSE OF THE ARCHITECTURAL, STRUCTURAL, MECHANICAL, SITE/CIVIL DRAWINGS AND DRAWINGS OF ALL OTHER DISCIPLINES. DISCREPANCIES BETWEEN THESE DRAWINGS AND THOSE OF OTHER DISCIPLINES SHALL BE BROUGHT TO THE ATTENTION OF THE ARCHITECT FOR CLARIFICATION PRIOR TO COMMENCING WORK.
5. THE CONTRACTOR SHALL VERIFY ALL EXISTING CONDITIONS IN THE FIELD PRIOR TO COMMENCING WORK. VERIFY ALL DIMENSIONS, ELEVATIONS, AND LOCATIONS OF EXISTING UTILITIES AND REPORT ANY DISCREPANCIES BETWEEN THE CONTRACT DRAWINGS AND THE FIELD CONDITIONS TO THE ARCHITECT FOR CLARIFICATION PRIOR TO COMMENCING WORK.
6. EXISTING UTILITIES AND STRUCTURES TO REMAIN SHALL BE PROTECTED AS REQUIRED.
7. COORDINATE THE LOCATION OF ALL SUPPORT OF EXCAVATION ELEMENTS WITH THAT OF NEW WORK. CONSTRUCTION SEQUENCING SHALL BE MODIFIED AS REQUIRED FOR EXECUTION OF THIS WORK AND THAT OF NEW FOUNDATIONS.
8. THE CONTRACTOR SHALL OBTAIN APPROVAL FROM THE OWNER'S ENGINEER PRIOR TO RELOCATING ANY SUPPORT OF EXCAVATION ELEMENT TO FACILITATE FOUNDATION CONSTRUCTION.
9. REFER TO STRUCTURAL DRAWINGS (FO AND S SERIES) FOR BUILDING FOUNDATION DETAILS.
10. REFER TO ARCHITECTURAL DRAWINGS (A SERIES) FOR GENERAL BUILDING DETAILS.
11. REFER TO CIVIL DRAWINGS (C SERIES) FOR SITE UTILITIES AND GRADING DETAILS.
12. THE CONTRACTOR SHALL COORDINATE HIS WORK WITH THAT OF OTHER TRADES, INCLUDING BUT NOT LIMITED TO: SITE UTILITIES, GENERAL EARTHWORK, AND BUILDING FOUNDATION CONSTRUCTION.
13. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS FROM THE APPROPRIATE AGENCIES PRIOR TO COMMENCING WORK, AS REQUIRED.
14. BENCH CUT OR SLOPE ALL EXCAVATIONS TO COMPLY WITH OSHA STANDARDS UNLESS SUITABLE TEMPORARY SHORING OR BRACING IS PROVIDED.
15. DO NOT OVER-EXCAVATE UNLESS DIRECTED BY THE OWNER'S ENGINEER FOR REMOVAL OF UNSUITABLE SOIL.
16. REFER TO GEOTECHNICAL ENGINEERING REPORT PREPARED BY LANGAN ENGINEERING, ENVIRONMENTAL, SURVEYING AND LANDSCAPE ARCHITECTURE, D.P.C., DATED 16 NOVEMBER 2016 FOR INFORMATION PERTAINING TO GENERAL SUBSURFACE CONDITIONS.
17. BASED ON THE GEOTECHNICAL ENGINEERING REPORT NOTED ABOVE, GROUNDWATER HAS BEEN ASSUMED TO VARY FROM BETWEEN ABOUT EL. –2.4 FT AND EL. +3.0 FT.

STRUCTURAL STEEL NOTES

1. STEEL CORE BEAMS AND OTHER STRUCTURAL STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A572 OR A992, GRADE 50, U.ON.
2. MISCELLANEOUS STEEL SHALL CONFORM TO THE REQUIREMENTS OF ASTM A572, GRADE 50, U.O.N.
3. ALL WELDING SHALL BE PERFORMED BY CERTIFIED WELDERS.
4. FIELD AND SHOP WELDING SHALL CONFORM TO THE REQUIREMENTS OF THE LATEST AMERICAN WELDING SOCIETY STRUCTURAL WELDING CODE.
5. WELDING ELECTRODES SHALL BE E70XX, U.O.N.
6. SINGLE PASS FILLET WELDS SHALL BE AS NOTED ON THE CONTRACT DRAWINGS, BUT SHOULD NOT BE LESS THAN 5/16 INCH U.O.N.
7. REFER TO STRUCTURAL DRAWINGS (FO AND S SERIES) AND THE PROJECT SPECIFICATIONS FOR STRUCTURAL STEEL REQUIREMENTS RELATED TO ALL OTHER WORK.

CONCRETE NOTES

1. ALL CONCRETE SHALL BE NORMAL WEIGHT CONTROLLED CONCRETE, U.O.N., AND SHALL COMPLY WITH THE A.C.I. BUILDING CODE AND THE NEW YORK CITY BUILDING CODE.
2. CAST-IN-PLACE CONCRETE FOR PRIMARY SECANT PILES SHALL HAVE A MINIMUM UNCONFINED COMPRESSIVE STRENGTH AT 28-DAYS (f'c) OF 3,000 PSI. ALL OTHER CAST IN PLACE CONCRETE SHALL HAVE A MINIMUM UNCONFINED COMPRESSIVE STRENGTH AT 28 DAYS (f'c) OF 3,000 PSI, U.O.N.
3. THE CONTRACTOR SHALL SUBMIT MIX DESIGNS FOR ALL PROPOSED CAST-IN-PLACE CONCRETE MATERIALS PROPOSED FOR USE.
4. MINIMUM CONCRETE COVER SHALL BE IN ACCORDANCE WITH ACI 318-11.
5. TOLERANCES FOR CONCRETE CONSTRUCTION SHALL BE IN ACCORDANCE WITH ACI 117-10.
6. ONE SET OF SIX 4"X8" CYLINDERS SHALL BE TAKEN BY AN INDEPENDENT TESTING AGENCY FOR EVERY 50 CUBIC YARDS OF CONCRETE PLACED OR A MINIMUM OF ONE SET FOR EACH DAY THAT CONCRETE IS CAST. SAMPLES SHALL BE COMPRESSION TESTED AS FOLLOWS: (1) @ 3 DAYS, (1) @ 7 DAYS, (1) @ 14 DAYS, AND (2) @ 28 DAYS. SAMPLES ATTAINING THE REQUIRED COMPRESSIVE STRENGTH PRIOR TO THE NEXT TESTING INTERVAL SHALL NOT REQUIRE FURTHER TESTING. SAMPLING SHALL BE IN ACCORDANCE WITH ASTM C172. CYLINDERS SHALL BE PREPARED AND CURED IN ACCORDANCE WITH ASTM C31 AND ASTM C511. COMPRESSION TESTING SHALL BE IN ACCORDANCE WITH ASTM C39. FIELD TESTING OF SAMPLES SHALL BE IN ACCORDANCE WITH SECTION 1905.6.3.6 OF THE NEW YORK CITY BUILDING CODE.
7. REFER TO STRUCTURAL DRAWINGS (FO AND S SERIES) AND THE PROJECT SPECIFICATIONS FOR CONCRETE REQUIREMENTS RELATED TO ALL OTHER WORK.

GROUT NOTES

1. GROUT FOR TIEBACKS AND TOE-PINS SHALL CONSISTS OF A MIXTURE OF PORTLAND CEMENT (TYPE I, II, OR III) AND WATER. CONTRACTOR SHALL SUBMIT A GROUT MIX DESIGN SUITABLE FOR ACHIEVING A MINIMUM UNCONFINED COMPRESSIVE STRENGTH AT 28 DAYS (f'c) OF 5,000 PSI.
2. GROUT SHALL BE MIXED THOROUGHLY WITH A HIGH SPEED PADDLE MIXER OR MOYNO. READY MIX GROUT SHALL BE AN ACCEPTABLE ALTERNATIVE.
3. GROUT SHALL BE PUMPED USING A HYDRAULIC PUMP AND SHALL BE PLACED BY TREMIE FROM THE BOTTOM UP.
4. ONE SET OF SIX 3"X6" CYLINDERS SHALL BE TAKEN BY AN INDEPENDENT TESTING AGENCY FOR EVERY 50 CUBIC YARDS OF GROUT PLACED OR A MINIMUM OF ONE SET FOR EACH DAY THAT GROUT IS CAST. SAMPLES SHALL BE COMPRESSION TESTED AS FOLLOWS: (1) @ 3 DAYS, (1) @ 7 DAYS, (1) @ 14 DAYS, AND (2) @ 28 DAYS. SAMPLES ATTAINING THE REQUIRED COMPRESSIVE STRENGTH PRIOR TO THE NEXT TESTING INTERVAL SHALL NOT REQUIRE FURTHER TESTING. COMPRESSION TESTING SHALL BE IN ACCORDANCE WITH ASTM C39.

TIMBER NOTES

1. TIMBER FOR GUARDRAILS SHALL BE ROUGH SAWN, FULL SIZE, CONSTRUCTION GRADE LUMBER WITH A MINIMUM ALLOWABLE BENDING STRESS OF 1,500 PSI.
2. WOOD AND TIMBER FOR OTHER ELEMENTS CONSTRUCTED SHALL BE COMPRISED OF SOUTHERN PINE NO. 1 DENSE (OR APPROVED EQUIVALENT) WITH A MINIMUM FIBER BENDING STRESS EQUAL TO 1,450 PSI, A MINIMUM FIBER COMPRESSION STRESS PARALLEL TO THE GRAIN EQUAL TO 1,750 PSI, AND A MINIMUM YOUNG'S MODULUS EQUAL TO 660,000 PSI.
3. ALL TIMBERS SHALL BE OF THE MINIMUM SIZES SHOWN ON THE DRAWINGS.

GENERAL PHASING NOTES

1. THE CONTRACTOR SHALL ESTABLISH AND INSTALL ALL REQUIRED MONITORING FOR ADJACENT BUILDINGS AND STRUCTURES.
2. THE CONTRACTOR SHALL VERIFY LOCATION OF, AND CLEAR ALL UTILITIES, OBSTRUCTIONS, AND STRUCTURES OVER AND UNDER AREA OF EXCAVATION.
3. LAYOUT SECANT PILE GUIDE WALL BY LICENSED SURVEYOR.
4. EXCAVATE FOR GUIDE WALL. CARE SHALL BE TAKEN TO PROTECT ADJACENT STRUCTURES AND UTILITIES.
5. COMPACT SUBGRADE OF GUIDE WALLS AS NECESSARY TO ENSURE STABLE BOTTOM AND SIDES.
6. FORM AND CAST GUIDE WALLS. IDENTIFY LOCATIONS OF PRIMARY AND SECONDARY SECANT PILES ON THE SURFACE OF THE GUIDE WALLS.
7. GRADE SITE AS REQUIRED TO PROVIDE STABLE WORKING GRADE. WHERE REQUIRED, SLOPES SHALL NOT EXCEED AND INCLINATION OF 1.5H:1V. IN NO CASE SHALL EXCAVATION UNDERMINE OTHER STRUCTURES OR THE ADJOINING STREETS.
8. DRILL PRIMARY SECANT AS INDICATED HEREIN.
9. DRILL SECONDARY SECANT PILES AND NECESSARY TOE-PINS AS INDICATED HEREIN.
10. TWO WEEKS PRIOR TO EXCAVATION AND/OR DEWATERING INSTALL REMAINING MONITORING (INCLINOMETERS AND PIEZOMETERS) TO ACQUIRE REQUIRED BASELINE READINGS.
11. PERFORM GENERAL EXCAVATION TO ELEVATIONS INDICATED HEREIN AND INSTALL BRACING AT THE ELEVATIONS INDICATED HEREIN.
12. PERFORM DEWATERING AS REQUIRED TO MAINTAIN GROUNDWATER AT LEAST 2 FEET BELOW WORKING GRADES.
13. CONTINUE GENERAL EXCAVATION TO THE DEPTHS REQUIRED OR AS DIRECTED BY THE OWNERS ENGINEER.
14. BACKFILL WHERE REQUIRED TO FINAL SUBGRADE ELEVATIONS USING APPROVED MATERIALS.
15. PREPARE SUBGRADE AND CAST MUD SLAB PER STRUCTURAL DRAWINGS (FO SERIES AND S SERIES).
16. CONSTRUCT FOUNDATIONS AS PER STRUCTURAL DRAWINGS (FO SERIES AND S SERIES) AND PROJECT SPECIFICATIONS.
17. THE ANNULUS BETWEEN NEW FOUNDATIONS AND THE SUPPORT OF EXCAVATION SYSTEM SHALL BE BACKFILLED PER THE NOTES PROVIDED HEREIN AND THE CONTRACT SPECIFICATIONS. BACKFILL SHALL NOT BE PLACED UNTIL THE FOUNDATION WALLS HAVE BEEN SUITABLY BRACED AGAINST LATERAL MOVEMENT UNLESS OTHERWISE AUTHORIZED IN WRITING BY THE ENGINEER OF RECORD FOR FOUNDATIONS.

SECANT PILE WALL INSTALLATION NOTES

1. ALL SECANT PILES SHALL BE INSTALLED IN THE LOCATIONS SHOWN ON THE CONTRACT DRAWINGS UNLESS OTHERWISE APPROVED BY THE OWNER'S ENGINEER. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCURATE LAYOUT, INCLUDING ANY NECESSARY SURVEYING.
2. A CONTINUOUS CONCRETE GUIDE WALL SHALL BE UTILIZED TO ESTABLISH THE TOP POSITION OF ALL THE SECANT PILES.
3. SECANT PILES SHALL BE DRILLED THROUGH TEMPORARY STEEL CASING ROTATED INTO THE GROUND USING THE ROTARY DRIVE OF A DRILL RIG.
4. TEMPORARY STEEL CASING SHALL BE DRILLED USING TRADITIONAL DRILL TOOLING (E.G. KELLY BAR WITH ROCK AUGER, OR OTHER APPROVED METHOD) FOR REMOVAL OVERBURDEN SOIL. EXCAVATION SHALL NOT PROCEED BEYOND THE BOTTOM OF THE CASING UNLESS DRILLING IN COMPETENT BEDROCK. THE CASING SHALL BE FIRMLY SEATED ON BEDROCK TO MITIGATE INFILTRATION OF SOIL AND WATER PRIOR TO CONCRETE PLACEMENT.
5. UPON REACHING BEDROCK, OR COMPLETING ROCK SOCKET DEVELOPMENT, THE SURFACE AT THE BOTTOM OF THE ELEMENT SHALL BE THOROUGHLY CLEANED WITH A CLEAN-OUT BUCKET OR EQUIVALENT TOOLING TO PROVIDE FIRM SOUND CONTACT WITH THE BEDROCK.
6. PROVIDE WATER OR DRILLING SLURRY WHEN DRILLING BELOW THE GROUNDWATER TABLE TO MAINTAIN A STABLE EXCAVATION BOTTOM, AS REQUIRED.
7. PRIOR TO DRILLING, CASING SHALL BE PLUMBED USING A LEVEL OR ALTERNATE MEANS. VERTICALITY SHALL BE CHECKED PERIODICALLY DURING DRILLING TO ENSURE PROPER ALIGNMENT. ADJUST MEANS AND MAST ORIENTATION AS REQUIRED TO MAINTAIN VERTICALITY.
8. SECANT PILES SHALL BE DRILLED PLUMB TO WITHIN 1% OF VERTICAL.
9. SECANT PILES SHALL BE FIRMLY SEATED OR SOCKETED AS INDICATED HEREIN INTO ROCK MEETING NYCBC CLASS 1C OR BETTER.
10. ALL CONCRETE SHALL BE PLACED BY TREMIE METHOD.
11. A MINIMUM CONCRETE HEAD OF 15 FEET SHALL BE MAINTAINED WHEN EXTRACTING TEMPORARY CASING.
12. ROCK SOCKETS: WHERE REQUIRED OR ELECTED, ROCK SOCKETS SHALL BE DRILLED USING ROTARY DRILLING METHODS OR A DOWN-THE-HOLE HAMMER. ROCK SOCKETS SHALL BE AS SHOWN ON THE DETAILS PROVIDED HEREIN AND SHALL BE FORMED IN ROCK MEETING NYCBC CLASS 1C OR BETTER.
13. TOE-PINS: WHERE REQUIRED OR ELECTED, INSTALL TOE-PINS AS SHOWN ON THE DETAILS PROVIDED HEREIN. ROCK SOCKETS FOR THE TOE-PINS SHALL BE DRILLED WITH AN APPROVED DRILLING METHOD AND SHALL BE FORMED IN ROCK MEETING NYCBC CLASS 1C OR BETTER.
14. SECONDARY SECANT PILES SHALL CONTAIN A FULL LENGTH CORE BEAM CENTERED WITHIN THE PILE. CORE BEAMS SHALL PLUMBED TO VERTICAL AND FLANGES SHALL BE ORIENTED PARALLEL WITH THE WALL ALIGNMENT.
15. FINAL DEPTHS OF SECANT PILES SHALL BE MEASURED USING A SUITABLE WEIGHTED TAPE OR BY OTHER METHODS DEEMED ACCEPTABLE TO THE OWNER'S ENGINEER PRIOR TO PLACEMENT OF CORE BEAMS OR CONCRETE.
16. NEW SECANT PILES SHALL NOT BE DRILLED WITHIN 10 FEET OF PREVIOUSLY DRILLED SECANT PILES UNLESS CONCRETE OF THE PREVIOUS SECANT PILE HAS CURED FOR A MINIMUM OF 24 HOURS.
17. SECANT PILES SHALL FORM A CONTIGUOUS WALL WITH A 6-INCH MINIMUM OVERLAP BETWEEN ADJACENT PILES.
18. THE CENTER TO CENTER SPACING OF INDIVIDUAL SECANT PILES SHALL NOT EXCEED 33.37 INCHES UNLESS SPECIFICALLY APPROVED BY THE OWNER'S ENGINEER PRIOR TO CONSTRUCTION, OR SHOWN ON THE CONTRACT DRAWINGS.
19. SECANT PILE INSTALLATION SHALL BE CONDUCTED SUCH THAT THERE IS NO HEAVE, SETTLEMENT OR LOSS OF SUPPORT TO ADJACENT STRUCTURES.
20. REMEDIAL GROUTING SHALL BE PERFORMED AS REQUIRED TO SEAL INTERFACES IN INSTANCES OF OBSERVED GROUNDWATER SEEPAGE.
21. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS FOR MATERIALS AND INSTALLATION PROCEDURES. ALTERNATES, WHERE PROPOSED, SHALL BE ACCOMPANIED BY ALL ATTENDANT SUPPORTING CALCULATIONS.
22. REFER TO SOE-103 AND SOE-104 FOR SECANT PILE LAYOUT.
23. REFER TO SOE-200 SERIES, SOE-300 SERIES, AND SOE-400 SERIES FOR ADDITIONAL INSTALLATION SEQUENCING NOTES AND DETAILS.

TIEBACK INSTALLATION AND TESTING NOTES

1. REFER TO SOE-102 FOR TIEBACK ANCHOR SCHEDULE, PLATE SIZES, LOADS, AND ORIENTATION.
2. TIEBACKS SHALL CONSIST OF SINGLE-CORROSION PROTECTED HOLLOW BARS MANUFACTURED BY SKYLINE STEEL OR APPROVED EQUIVALENT. WHERE REQUIRED, FREE STRESSING LENGTH SHALL BE FULLY COATED WITH A CORROSION INHIBITING GREASE AND THEN ENCAPSULATED BY A SEAMLESS POLYPROPYLENE SHEATH, OR WRAPPED USING PVC TAPE.
3. CENTRALIZERS, SPACERS, AND ANCHOR HEADS SHALL BE AS RECOMMENDED BY THE TIEBACK MANUFACTURER TO ACCOMMODATE GROUTING OPERATIONS REQUIRED FOR EACH TIEBACK.
4. THE TIEBACK BOND ZONE SHALL HAVE A MINIMUM NOMINAL DIAMETER OF AT LEAST 6 INCHES AND LENGTH ACCORDING TO TIEBACK ANCHOR SCHEDULE SHOWN HEREIN.
5. CARE SHALL BE TAKEN NOT TO DAMAGE THE TIEBACK ELEMENT.
6. TIEBACKS SHALL BE INSTALLED AT THE ELEVATIONS AND ANGLES SHOWN HEREIN.
7. ALL TIEBACKS SHALL BE PROOF OR PERFORMANCE TESTED IN ACCORDANCE WITH THE REQUIREMENTS OUTLINED IN THE POST-TENSIONING INSTITUTE (PTI) DOCUMENT "RECOMMENDATIONS FOR PRESTRESSED ROCK AND SOIL ANCHORS", PTI-DC35.1-14.

   PROOF TEST: AL, 0.25P, 0.50P, 0.75P, 1.00P, 1.20P, 1.33P. HOLD 1.33P FOR CREEP TEST. (WHERE P = DESIGN LOAD). RECORD READINGS AT 0,1,2,3,4,5,6 AND 10 MINUTES. RELEASE TO TRANSFER LOAD AND LOCK OFF ANCHOR NUT.

   PERFORMANCE TEST:
   AL, 0.25P
   AL, 0.25P, 0.50P
   AL, 0.25P, 0.50P, 0.75P
   AL, 0.25P, 0.50P, 0.75P, 1.00P
   AL, 0.25P, 0.50P, 0.75P, 1.00P, 1.20P
   AL, 0.25P, 0.50P, 0.75P, 1.00P, 1.20P, 1.33P
   HOLD 1.33P FOR CREEP TEST. RECORD MOVEMENTS USING A DIAL INDICATOR CAPABLE OF READING INCREMENTS OF 0.001 INCHES. RECORD READINGS AT 0, 1, 2, 3, 4, 5, 6, AND 10 MINUTES. RELEASE TO TRANSFER LOAD AND LOCK OFF ANCHOR NUT.

8. TEN PERCENT OF THE APPLICABLE TIEBACKS SHALL BE PERFORMANCE TESTED. THE REMAINDER OF APPLICABLE TIEBACKS SHALL BE PROOF TESTED.
9. JACKING SHALL BE PERFORMED UTILIZING A CALIBRATED CENTER-HOLE JACK.
10. TIEBACK MOVEMENTS SHALL BE RECORDED WITH A DIAL INDICATOR CAPABLE OF READING TO INCREMENTS OF 0.001-INCH.
11. TIEBACKS SHALL HAVE AN ALLOWABLE CAPACITY SUITABLE FOR ACHIEVING LOADS PRESCRIBED ON THE DRAWINGS. WHERE INDICATED, TIEBACKS SHALL BE LOCKED OFF AT 80 PERCENT OF THE DESIGN VALUE UPON COMPLETION OF TESTING U.O.N.
12. AFTER APPLICABLE TIEBACKS ARE LOCKED-OFF THE LOAD SHALL BE RELEASED AND THE TIEBACK SHALL BE LIFTED-OFF BY BRINGING THE LOAD BACK UP TO THE ASSIGNED VALUE TO ENSURE THAT LOCK-OFF IS WITHIN 5 PERCENT OF THE LOCK-OFF VALUE. IF IT IS, THE TIEBACK CAN BE LOCKED-OFF. IF IT IS NOT, REPEAT THE LOCK-OFF/LIFT-OFF TEST UNTIL WITHIN 5 PERCENT OF THE ASSIGNED VALUE.
13. CONTRACTOR SHALL SUBMIT TIEBACK SHOP DRAWINGS FOR APPROVAL PRIOR TO COMMENCING TIEBACK INSTALLATION. SHOP DRAWINGS SHALL CONTAIN TIEBACK DETAILS, INSTALLATION, AND TESTING PROCEDURES.
14. CONTRACTOR PROPOSED ALTERNATES UTILIZING SOLID THREAD BAR SHALL BE INSTALLED USING TEMPORARY STEEL CASING EXTENDING TO BEDROCK.
15. TIEBACKS SHALL BE TREMIE-GROUTED.

GENERAL EXCAVATION NOTES

1. SLOPED EXCAVATIONS SHALL BE PERMITTED WHERE ADEQUATE CLEARANCES EXIST.
2. EXCAVATIONS SHALL BE SLOPED IN ACCORDANCE WITH ALL APPLICABLE OSHA AND DOB STANDARDS.
3. SLOPES SHALL NOT EXCEED AN INCLINATION OF 1H:1V. THE INCLINATION SHALL BE DECREASED SHOULD INSTABILITY SUCH AS RAVELING BE OBSERVED OR WHERE WATER IS FOUND FLOWING THROUGH THE SLOPE FACE.
4. STOCKPILING OF EXCAVATED MATERIAL SHALL NOT BE PERMITTED WITHIN 10 FT OF THE TOP OF SLOPES.
5. EXCAVATION WITHIN 10 FT OF THE SITE PERIMETER SHALL NOT EXTEND MORE THAN 2 FT BELOW THE BRACING LEVELS INDICATED ON THE CONTRACT DRAWINGS UNTIL SUCH BRACING HAS BEEN INSTALLED, TESTED, AND PRELOADED.
6. UNSUITABLE SOILS SHALL BE REMOVED AS DIRECTED BY THE OWNER'S ENGINEER
7. EXCAVATIONS SHALL BE CARRIED TO THE LOWEST LEVEL NECESSARY TO ACHIEVE EITHER FINAL SUBGRADE OR AS REQUIRED TO SATISFY NYSDEC BROWNFIELD CLEAN-UP REQUIREMENTS. HOWEVER, SOIL EXCAVATION SHALL NOT EXTEND BELOW EL. –10'-0" WITHOUT THE WRITTEN APPROVAL OF THE SOE ENGINEER OR RECORD.

ROCK EXCAVATION NOTES

1. ROCK REQUIRING REMOVAL FOR INSTALLATION OF THE BUILDING FOUNDATIONS SHALL BE LINE DRILLED AS INDICATED HEREIN.
2. THE CENTER AXIS OF LINE DRILLING HOLES SHALL BE LOCATED A MINIMUM OF 6-INCHES BEYOND THE OUTBOARD FACE OF FOUNDATION WALLS.
3. CARE SHALL BE TAKEN TO MITIGATE DAMAGE OR UNDERMINING OF THE SUPPORT OF EXCAVATION SYSTEM.
4. ROCK REMOVAL SHALL BE PERFORMED USING MECHANICAL EXCAVATION METHODS INCLUDING BUT NOT LIMITED TO HOE-RAMS OR SPLITTERS UNLESS OTHERWISE APPROVED. ADDITIONAL LINE DRILLING SHALL BE PERFORMED AS REQUIRED. BLASTING SHALL NOT BE PERMITTED.
5. ROCK REMOVALS SHALL START AT THE INTERIOR OF THE SITE AND SHALL PROGRESS TOWARD THE PERIMETER SUCH THAT BURDEN IS REMOVED PRIOR TO REACHING SITE BOUNDARIES.
6. EXPOSED ROCK FACES SHALL BE GEOLOGICALLY MAPPED BY THE SPECIAL INSPECTOR TO DETERMINE IF BEDROCK DISCONTINUITIES WARRANT INSTALLATION OF ROCK DOWELS OR OTHER ROCK STABILIZATION TECHNIQUES. ROCK AT THE PERIMETER OF THE SITE SHALL BE EXCAVATED IN LIFTS NOT EXCEEDING 5 FEET IN HEIGHT AND EXCAVATION SHALL NOT PROCEED UNTIL ALL REQUIRED STABILIZATION MEASURES HAVE BEEN INSTALLED TO THE SATISFACTION OF THE SOE ENGINEER OF RECORD.

BACKFILL NOTES

1. BACKFILL SHALL SHALL CONSIST OF CERTIFIED, CLEAN GRANULAR SOIL, FREE OF ORGANIC MATTER AND OTHER DELETERIOUS MATERIALS, IN ACCORDANCE WITH SECTION 1803.2 OF THE NEW YORK CITY BUILDING CODE, AND MEETING THE FOLLOWING GRADATION REQUIREMENTS:

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3-INCH	100
1/4-INCH	30 TO 75
NO.40	5 TO 40
NO.200	0 TO 10

2. MOLE ROCK SHALL NOT BE PERMITTED.
3. THE CONTRACTOR SHALL SUBMIT GRADATION TEST RESULTS AND MOISTURE DENSITY RELATIONSHIPS FOR ALL PROPOSED FILL MATERIALS.
4. ALL BACKFILL MATERIALS SHALL BE APPROVED BY THE OWNER'S ENVIRONMENTAL AND GEOTECHNICAL ENGINEERS PRIOR TO DELIVERY OR PLACEMENT.
5. BACKFILL SHALL BE PLACED IN UNIFORM HORIZONTAL LIFTS. THE THICKNESS OF LIFTS PRIOR TO COMPACTION SHALL NOT EXCEED 12 INCHES.
6. BACKFILL SHALL BE COMPACTED TO 95% OF THE MAXIMUM DRY DENSITY AS DETERMINED BY ASTM D1557 (MODIFIED PROCTOR).
7. COMPACTION SHALL BE VERIFIED BY THE SPECIAL INSPECTOR IN ACCORDANCE WITH ASTM D2922, AS APPLICABLE. TESTING SHALL BE PERFORMED AT INTERVALS OF ONE TEST PER 1,000 SQUARE FEET FOR EACH LIFT PLACED.
8. FREE DRAINING GRAVEL OR CRUSHED STONE, LEAN CONCRETE AND CONTROLLED LOW STRENGTH MATERIAL (CLSM) SHALL BE ACCEPTABLE ALTERNATES
9. FREE DRAINING GRAVEL OR CRUSHED STONE PLACED TO ESTABLISH FINAL SUBGRADE BENEATH THE MAT FOUNDATIONS SHALL MEET THE REQUIREMENTS FOR NYSDOT ITEM 605.0901 UNDERDRAIN FILTER TYPE 1 OR AAHSTO NO. 57.

MONITORING NOTES

1. MONITORING SHALL CONFORM TO SECTION 310901 OF THE PROJECT SPECIFICATIONS AND THE REQUIREMENTS PRESENTED HEREIN.
2. SURVEY MONITORING POINTS SHALL BE INSTALLED AT LOCATIONS DETERMINED IN CONSULTATION WITH THE OWNER'S ENGINEER. MONITORING POINTS SHALL BE INSTALLED AND BASELINE READINGS SHALL BE TAKEN PRIOR TO COMMENCING EXCAVATION ACTIVITIES.
3. A LICENSED SURVEYOR SHALL BE RETAINED TO MONITOR MOVEMENTS OF THE SUPPORT OF EXCAVATION SYSTEM AND ADJOINING GROUND SURFACE.
4. INSTALL SURVEY MONITORING POINTS ON SUBSURFACE STRUCTURES AT MAXIMUM HORIZONTAL INTERVALS OF 25 FEET, BUT NOT LESS THAN TWO POINTS PER WALL. MONITORING POINTS SHALL BE ESTABLISHED AT EACH HORIZONTAL LOCATION NEAR THE BASE OF AND TOP OF BUILDINGS.
5. AT A MINIMUM, SURVEY MONITORING POINTS SHALL BE INSTALLED AT THE SUPPORT OF EXCAVATION SYSTEM AT THE TOP OF EVERY TENTH SECANT PILE. INSTALL SURVEY MONITORING POINTS VERTICALLY IN 15 FEET MAXIMUM INTERVALS BEGINNING AT THE TOP OF THE SUPPORT OF EXCAVATION WALL.
6. OPTICAL SURVEY READINGS SHALL BE TAKEN TO AN ACCURACY OF ±0.005 FT (1.5MM). OPTICAL SURVEYING SHALL BE PERFORMED USING EITHER A MANUALLY OPERATED TOTAL STATION OR AN AUTOMATIC TOTAL STATION REFERENCED TO A STABLE BENCHMARK BEYOND THE LIMITS OF THE PROJECT SITE.
7. AT A MINIMUM, SURVEY MONITORING SHALL BE PERFORMED ONCE WEEKLY DURING EXCAVATION. THE FREQUENCY OF MONITORING SHALL BE INCREASED OR DECREASED AS DIRECTED BY THE OWNER'S ENGINEER PENDING THE RESULTS OF RECORDED MONITORING DATA TRENDS.
8. THE CONTRACTOR SHALL NOTIFY THE CONSTRUCTION MANAGER, OWNER, AND THE DESIGN TEAM IMMEDIATELY IF LATERAL MOVEMENT OF THE SUPPORT OF EXCAVATION SYSTEM EXCEEDS 3/4-INCH. THE CONTRACTOR'S MONITORING CONSULTANT SHALL REVIEW THE DATA FOR TRENDS AND SHALL IDENTIFY IF MOVEMENTS ARE ATTRIBUTED TO INSTRUMENT ERROR OR TOLERANCES.
9. THE MAXIMUM PERMISSIBLE LATERAL MOVEMENT OF THE SUPPORT OF EXCAVATION SYSTEM SHALL BE 1-INCH. VERTICAL MOVEMENT SHALL BE LIMITED TO 1/4-INCH.
10. IN THE EVENT THAT MONITORING INDICATES MOVEMENT EXCEEDING THE LIMIT LEVELS DESCRIBED HEREIN OR DEFINED IN SECTION 310901, THE CONTRACTOR SHALL CEASE CONSTRUCTION ACTIVITIES. WHERE REQUIRED, THE CONTRACTOR SHALL PROVIDE STABILIZATION OF THE EXCAVATION SUPPORT SYSTEM VIA INSTALLATION OF TEMPORARY EARTHEN BERMS AND/OR ADDITIONAL BRACING. ADDITIONAL EXCAVATION ACTIVITIES SHALL NOT PROCEED WITHOUT THE AUTHORIZATION OF THE OWNER'S ENGINEER AND ANY OTHER AGENCIES HAVING JURISDICTION.
11. ALL SURVEY MONITORING POINTS SHALL BEAR A UNIQUE IDENTIFICATION. AS-BUILT PLANS SHALL BE PREPARED FOR ALL SURVEY MONITORING POINTS INSTALLED. PLANS SHALL BE AMENDED AS REQUIRED DURING CONSTRUCTION FOR THE ABANDONMENT, REPLACEMENT, OR ADDITION OF NEW SURVEY MONITORING LOCATIONS. ALL MONITORING RESULTS SHALL BE PROVIDED TO THE CONSTRUCTION MANAGER, OWNER'S ENGINEER, AND ANY OTHER AGENCIES HAVING JURISDICTION WITHIN 24 HOURS OF TAKING READINGS.
12. SEISMOGRAPHS SHALL BE INSTALLED AT LOCATIONS DETERMINED IN CONSULTATION WITH THE OWNER'S ENGINEER. SEISMOGRAPHS SHALL BE INSTALLED AND BASELINE READINGS SHALL BE TAKEN PRIOR TO COMMENCING EXCAVATION ACTIVITIES.
13. PORTABLE VIBRATION MONITORS/SEISMOGRAPHS SHALL BE INSTALLED ADJACENT TO AREAS WHERE WORK IS TO BE PERFORMED.
    A. THE MAXIMUM PERMISSIBLE PEAK PARTICLE VELOCITY (PPV) SHALL BE 2.0 IN/SEC FOR ALL STRUCTURES. SENSITIVITY OF SEISMOGRAPHS SHALL BE SET TO 0.5 IN/SEC FOR NOTIFICATION IN ORDER TO PROPERLY ADDRESS OR MODIFY MEANS AND METHODS AS NECESSARY.
    B. THE MAX PPV MAY BE REDUCED BY THE OWNER'S ENGINEER IF MOVEMENTS AND/OR CRACKING ARE DETECTED IN ADJACENT BUILDINGS OR THE PERFORMANCE OF THE SUPPORT OF EXCAVATION SYSTEM IS IMPAIRED.
    C. THE MAXIMUM PERMISSIBLE LEVELS SHALL BE CALCULATED AS THE PEAK VECTOR SUM OF VELOCITY MEASUREMENTS TAKEN IN THREE ORTHOGONAL DIRECTIONS.
14. INCLINOMETERS SHALL BE INSTALLED AT LOCATIONS DETERMINED IN CONSULTATION WITH THE OWNERS ENGINEER.
15. PIEZOMETERS SHALL BE INSTALLED AT LOCATIONS DETERMINED IN CONSULTATION WITH THE OWNER'S ENGINEER.
16. RECORDS OF THE MONITORING PROGRAM SHALL BE RETAINED.

NEW YORK CITY BUILDING DEPARTMENT NOTES

1. ALL WORK SHALL BE PERFORMED IN ACCORDANCE WITH THE REQUIREMENTS OUTLINED IN THE 2014 NEW YORK CITY BUILDING CODE.
2. EXCAVATION AND FILL OPERATIONS SHALL BE CONDUCTED IN SUCH A MANNER THAT LIFE AND PROPERTY ARE NOT ENDANGERED AS PER SECTION 3304.2 OF THE NEW YORK CITY BUILDING CODE.
3. THE CONTRACTOR SHALL NOTIFY THE DEPARTMENT OF BUILDINGS AT LEAST 24 HOURS, BUT NO MORE THAN 48 HOURS PRIOR TO COMMENCING EXCAVATION, OR ON THE LAST BUSINESS DAY BEFORE THE COMMENCEMENT DATE AS PER SECTION 3304.3.1 OF THE NEW YORK CITY BUILDING CODE.
4. THE CONTRACTOR SHALL PROVIDE A WRITTEN NOTICE TO THE ADJACENT PROPERTY OWNER NOT LESS THAN 10 DAYS PRIOR TO THE SCHEDULED STARTING DATE OF EXCAVATION. THE WRITTEN NOTICE SHALL PROVIDE A DESCRIPTION OF THE WORK TO BE PERFORMED, THE TIMEFRAME AND SCHEDULE, AND THE CONTACT INFORMATION OF THE PERSON CAUSING THE EXCAVATION AND OF THE DEPARTMENT AS PER SECTION 3304.3.2 OF THE NEW YORK CITY BUILDING CODE.
5. ALL SIDES OR SLOPES OF EXCAVATIONS OR EMBANKMENTS SHALL BE INSPECTED AFTER RAINSTORMS, OR ANY OTHER HAZARD-INCREASING EVENT, AND SAFE CONDITIONS SHALL BE RESTORED AS PER SECTION 3304.4.2 OF THE NEW YORK CITY BUILDING CODE.
6. EXCAVATIONS SHALL BE DRAINED AND DRAINAGE SHALL BE MAINTAINED USING PUMPING AS REQUIRED AS PER SECTION 3304.8 OF THE NEW YORK CITY BUILDING CODE. WHERE PUMPING IS REQUIRED, PERMITS SHALL BE OBTAINED FROM THE AGENCY HAVING JURISDICTION.
7. ALL WORK CONTAINED HEREIN SHALL BE SUBJECT TO SPECIAL INSPECTION IN ACCORDANCE WITH CHAPTER 17 OF THE NEW YORK CITY BUILDING CODE. SPECIAL INSPECTORS SHALL MEET THE QUALIFICATIONS OUTLINED IN THE RULES OF THE CITY OF NEW YORK, SECTION 101-06, DATED 6-30-08. REQUIRED SPECIAL INSPECTIONS INCLUDE.
    A. SUBSURFACE CONDITIONS AS PER SECTION 1704.7
       a. SUBGRADE
       b. FILL PLACEMENT
       c. IN-PLACE SOIL DENSITY
    B. CONCRETE CONSTRUCTION AS PER SECTION 1704.4
       a. CONCRETE MIX DESIGN
       b. CONCRETE CYLINDERS AND TESTING
       c. CAST-IN-PLACE CONCRETE INCLUDING PLACEMENT OF FORM WORK AND REINFORCING STEEL
       d. GROUT MIX DESIGN
       e. GROUT CUBES AND TESTING
    C. EXCAVATION – SHEETING, SHORING AND BRACING AS PER 1704.20.2, 1814, AND 3304.4
       a. SHORING, BRACING, AND SHEETING
       b. EXCAVATION
       c. SECANT PILE INSTALLATION
       d. TIEBACK INSTALLATION AND TESTING
    D. STEEL CONSTRUCTION AS PER SECTION 1704.3
       a. WELDING
8. REFER TO THE PROJECT SPECIFICATIONS FOR ADDITIONAL INFORMATION ON SCOPE AND DETAILED REQUIREMENTS FOR INSPECTIONS AND TESTING.
9. REFER TO THE PROJECT SPECIFICATIONS AND DRAWINGS FOR INSPECTION AND TESTING REQUIREMENTS PERTAINING TO WORK OF OTHER TRADES.

PLOT PLAN

SCALE: 1/64" = 1'-0"

SOURCE:
HALLETTS POINT, BOUNDARY AND TOPOGRAPHIC SURVEY PREPARED BY CONTROL POINT ASSOCIATES INC.PC, DATED JUN. 28, 2016.

DRAWING LIST

DRAWING	TITLE
SOE-001.00	SUPPORT OF EXCAVATION – GENERAL NOTES
SOE-101.00	SUPPORT OF EXCAVATION – GENERAL PLAN (PART 1)
SOE-102.00	SUPPORT OF EXCAVATION – GENERAL PLAN (PART 2)
SOE-103.00	SUPPORT OF EXCAVATION – LAYOUT PLAN (PART 1)
SOE-104.00	SUPPORT OF EXCAVATION – LAYOUT PLAN (PART 2)
SOE-201.00	SUPPORT OF EXCAVATION – TYPICAL SECTIONS (SHEET 1 OF 4)
SOE-202.00	SUPPORT OF EXCAVATION – TYPICAL SECTIONS (SHEET 2 OF 4)
SOE-203.00	SUPPORT OF EXCAVATION – TYPICAL SECTIONS (SHEET 3 OF 4)
SOE-204.00	SUPPORT OF EXCAVATION – TYPICAL SECTIONS (SHEET 4 OF 4)
SOE-301.00	SUPPORT OF EXCAVATION – ELEVATIONS (SHEET 1 OF 6)
SOE-302.00	SUPPORT OF EXCAVATION – ELEVATIONS (SHEET 2 OF 6)
SOE-303.00	SUPPORT OF EXCAVATION – ELEVATIONS (SHEET 3 OF 6)
SOE-304.00	SUPPORT OF EXCAVATION – ELEVATIONS (SHEET 4 OF 6)
SOE-305.00	SUPPORT OF EXCAVATION – ELEVATIONS (SHEET 5 OF 6)
SOE-306.00	SUPPORT OF EXCAVATION – ELEVATIONS (SHEET 6 OF 6)
SOE-401.00	SUPPORT OF EXCAVATION – DETAILS (SHEET 1 OF 2)
SOE-402.00	SUPPORT OF EXCAVATION – DETAILS (SHEET 2 OF 2)
SOE-501.00	SUPPORT OF EXCAVATION – MONITORING PLAN (PART 1)
SOE-502.00	SUPPORT OF EXCAVATION – MONITORING PLAN (PART 2)

Halletts Point Building 3

26-40 1st Street,
Queens, NY 11102

Halletts Building 3 SPE LLC
C/O Royal Realty Corp.
One Bryant Park
New York, NY 10036

Davis Brody Bond, LLP
Architects & Planners
1 New York Plaza - Suite 4200
New York, NY 10004
212.633.4700

Interior Designer
Selldorf Architects
860 Broadway, 2nd Floor
New York, NY 10003
212.219.9571

Structural Engineer
Severud Associates
469 Seventh Avenue, 9th Floor
New York, NY 10018
212.986.3700

Mechanical/ Electrical/ Plumbing Engineers
Jaros Baum & Bolles
80 Pine Street #12
New York, NY 10005
212.530.9300

Civil & Geotechnical Engineers
Langan
21 Pennsylvania Plaza
New York, NY 10001
212.479.5400

Marine Engineer
McLaren Engineering Group
131 West 35th Street, 4th Floor
New York, NY 10001
212.324.6315

Transportation Planning
Philip Habib & Associates
102 Madison Avenue, 11th Floor
New York, NY 10016
212.929.5656

Vertical Transportation
Van Deusen Associates
7 Pennsylvania Plaza
New York, NY 10001
212.868.9090

Exterior Envelope
Vidaris
360 Park Avenue South, 15th Floor
New York, NY 10010
212.689.5389

Sustainability & Energy Modeling
Atelier 10
45 East 20th Street, 4th Floor
New York, NY 10003
212.254.4500

Landscape Architect
Starr Whitehouse
80 Maiden Lane, Suite 1901
New York, NY 10038
212.487.3272

Lighting Designer
One Lux Studio
158 West 29th Street
New York, NY 10001
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Water Reuse System Engineers
Natural Systems Utilities
2 Clerico Lane Bldg. 1
Hillsborough, NJ 08844
908.359.5501

Pool Design
Lothrop Associates - Trace Pool Design
333 Westchester Avenue
White Plains, NY 10604
914.495.4290

Acoustic Consultant
Longman Lindsey
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New York, NY 10036
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242 West 27th Street
New York, NY 10001
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STATE OF NEW YORK
SAUL SHAPIRO
082466
LICENSED PROFESSIONAL ENGINEER

Seal

1	**03/31/2017**	**50% CD**

NOT FOR CONSTRUCTION

50% Construction Documents

Key Plan

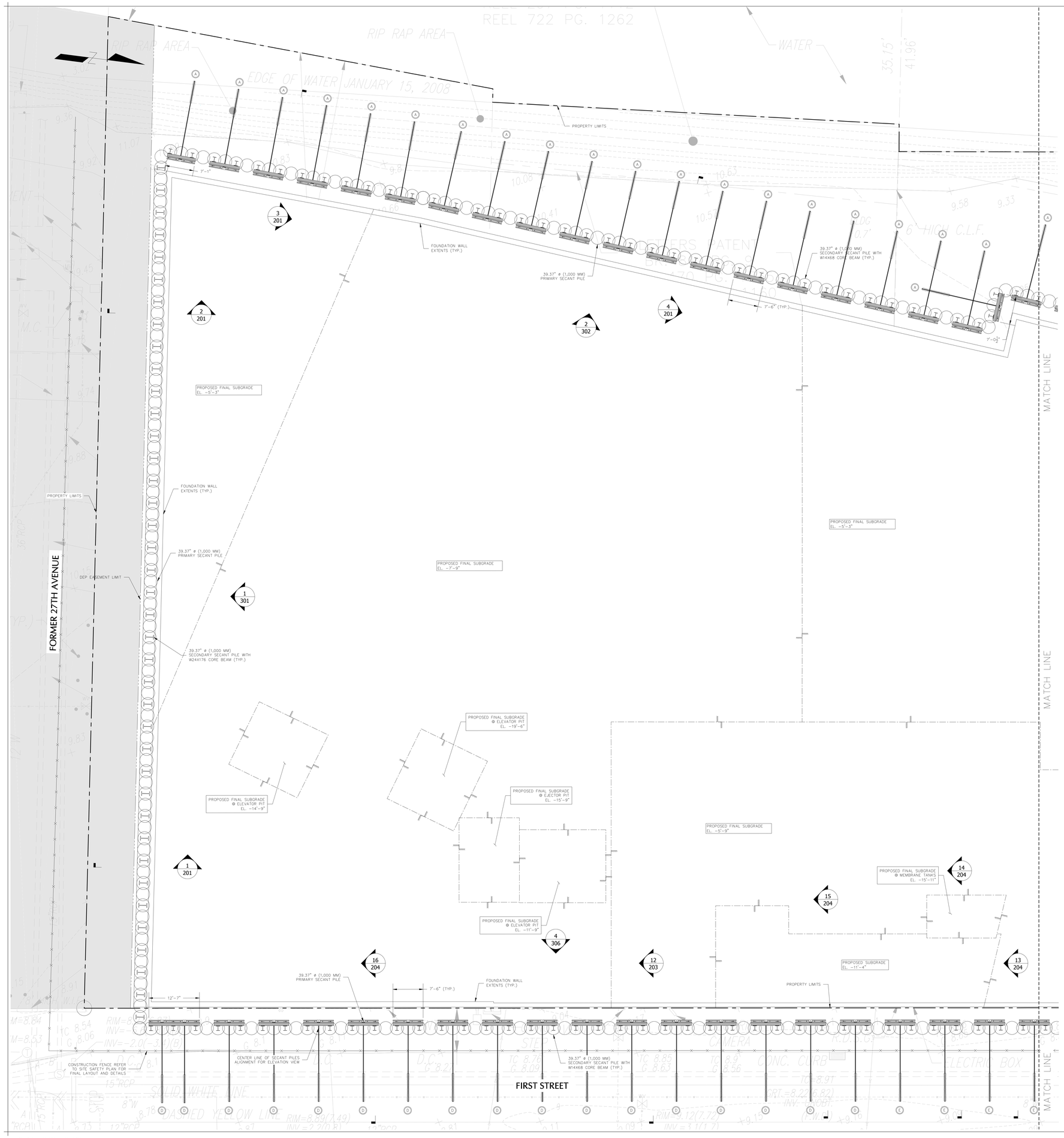
N

SUPPORT OF EXCAVATION - GENERAL NOTES

Scale NTS
Job No. 170296504
Issuing Firm LE
Drawn By ZW

SOE-001.00

Plot Date:



NOTES

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LEGEND

- PROPERTY LINE
- APPROXIMATE LOCATION OF CONSTRUCTION FENCE
- EXTENTS OF DEP EASEMENT
- APPROXIMATE LIMITS OF DEP EASEMENT

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New York, NY 10001
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Seal

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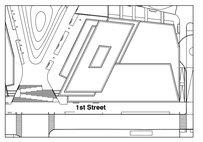


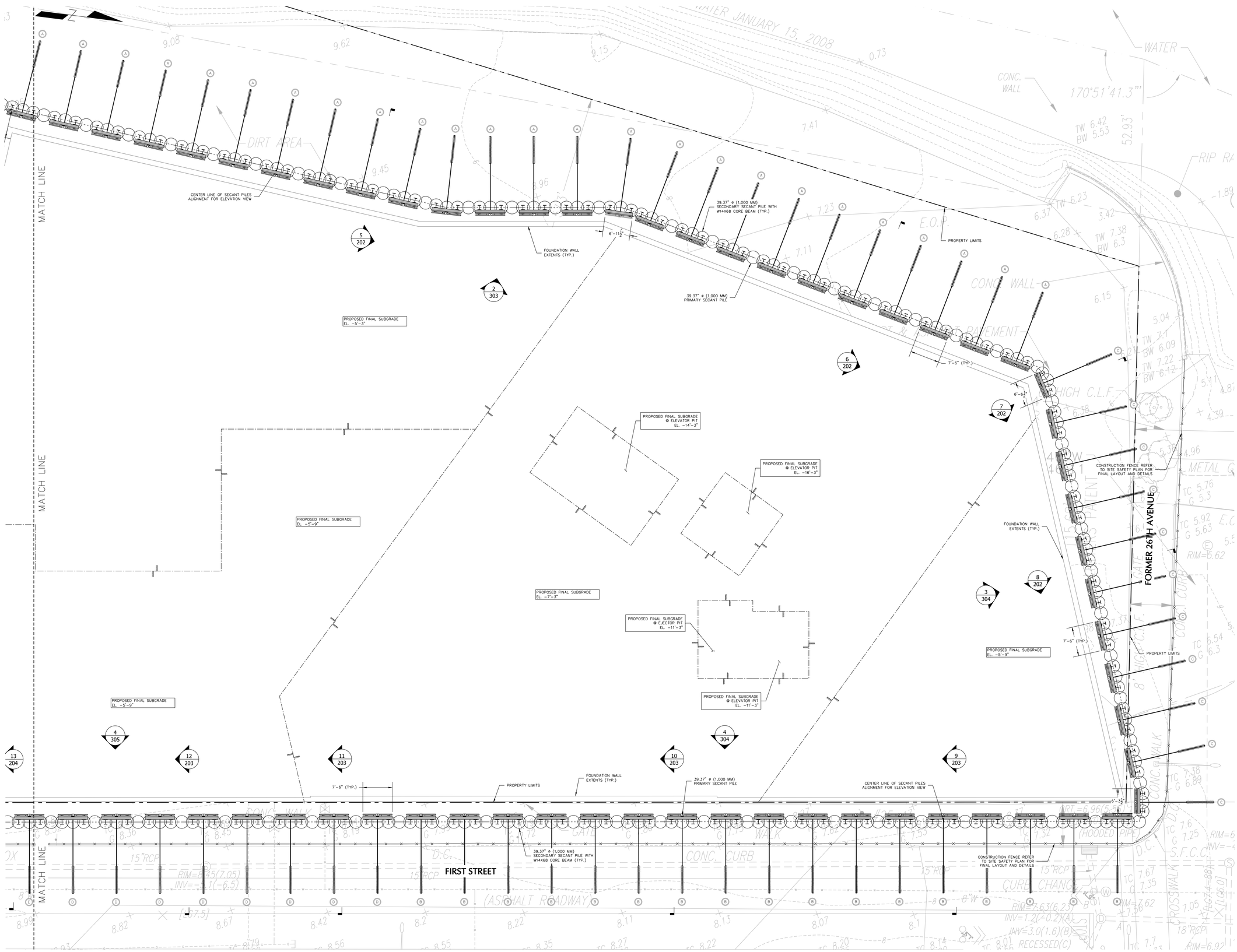
Key Plan N

SUPPORT OF EXCAVATION - GENERAL PLAN (PART 1)

Scale	1:8" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-101.00

Plot Date: 3/17/2016 4:22:16 PM



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LEGEND

PROPERTY LINE

APPROXIMATE LOCATION OF CONSTRUCTION FENCE

TIEBACK SCHEDULE

DESIGNATION	SKYLINE STEEL HOLLOW BAR SIZE	DESIGN LOAD (KIPS)	TEST LOAD (KIPS)	LOCK-OFF LOAD (KIPS)	BOND LENGTH (FEET)	MIN. DRILL HOLE DIAMETER (INCHES)	DIP ANGLE (°)	BASE PLATE SIZE	CHANNEL WALE SIZE
A	T76S	185	240	148	10	6	45	10"X10"X2"	(2) MC 13X40
B	T76S	165	215	132	8	6	56	10"X10"X1.5"	(2) MC 12X31
C	T76N	130	173	104	6	6	45	10"X10"X1.5"	(2) MC 12X31
D	T52/26	80	104	64	5	6	56	10"X10"X1.5"	(2) MC 12X31
E	T76N	130	173	104	6	6	56	10"X10"X1.5"	(2) MC 12X31

0 2' 4' 8' 16'
GRAPHIC SCALE

Plot Date: 3/17/2016 4:22:16 PM

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Landscape Architect
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Natural Systems Utilities
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Hillsborough, NJ 08844
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New York, NY 10036
212.315.6400

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Darius Toraby Architects
242 West 27th Street
New York, NY 10001
212.242.2955

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Seal

1	03/31/2017	50% CD

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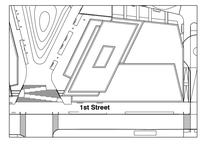
50% Construction Documents

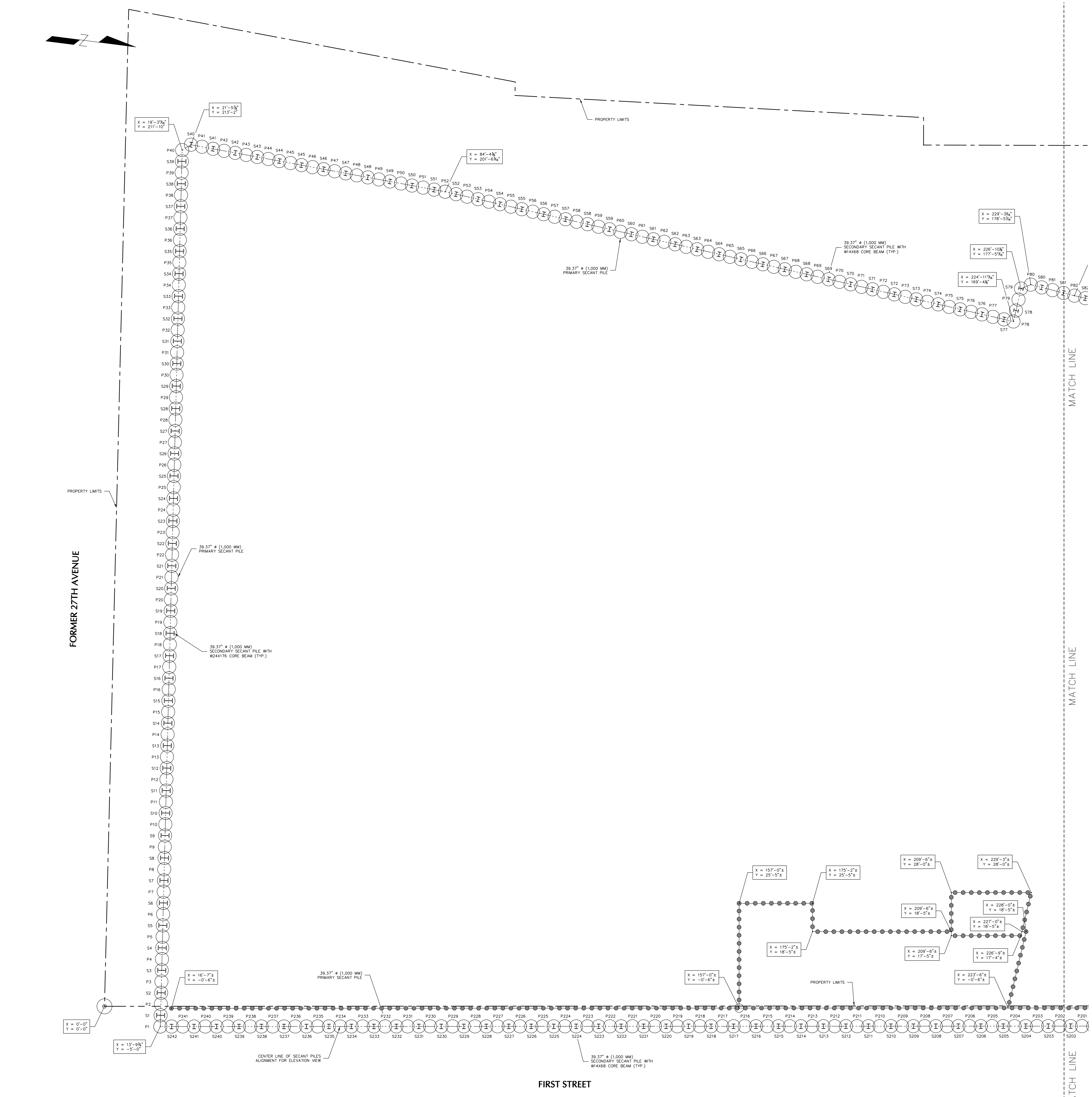


Key Plan

SUPPORT OF EXCAVATION - GENERAL PLAN (PART 2)

Scale	1/8" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-102.00



NOTES

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LEGEND

— - — - —	PROPERTY LINE
—×—×—	APPROXIMATE LOCATION OF CONSTRUCTION FENCE
—●—●—●—	APPROXIMATE LIMITS OF LINE DRILLING

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C/O Royal Realty Corp.
One Bryant Park
New York, NY 10036

Davis Brody Bond, LLP
Architects & Planners
1 New York Plaza - Suite 4200
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Selldorf Architects
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80 Pine Street #12
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New York, NY 10010
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New York, NY 10003
212.254.4500

Landscape Architect
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Lighting Designer
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Seal

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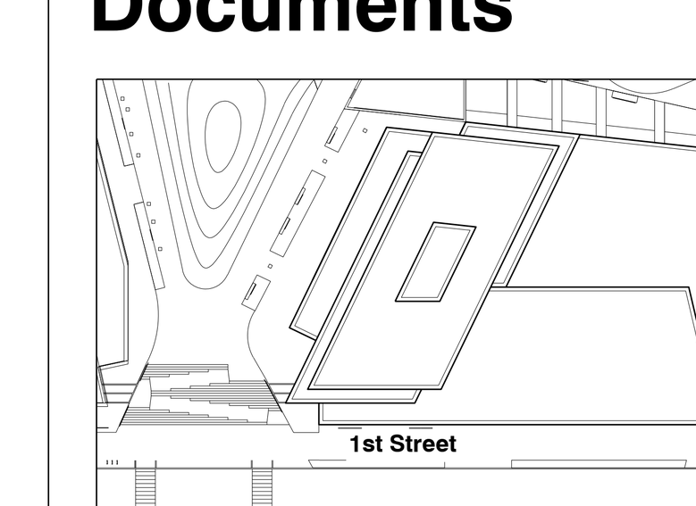


Key Plan

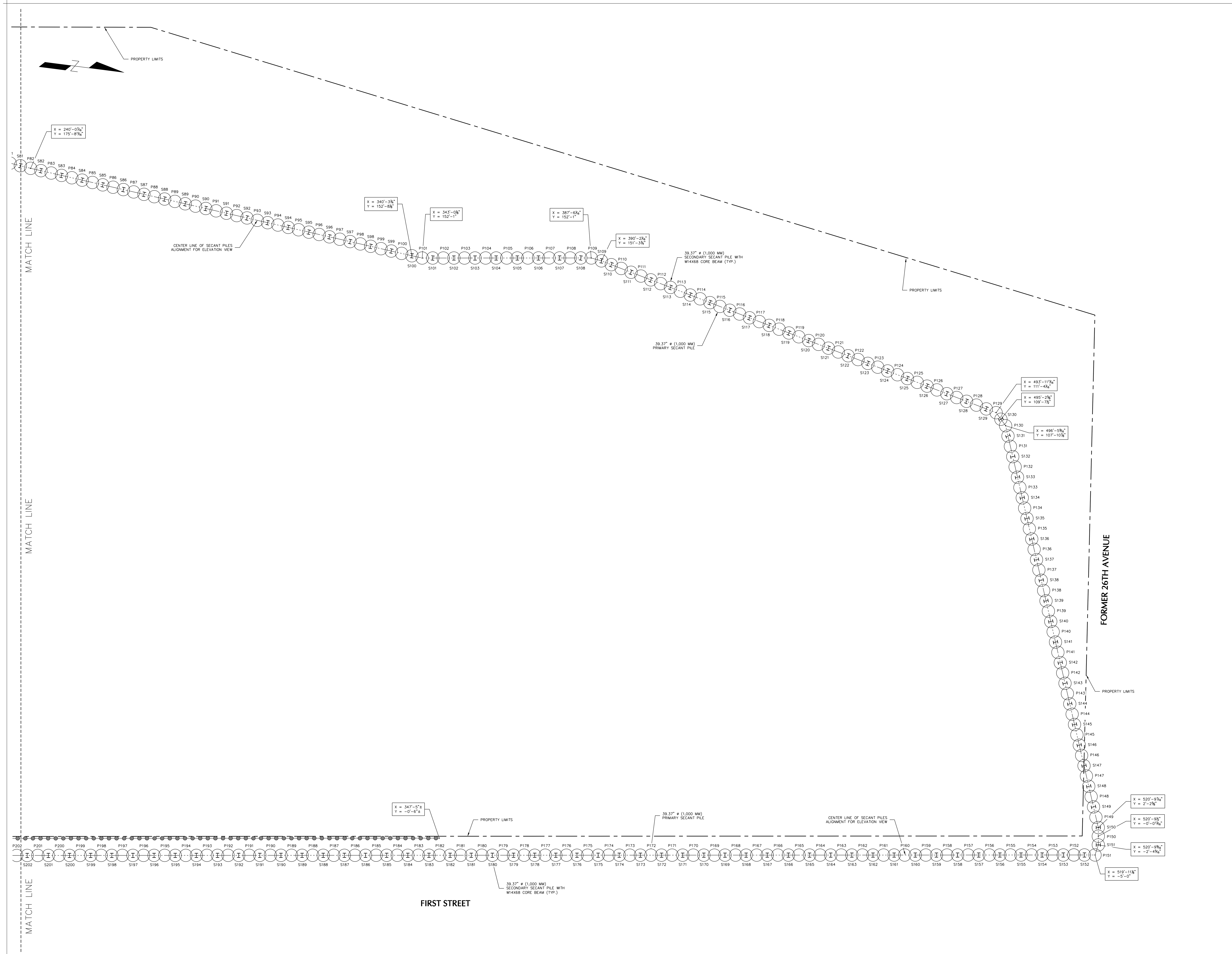
N

SUPPORT OF EXCAVATION - LAYOUT PLAN (PART 1)

Scale 1/8" = 1'-0"
Job No. 170296504
Issuing Firm LE
Drawn By ZW

SOE-103.00

Plot Date: 3/17/2016 4:22:16 PM



NOTES

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LEGEND

PROPERTY LINE

APPROXIMATE LOCATION OF CONSTRUCTION FENCE

APPROXIMATE LIMITS OF LINE DRILLING

Plot Date: 3/17/2016 4:22:16 PM

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Seal

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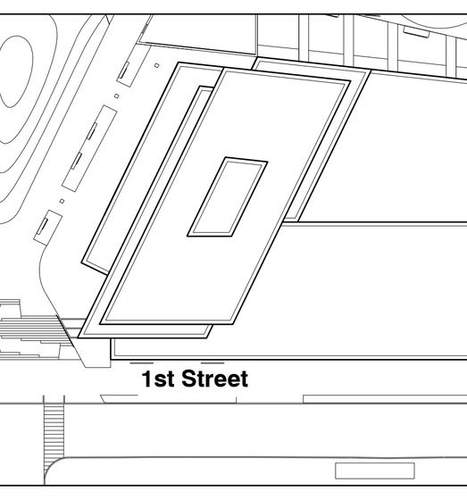
50% Construction Documents



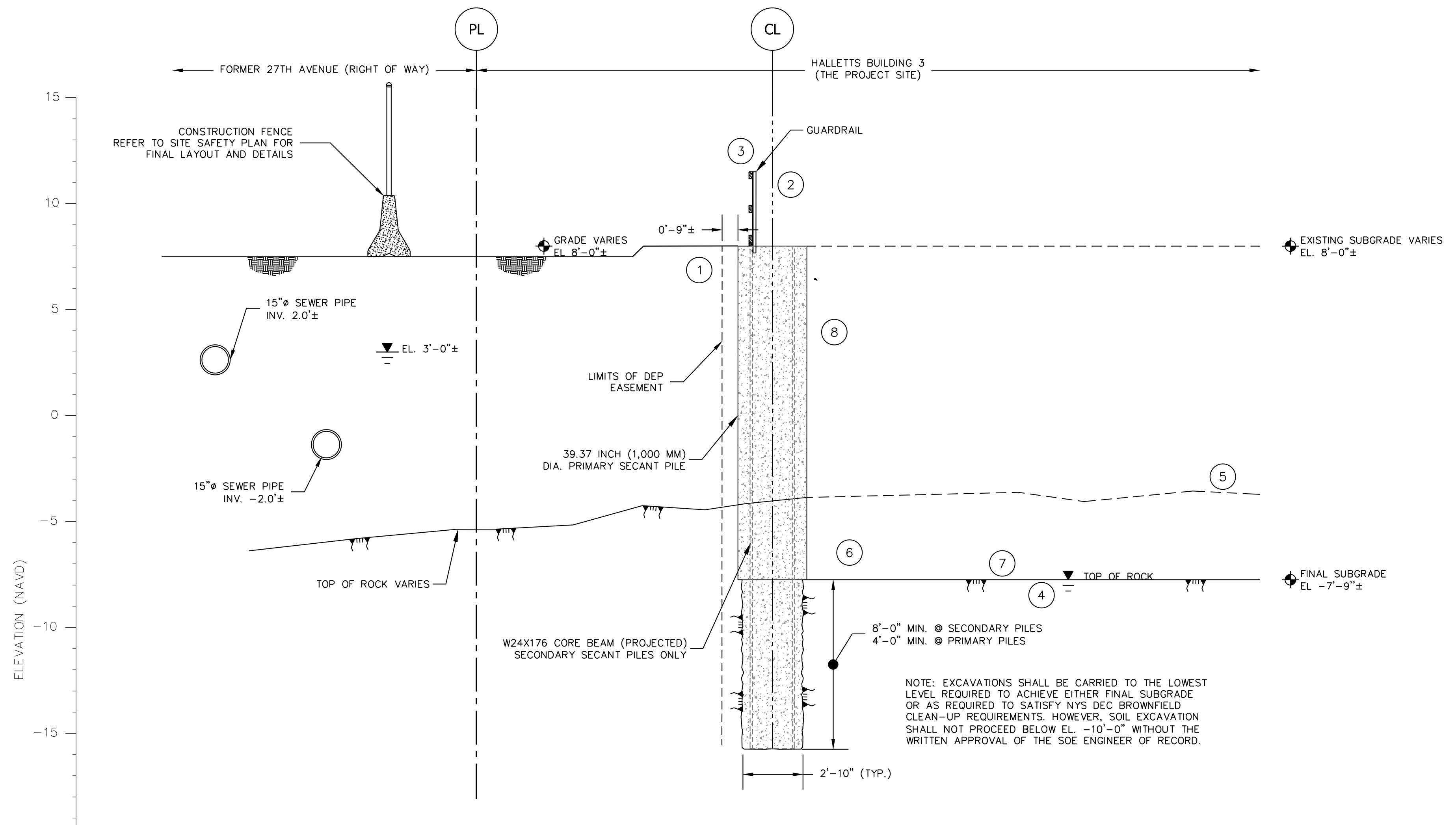
Key Plan

N

SUPPORT OF EXCAVATION - GENERAL PLAN (PART 2)

Scale 1/8" = 1'-0"
Job No. 170296504
Issuing Firm LE
Drawn By ZW

SOE-104.00

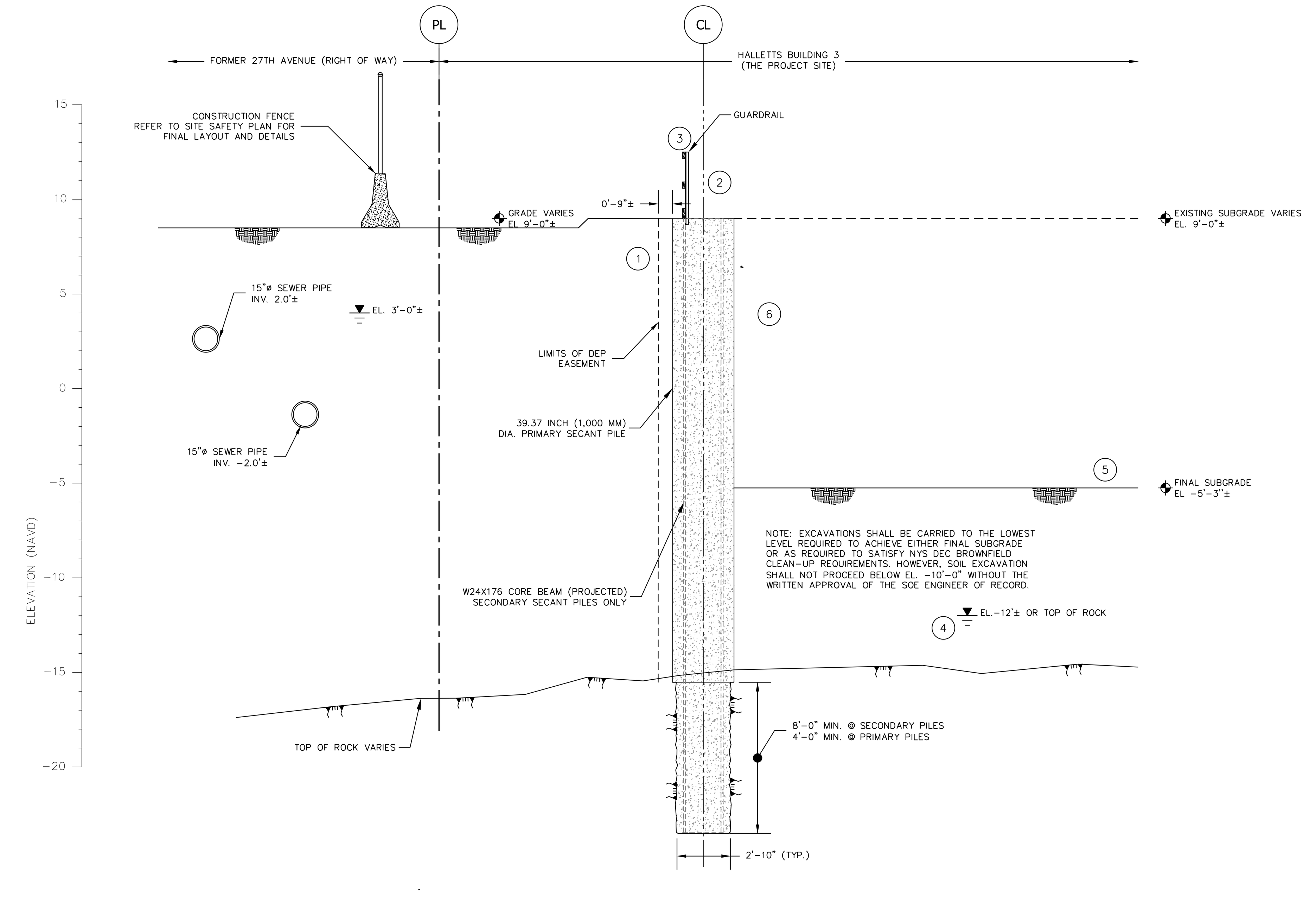


SEQUENCING NOTES

1. PRE-EXCAVATE AS REQUIRED ALONG ALIGNMENT OF THE SECANT WALL TO CLEAR SHALLOW OBSTRUCTIONS. WHERE REQUIRED, PRE-EXCAVATION SHALL BE OSHA COMPLIANT AND SHALL NOT ENDANGER ADJACENT STRUCTURES OR INFRASTRUCTURE. GRADE SURFACE AS REQUIRED TO PROVIDE LEVEL WORKING SURFACE. FORM AND CAST GUIDE WALL.
2. INSTALL PRIMARY SECANT PILES USING SEQUENCE SHOWN HEREIN TO REQUIRED TIP ELEVATION USING AN APPROVED DRILLING METHOD. INSTALL SECONDARY SECANT PILES IN ACCORDANCE WITH THE DETAILS SHOWN HEREIN.
3. INSTALL GUARDRAIL ALONG PERIMETER OF EXCAVATION LIMITS.
4. DEWATER AS REQUIRED TO MAINTAIN GROUNDWATER AT LEAST 2-FT BELOW SOIL SUBGRADE LEVEL OR TOP OF ROCK SUBGRADE.
5. EXCAVATE TO TOP OF ROCK.
6. PERFORM GEOLOGICAL MAPPING AS THE EXCAVATION PROGRESS, INSTALL ROCK DOWEL AS REQUIRED.
7. CONTINUE EXCAVATION AS REQUIRED TO ACHIEVE SUBGRADE ELEVATION, DEWATERING LOCALLY AS REQUIRED FOR INSTALLATION OF PERMANENT FOUNDATIONS.
8. INSTALL FOUNDATIONS AND WATERPROOFING AS REQUIRED. CHOP SECANT WALL CONCRETE LOCALLY AS REQUIRED TO PROVIDE NECESSARY CLEARANCE AND SUBSTRATE PREPARATION.

1 TYPICAL SECTION - SOUTH PERIMETER (FACING WEST)

Scale: 1/4" - 1'-0"



SEQUENCING NOTES

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5. CONTINUE EXCAVATION AS REQUIRED TO ACHIEVE SUBGRADE ELEVATION, DEWATERING LOCALLY AS REQUIRED FOR INSTALLATION OF PERMANENT FOUNDATIONS.
6. INSTALL FOUNDATIONS AND WATERPROOFING AS REQUIRED. CHOP SECANT WALL CONCRETE LOCALLY AS REQUIRED TO PROVIDE NECESSARY CLEARANCE AND SUBSTRATE PREPARATION.

2 TYPICAL SECTION - SOUTH PERIMETER (FACING WEST)

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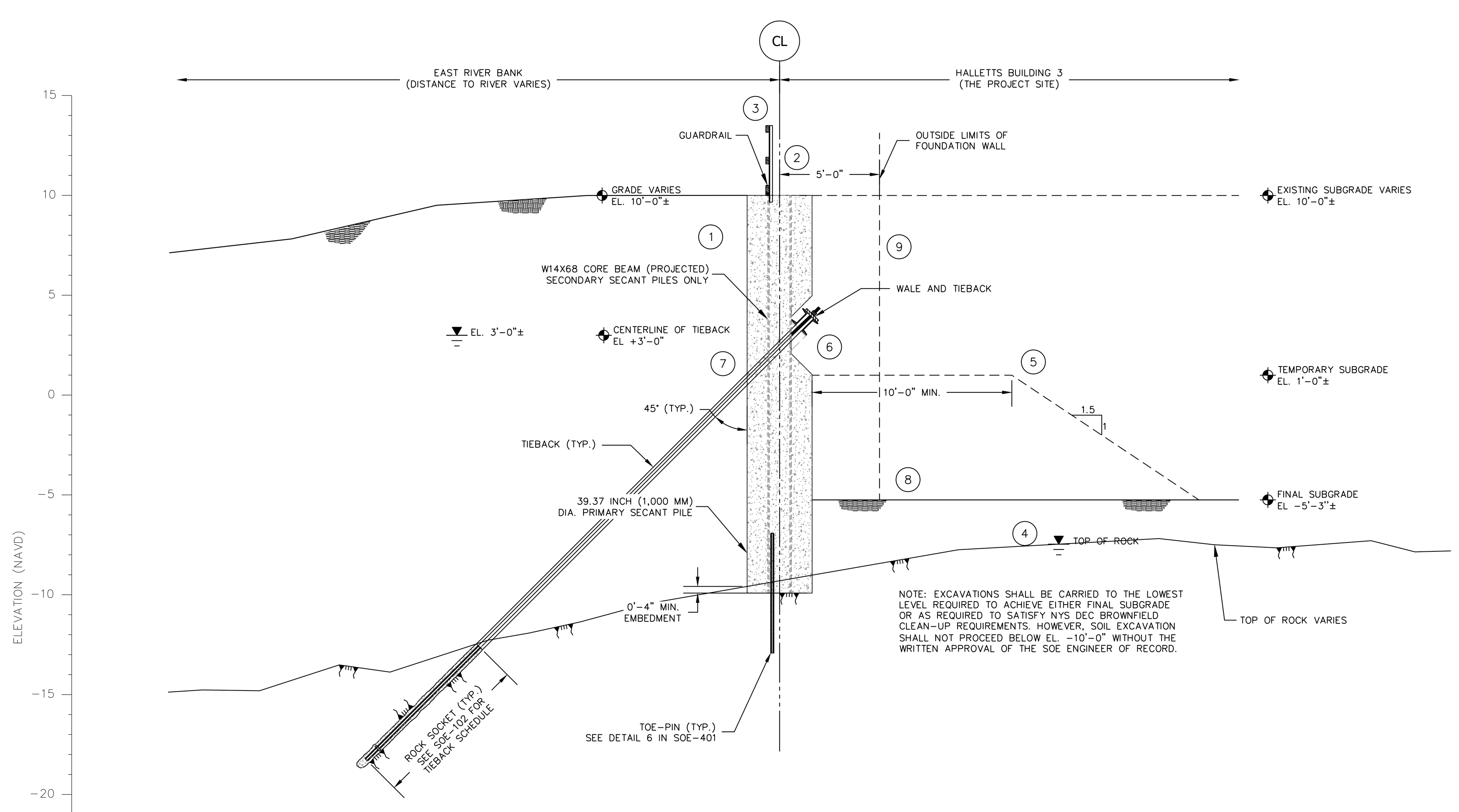

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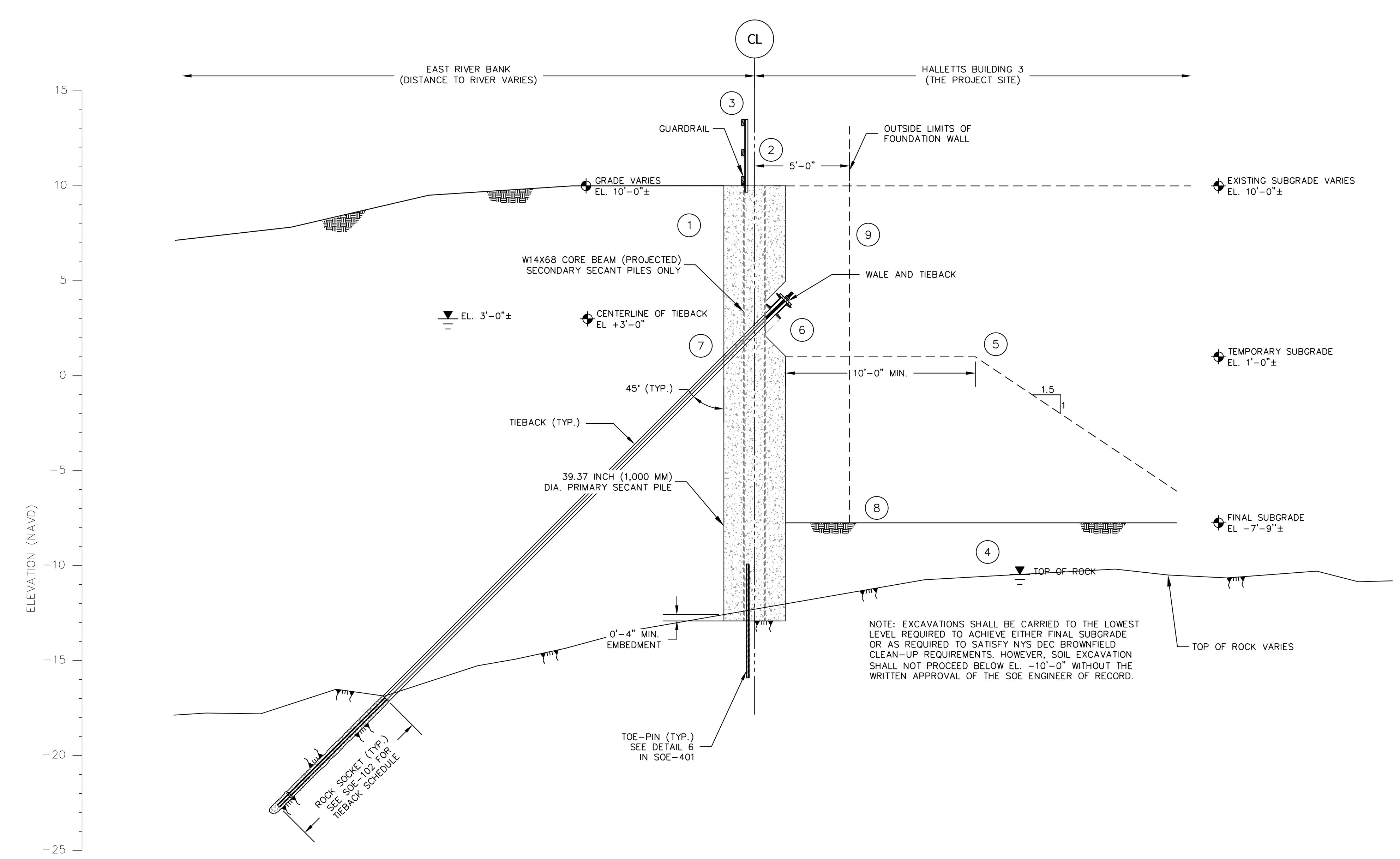
3. INSTALL GUARDRAIL ALONG PERIMETER OF EXCAVATION LIMITS.
4. DEWATER AS REQUIRED TO MAINTAIN GROUNDWATER AT LEAST 2-FT BELOW SUBGRADE LEVEL.
5. EXCAVATE AS REQUIRED TO ALLOW INSTALLATION OF WALES AND TIE-BACKS. SUBGRADE AT THE SOE PERIMETER SHALL NOT EXTEND MORE THAN 2 FEET BELOW THE TIEBACKS, PRIOR TO THEIR INSTALLATION. MAINTAIN A MINIMUM HORIZONTAL BENCH OF 10 FT AT THE SOE PERIMETER. SLOPES NOT EXCEEDING 1.5H:1V MAY BE UTILIZED IN AREAS BEYOND THE BENCH.
6. REMOVE CONCRETE AS REQUIRED FOR INSTALLATION OF WALES.
7. INSTALL TIEBACKS AS SHOWN. PERFORM REQUIRED LOAD TESTING AND LOCK-OFF AS PRESCRIBED HEREIN. TIE-BACKS SHALL NOT BE TENSIONED UNTIL GROUT HAS ACHIEVED A COMPRESSIVE STRENGTH OF 3,000 PSI. REFER TO TIEBACK INSTALLATION AND TESTING NOTES HEREIN AND SOE-102 FOR TIE-BACK SCHEDULE.
8. CONTINUE EXCAVATION AS REQUIRED TO ACHIEVE SUBGRADE ELEVATION, DEWATERING LOCALLY AS REQUIRED FOR INSTALLATION OF PERMANENT FOUNDATIONS.
9. INSTALL FOUNDATIONS AND WATERPROOFING AS REQUIRED. CHOP SECANT WALL CONCRETE LOCALLY AS REQUIRED TO PROVIDE NECESSARY CLEARANCE AND SUBSTRATE PREPARATION.

3 TYPICAL SECTION - WEST PERIMETER OF BUILDING 3 (FACING NORTH)

Scale: 1/4" - 1'-0"



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8. CONTINUE EXCAVATION AS REQUIRED TO ACHIEVE SUBGRADE ELEVATION, DEWATERING LOCALLY AS REQUIRED FOR INSTALLATION OF PERMANENT FOUNDATIONS.
9. INSTALL FOUNDATIONS AND WATERPROOFING AS REQUIRED. CHOP SECANT WALL CONCRETE LOCALLY AS REQUIRED TO PROVIDE NECESSARY CLEARANCE AND SUBSTRATE PREPARATION.

4 TYPICAL SECTION - WEST PERIMETER OF BUILDING 3 (FACING NORTH)

Scale: 1/4" - 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-300 SERIES FOR ELEVATIONS.
4. SEE SOE-400 SERIES FOR DETAILS.
5. SEE SOE-501 & 502 FOR MONITORING PLANS.

Halletts Point Building 3

26-40 1st Street, Queens, NY 11102

Halletts Building 3 SPE LLC
C/O Royal Realty Corp.
One Bryant Park
New York, NY 10036

Davis Brody Bond, LLP
Architects & Planners
1 New York Plaza - Suite 4200
New York, NY 10004
212.633.4700

Interior Designer
Selldorf Architects
860 Broadway, 2nd Floor
New York, NY 10003
212.219.9571

Structural Engineer
Severud Associates
469 Seventh Avenue, 9th Floor
New York, NY 10018
212.986.3700

Mechanical/ Electrical/ Plumbing Engineers
Jaros Baum & Bolles
80 Pine Street #12
New York, NY 10005
212.530.9300

Civil & Geotechnical Engineers
Langan
21 Pennsylvania Plaza
New York, NY 10001
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Marine Engineer
McLaren Engineering Group
131 West 35th Street, 4th Floor
New York, NY 10001
212.324.6315

Transportation Planning
Philip Habib & Associates
102 Madison Avenue, 11th Floor
New York, NY 10016
212.929.5656

Vertical Transportation
Van Deusen Associates
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Exterior Envelope
Vidaris
360 Park Avenue South, 15th Floor
New York, NY 10010
212.689.5389

Sustainability & Energy Modeling
Atelier 10
45 East 20th Street, 4th Floor
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212.254.4500

Landscape Architect
Starr Whitehouse
80 Maiden Lane, Suite 1901
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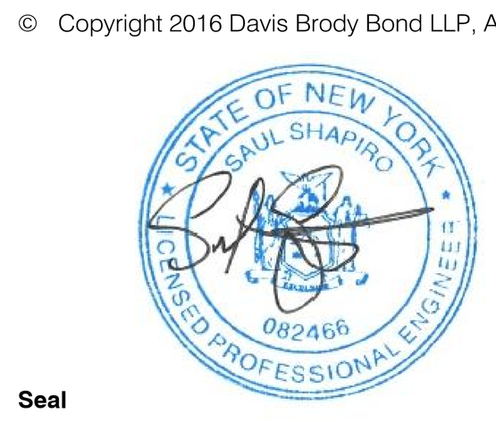
Davis Brody Bond



Seal

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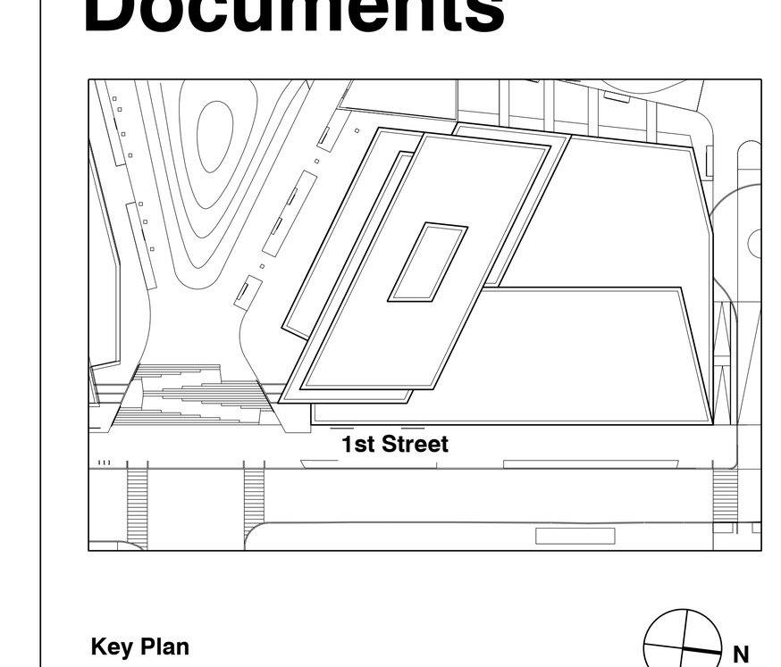
NOT FOR CONSTRUCTION

50% Construction Documents



Key Plan

SUPPORT OF EXCAVATION - TYPICAL SECTIONS (SHEET 1 OF 4)

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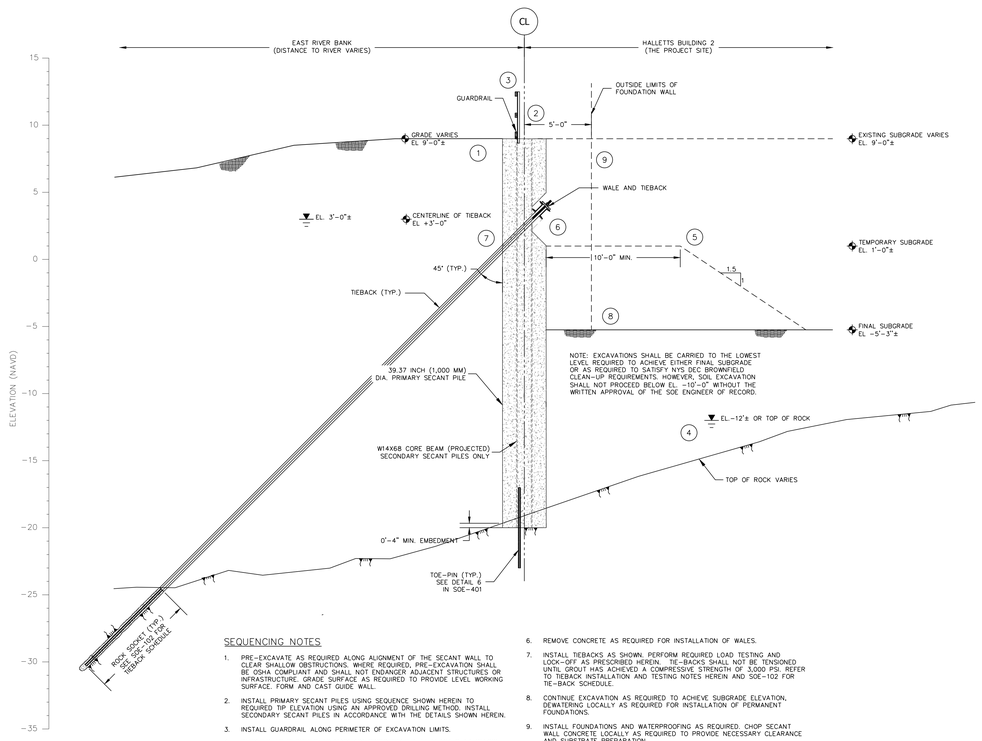
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-201.00

Plot Date:



SEQUENCING NOTES

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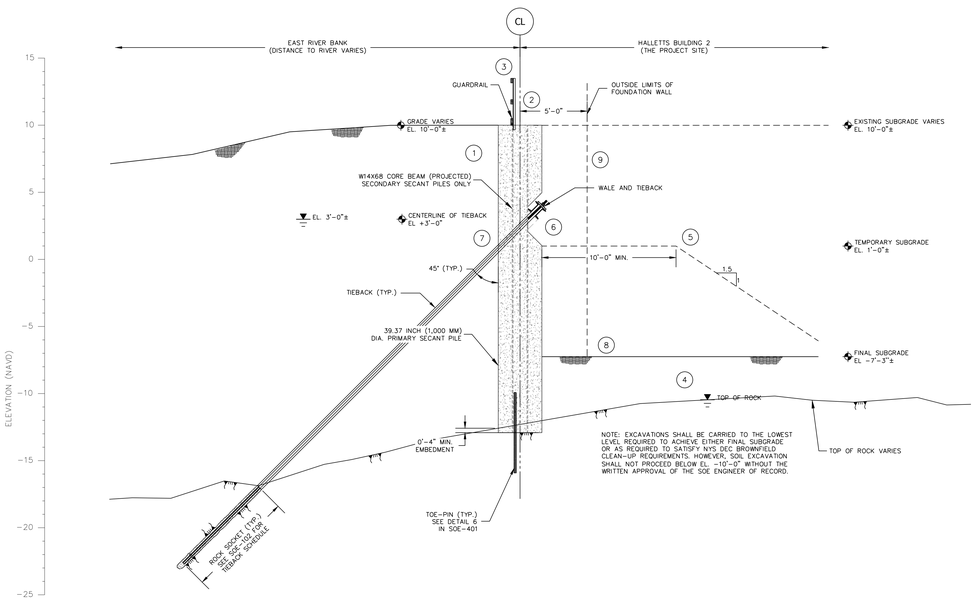
5 TYPICAL SECTION - WEST PERIMETER OF BUILDING 2 (FACING NORTH)
Scale: 1/4" - 1'-0"



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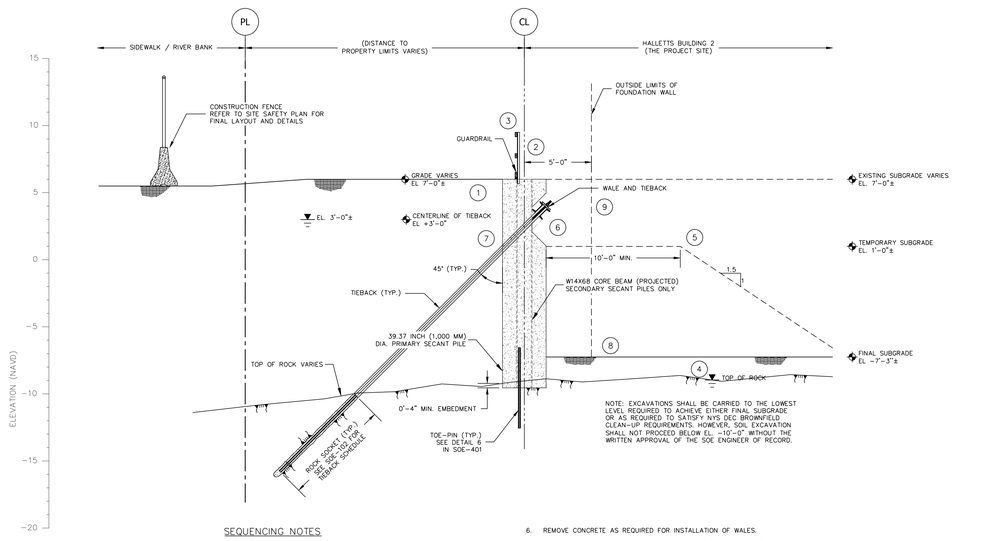

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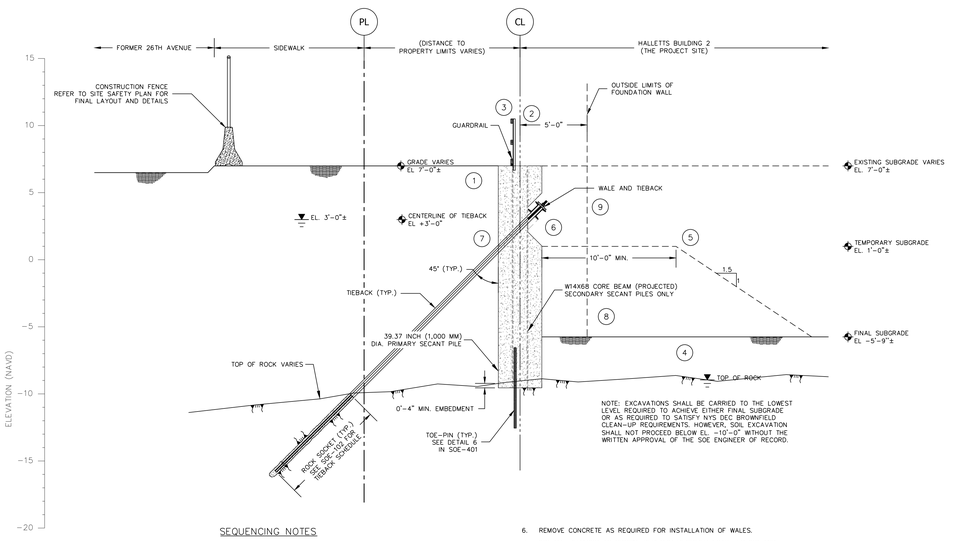
7 TYPICAL SECTION - NORTH PERIMETER (FACING EAST)
Scale: 1/4" - 1'-0"



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8 TYPICAL SECTION - NORTH PERIMETER (FACING EAST)
Scale: 1/4" - 1'-0"

NOTES

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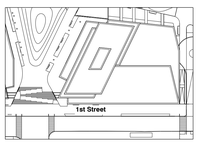

Key Plan N

SUPPORT OF EXCAVATION - TYPICAL SECTIONS (SHEET 2 OF 4)

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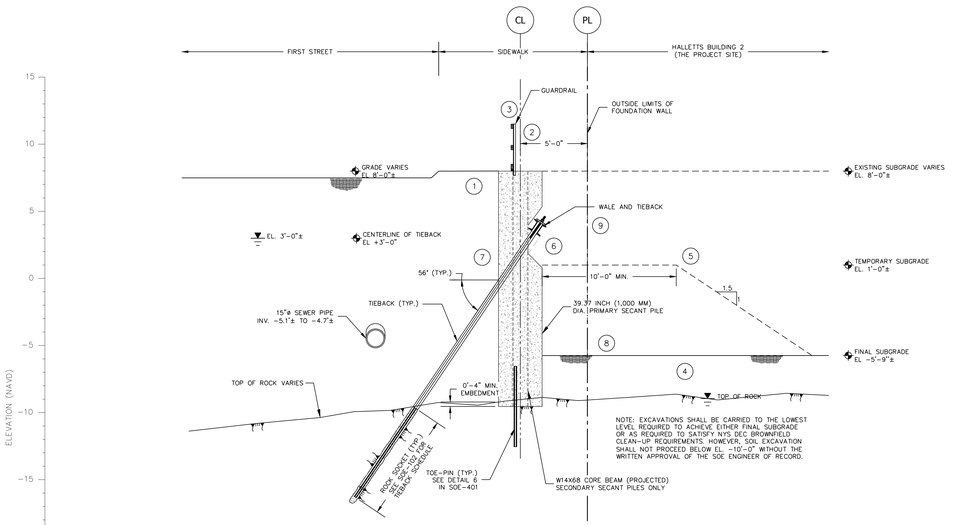
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-202.00

Plot Date:



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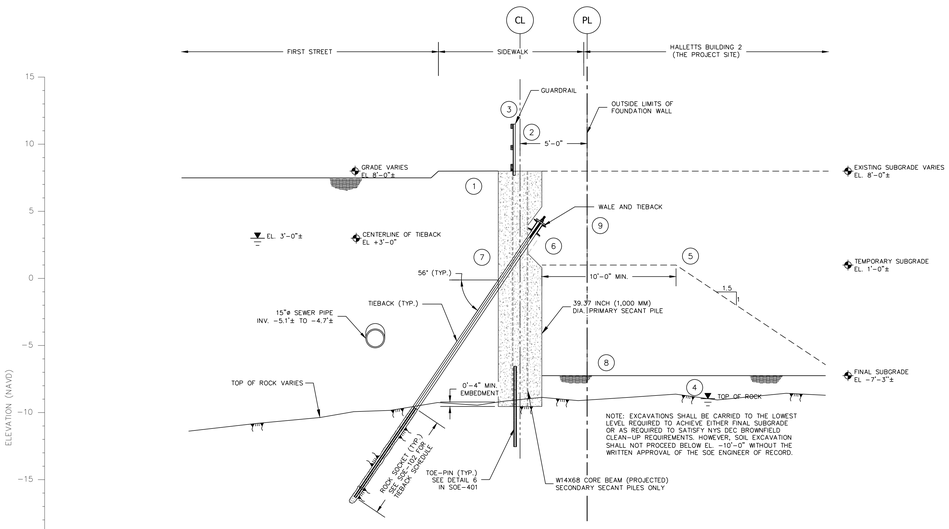
9 TYPICAL SECTION - EAST PERIMETER OF BUILDING 2 (FACING SOUTH)
Scale: 1/4" - 1'-0"



SEQUENCING NOTES

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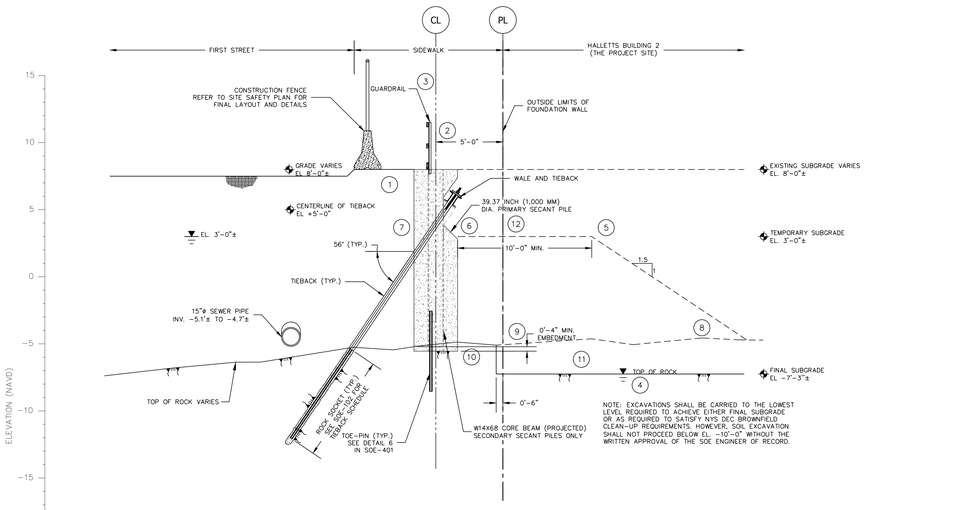

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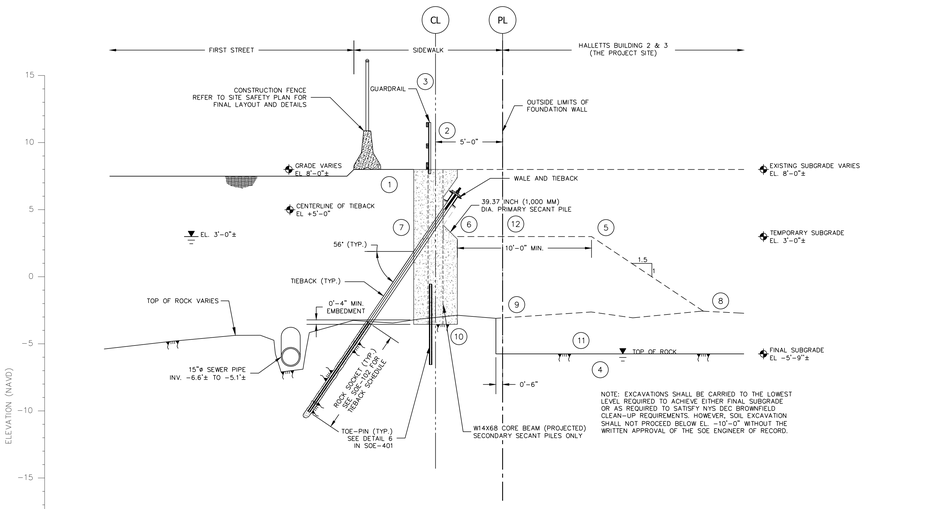

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12 TYPICAL SECTION - EAST PERIMETER OF BUILDINGS 2 & 3 (FACING SOUTH)
Scale: 1/4" - 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-300 SERIES FOR ELEVATIONS.
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Plot Date:

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Davis Brody Bond

Seal

1	03/31/2017	50% CD

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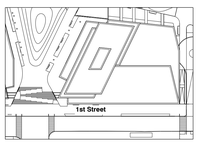
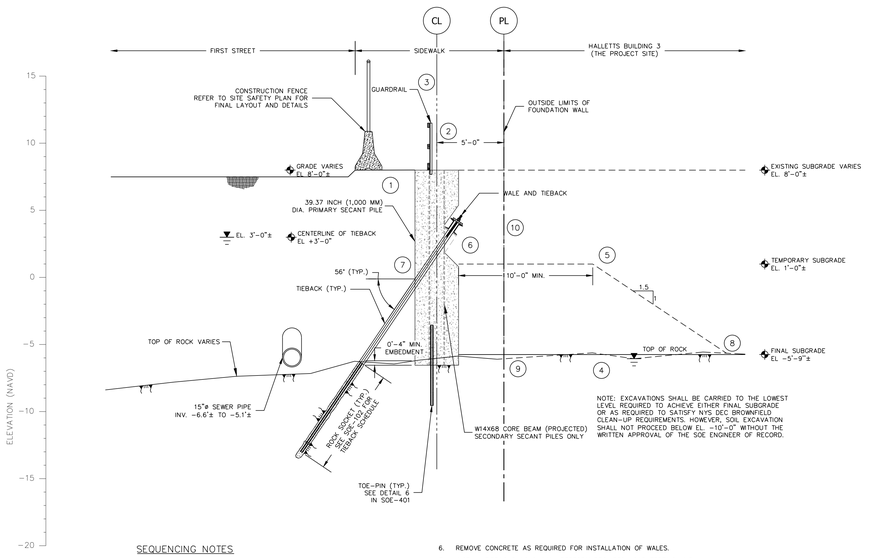


Key Plan N

SUPPORT OF EXCAVATION - TYPICAL SECTIONS (SHEET 3 OF 4)

Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-203.00



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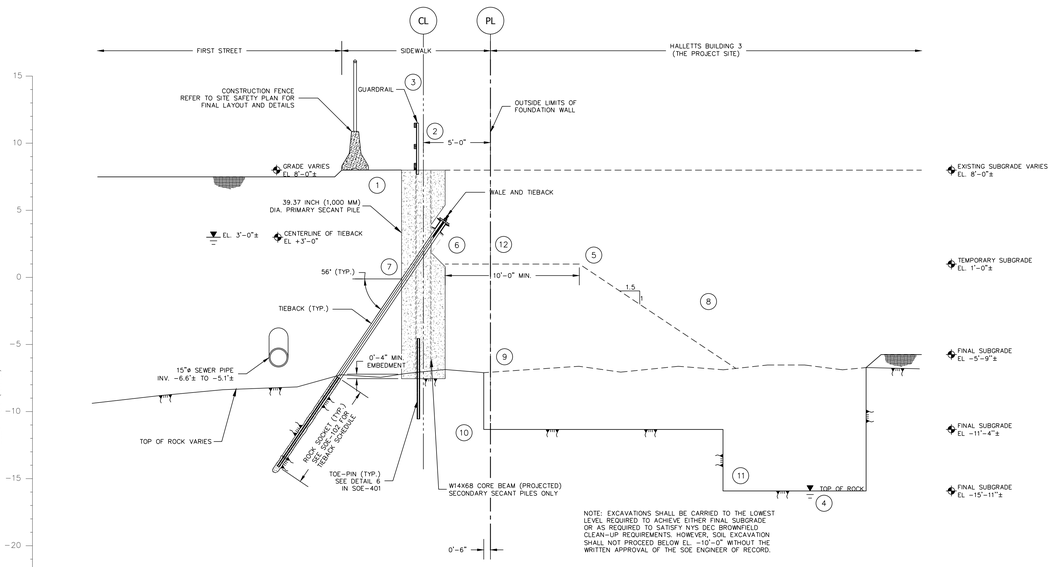

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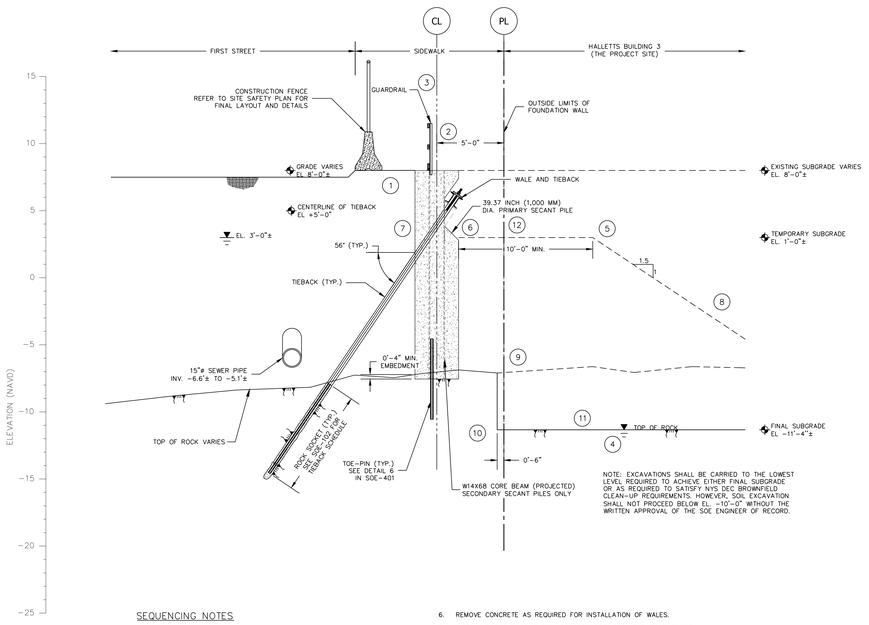

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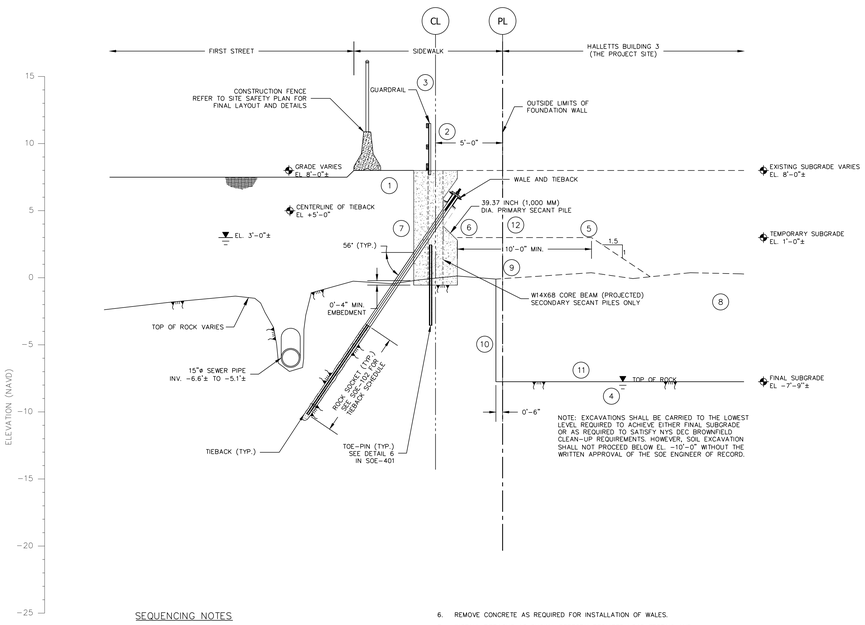

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16 TYPICAL SECTION - EAST PERIMETER OF BUILDING 3 (FACING SOUTH)
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Seal

1	03/31/2017	50% CD

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50% Construction Documents

Key Plan

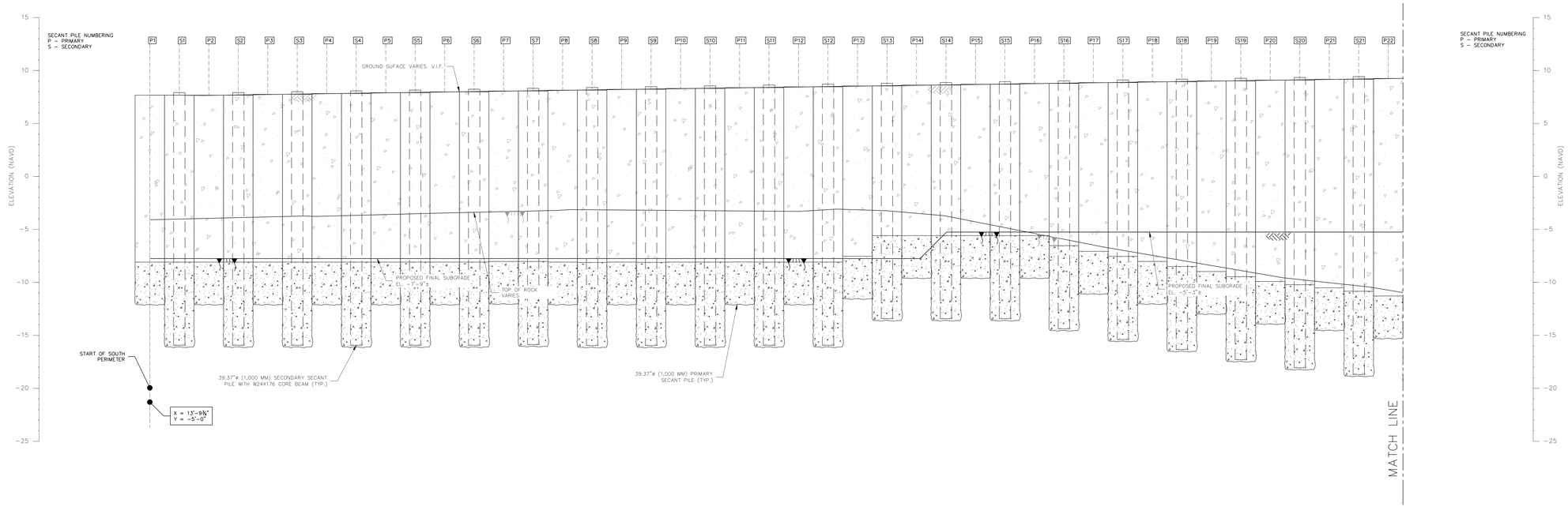
N

SUPPORT OF EXCAVATION - TYPICAL SECTIONS (SHEET 4 OF 4)

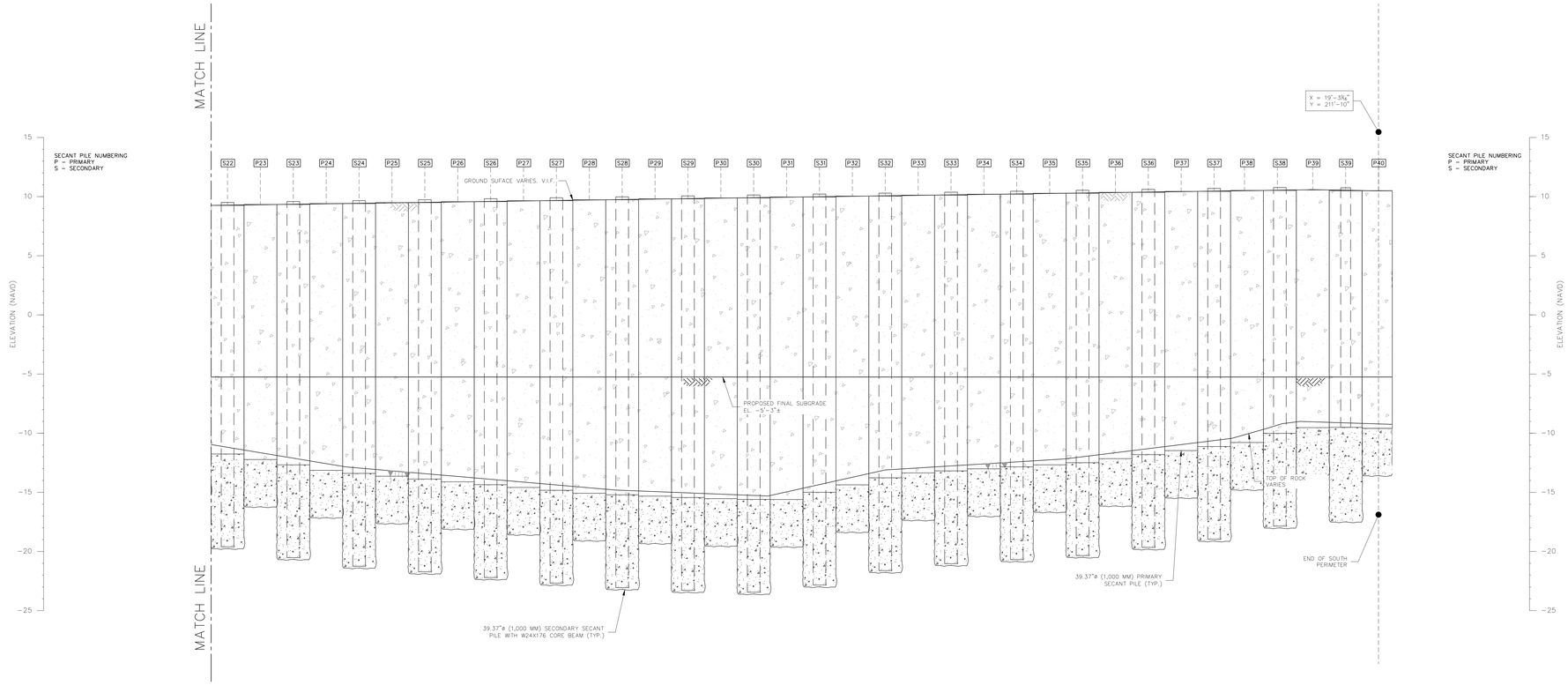
Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-204.00

Plot Date:



1A ELEVATION - SOUTH PERIMETER
Scale: 1/4" - 1'-0"



1B ELEVATION - SOUTH PERIMETER
Scale: 1/4" - 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-200 SERIES FOR TYPICAL SECTIONS.
4. SEE SOE-400 SERIES FOR DETAILS.
5. SEE SOE-501 & 502 FOR MONITORING PLANS.

Halletts Point Building 3

26-40 1st Street,
Queens, NY 11102

Halletts Building 3 SPE LLC
C/O Royal Realty Corp.
One Bryant Park
New York, NY 10036

Davis Brody Bond, LLP
Architects & Planners
1 New York Plaza - Suite 4200
New York, NY 10004
212.633.4700

Interior Designer
Selldorf Architects
860 Broadway, 2nd Floor
New York, NY 10003
212.219.9571

Structural Engineer
Severud Associates
469 Seventh Avenue, 9th Floor
New York, NY 10018
212.986.3700

Mechanical/ Electrical/ Plumbing Engineers
Jaros Baum & Bolles
80 Pine Street #12
New York, NY 10005
212.530.9300

Civil & Geotechnical Engineers
Langan
21 Pennsylvania Plaza
New York, NY 10001
212.479.5400

Marine Engineer
McLaren Engineering Group
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New York, NY 10001
212.324.6315

Transportation Planning
Philip Habib & Associates
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New York, NY 10016
212.929.5656

Vertical Transportation
Van Deusen Associates
7 Pennsylvania Plaza
New York, NY 10001
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Exterior Envelope
Vidaris
360 Park Avenue South, 15th Floor
New York, NY 10010
212.689.5389

Sustainability & Energy Modeling
Atelier 10
45 East 20th Street, 4th Floor
New York, NY 10003
212.254.4500

Landscape Architect
Starr Whitehouse
80 Maiden Lane, Suite 1901
New York, NY 10038
212.487.3272

Lighting Designer
One Lux Studio
158 West 29th Street
New York, NY 10001
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Water Reuse System Engineers
Natural Systems Utilities
2 Clerico Lane Bldg. 1
Hillsborough, NJ 08844
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Pool Design
Lothrop Associates - Trace Pool Design
333 Westchester Avenue
White Plains, NY 10604
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New York, NY 10036
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Seal

1	03/31/2017	50% CD

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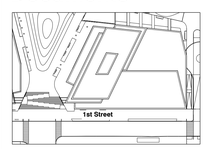
50% Construction Documents



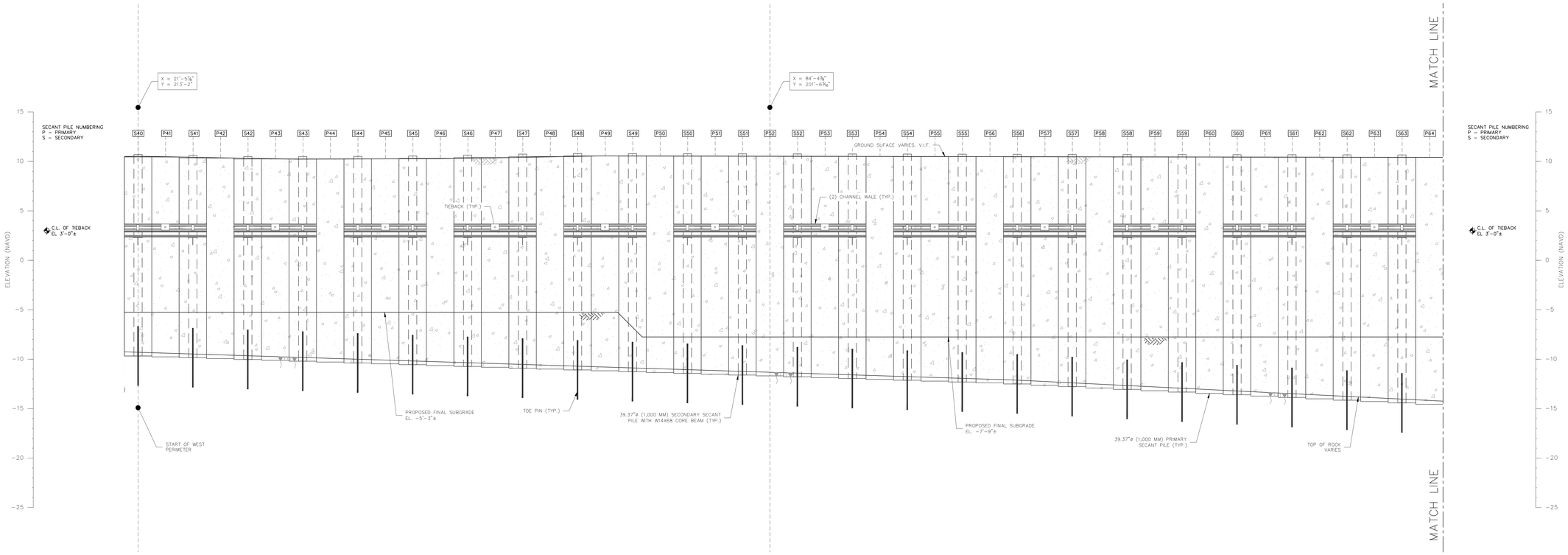
Key Plan N

SUPPORT OF EXCAVATION - ELEVATIONS (SHEET 1 OF 6)

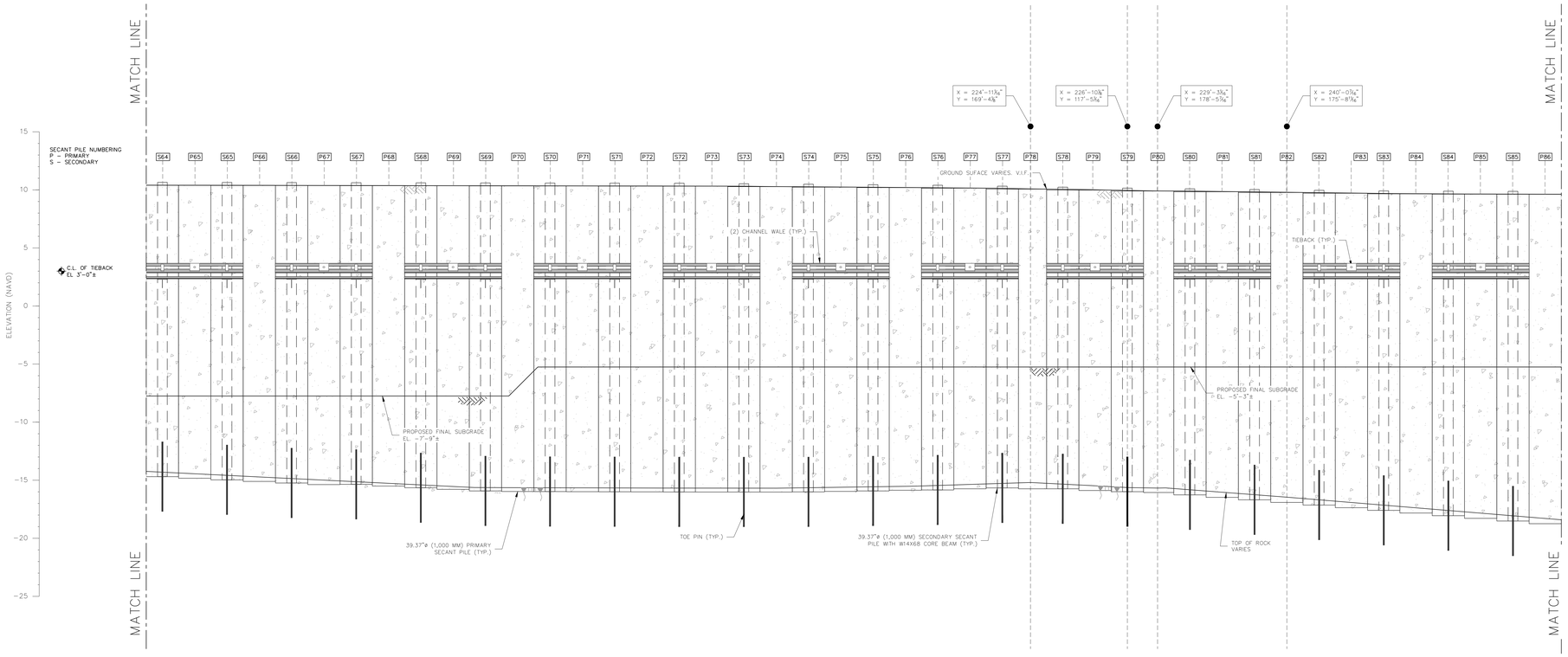
Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-301.00

Plot Date:



2A ELEVATION - WEST PERIMTER
Scale: 1/4" - 1'-0"



2B ELEVATION - WEST PERIMETER
Scale: 1/4" - 1'-0"

NOTES

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New York, NY 10003
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Hillsborough, NJ 08844
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New York, NY 10036
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242 West 27th Street
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Seal

1	03/31/2017	50% CD

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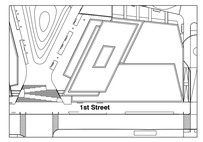
50% Construction Documents



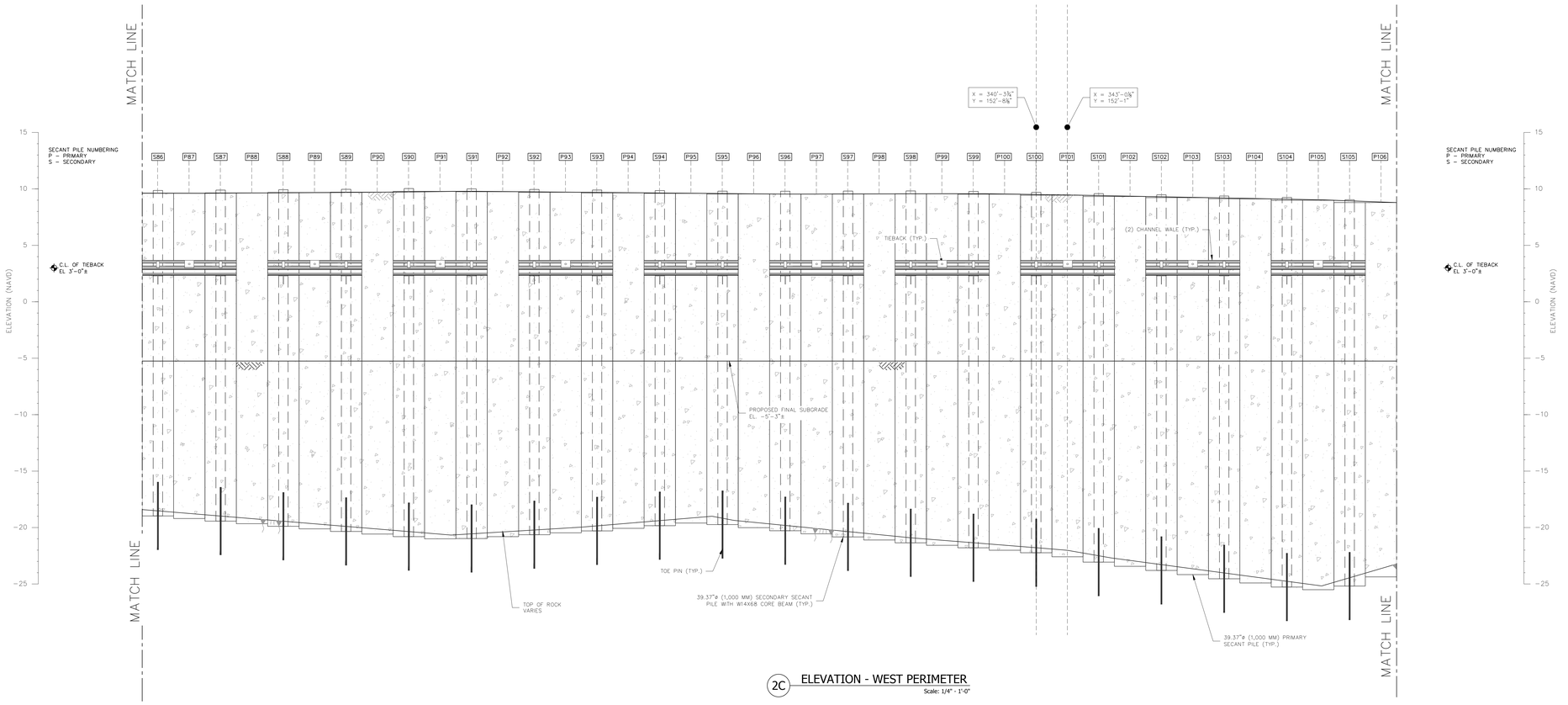
Key Plan N

SUPPORT OF EXCAVATION - ELEVATIONS (SHEET 2 OF 6)

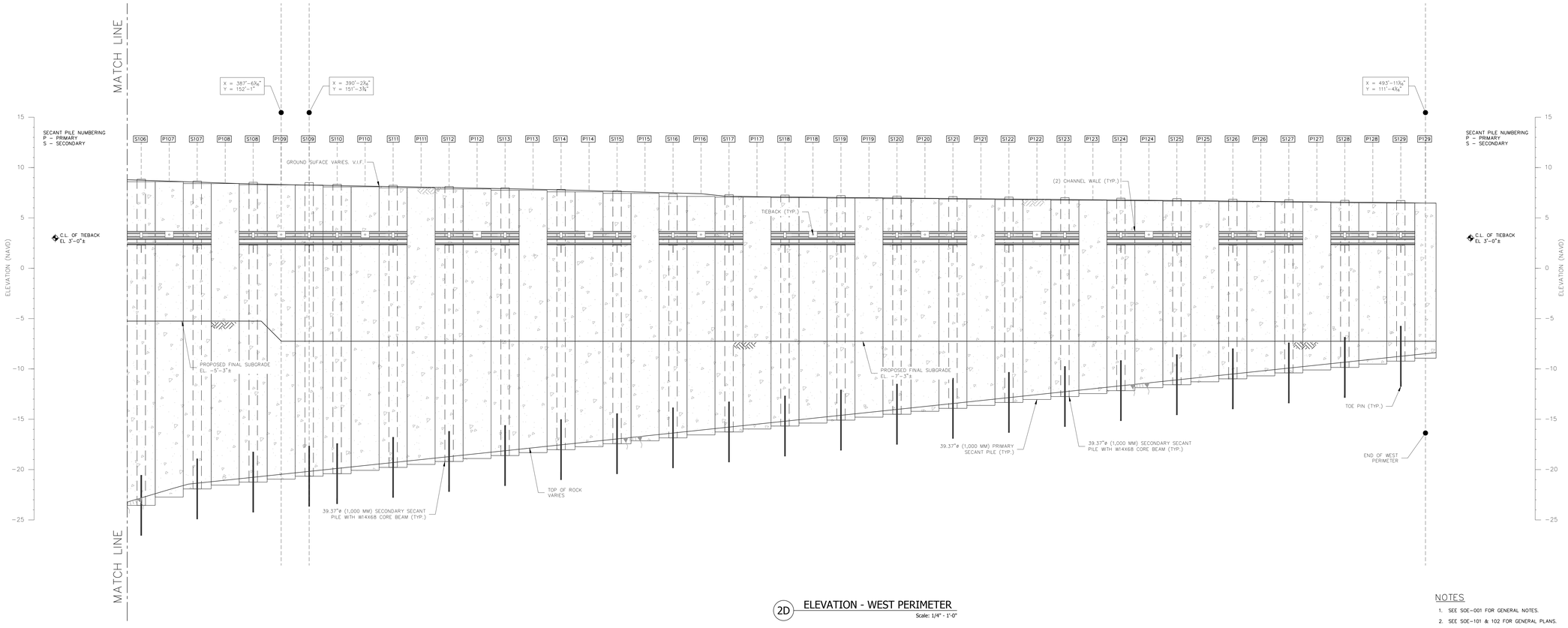
Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-302.00

Plot Date:



2C ELEVATION - WEST PERIMETER
Scale: 1/4" - 1'-0"



2D ELEVATION - WEST PERIMETER
Scale: 1/4" - 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-200 SERIES FOR TYPICAL SECTIONS.
4. SEE SOE-400 SERIES FOR DETAILS.
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Plot Date:

Halletts Point Building 3

26-40 1st Street,
Queens, NY 11102

Halletts Building 3 SPE LLC
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Davis Brody Bond, LLP
Architects & Planners
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Selldorf Architects
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Structural Engineer
Severud Associates
469 Seventh Avenue, 9th Floor
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Mechanical/ Electrical/ Plumbing Engineers
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80 Pine Street #12
New York, NY 10005
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Civil & Geotechnical Engineers
Langan
21 Pennsylvania Plaza
New York, NY 10001
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Marine Engineer
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Sustainability & Energy Modeling
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New York, NY 10003
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Seal

1	03/31/2017	50% CD

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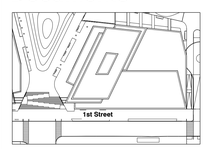
50% Construction Documents

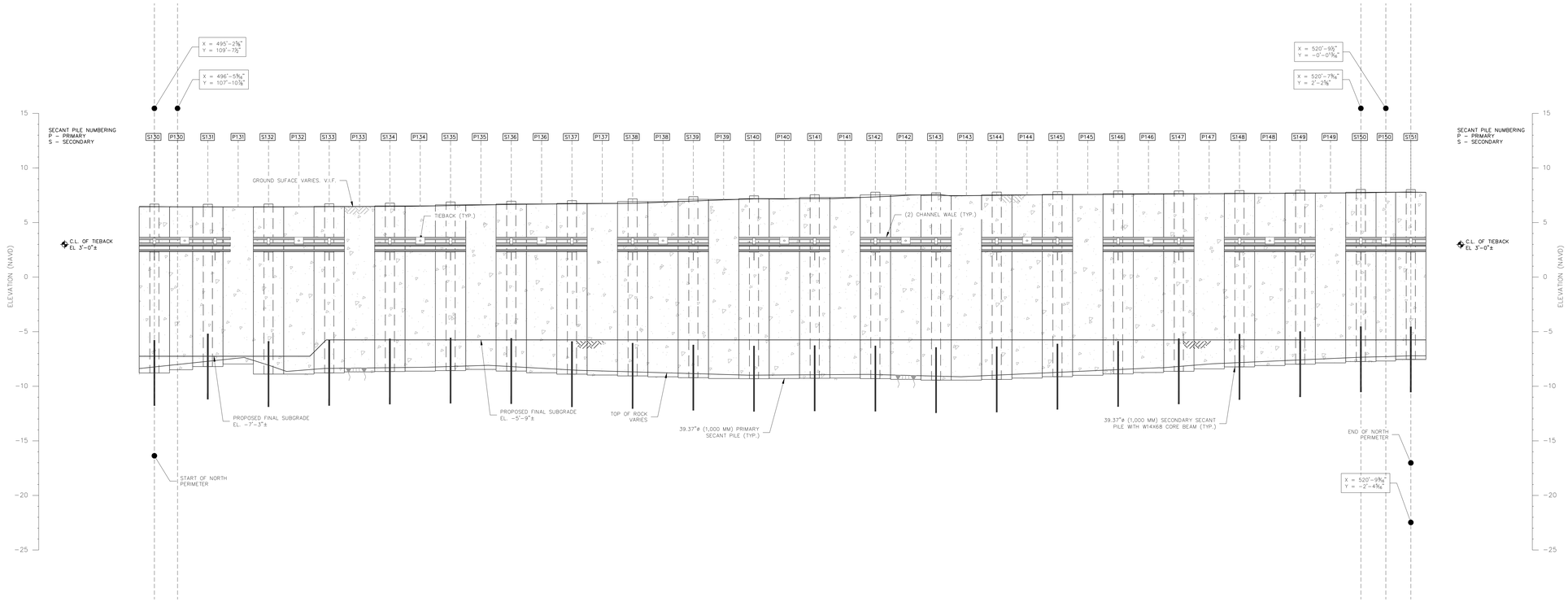


Key Plan N

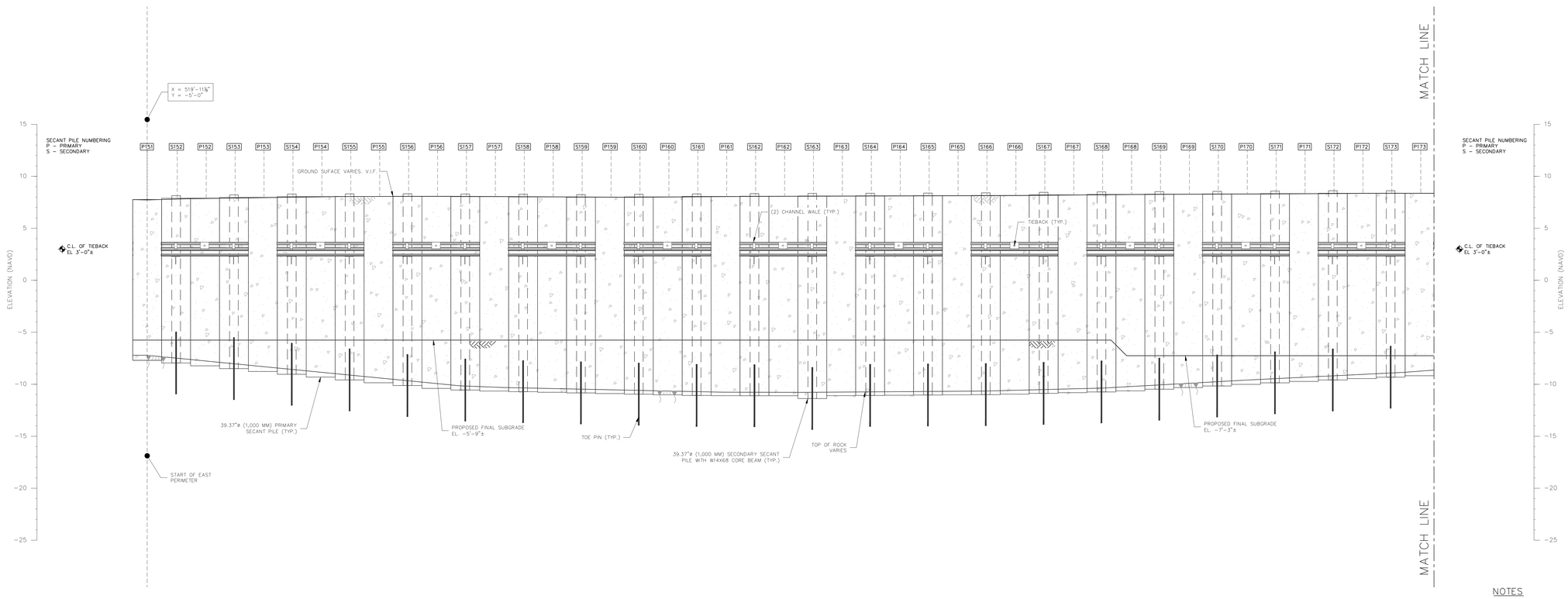
SUPPORT OF EXCAVATION - ELEVATIONS (SHEET 3 OF 6)

Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-303.00



3 ELEVATION - NORTH PERIMTER
Scale: 1/4" = 1'-0"



4A ELEVATION - EAST PERIMTER
Scale: 1/4" = 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
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Halletts Point Building 3

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Queens, NY 11102

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Architects & Planners
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New York, NY 10004
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New York, NY 10003
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Structural Engineer
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Mechanical/ Electrical/ Plumbing Engineers
Jaros Baum & Bolles
80 Pine Street #12
New York, NY 10005
212.530.9300

Civil & Geotechnical Engineers
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New York, NY 10001
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Marine Engineer
McLaren Engineering Group
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New York, NY 10001
212.324.6315

Transportation Planning
Philip Habib & Associates
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Vertical Transportation
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7 Pennsylvania Plaza
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Sustainability & Energy Modeling
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New York, NY 10003
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Hillsborough, NJ 08844
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Pool Design
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333 Westchester Avenue
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Seal

1	03/31/2017	50% CD

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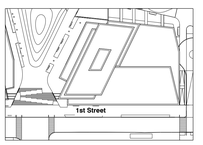
50% Construction Documents



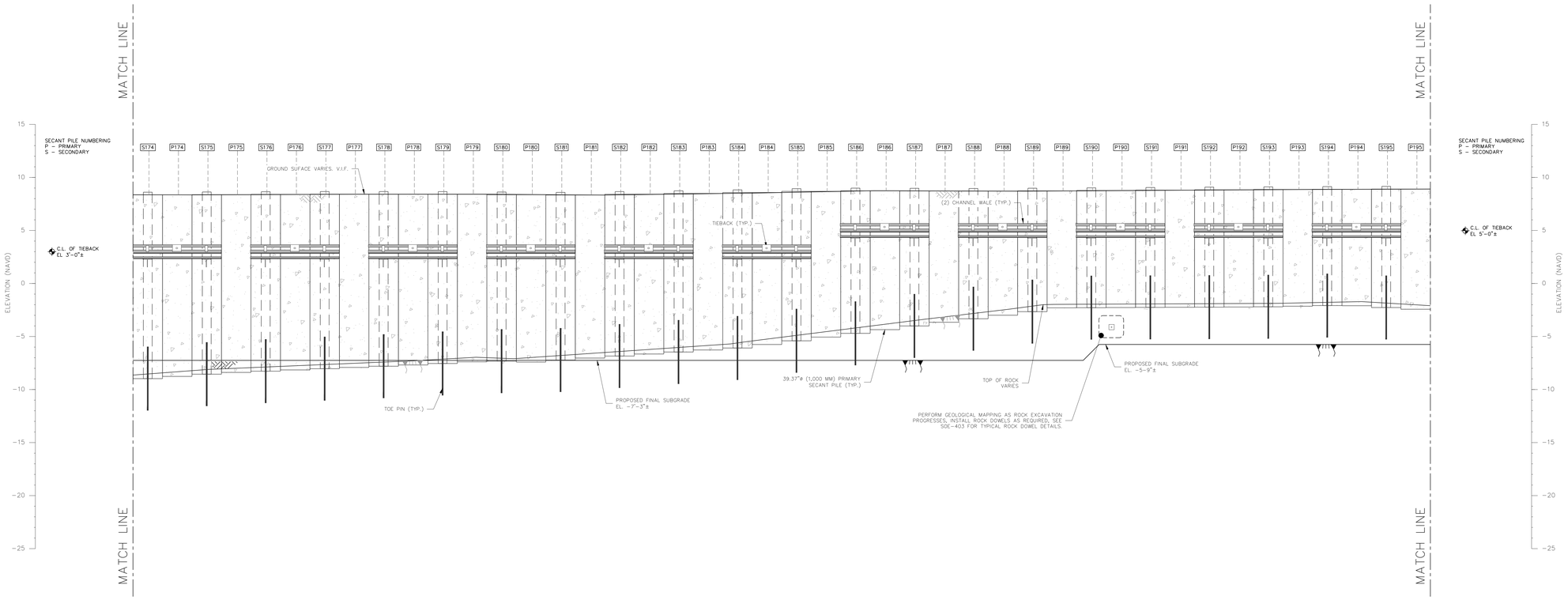
Key Plan N

SUPPORT OF EXCAVATION - ELEVATIONS (SHEET 4 OF 6)

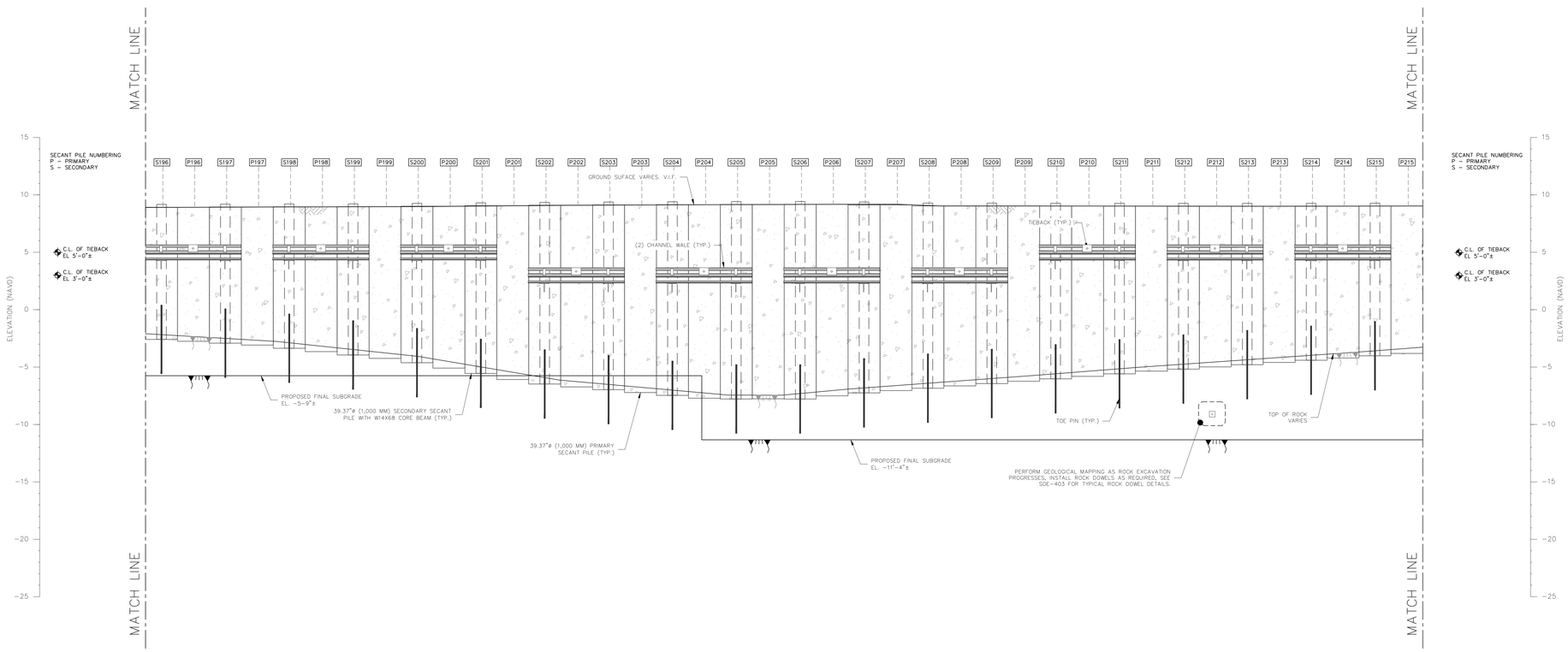
Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-304.00

Plot Date:



4B ELEVATION - EAST PERIMETER
Scale: 1/4" - 1'-0"



4C ELEVATION - EAST PERIMETER
Scale: 1/4" - 1'-0"

NOTES

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Plot Date:

Halletts Point Building 3

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Queens, NY 11102

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Seal

1	03/31/2017	50% CD

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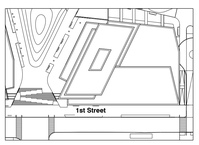
50% Construction Documents

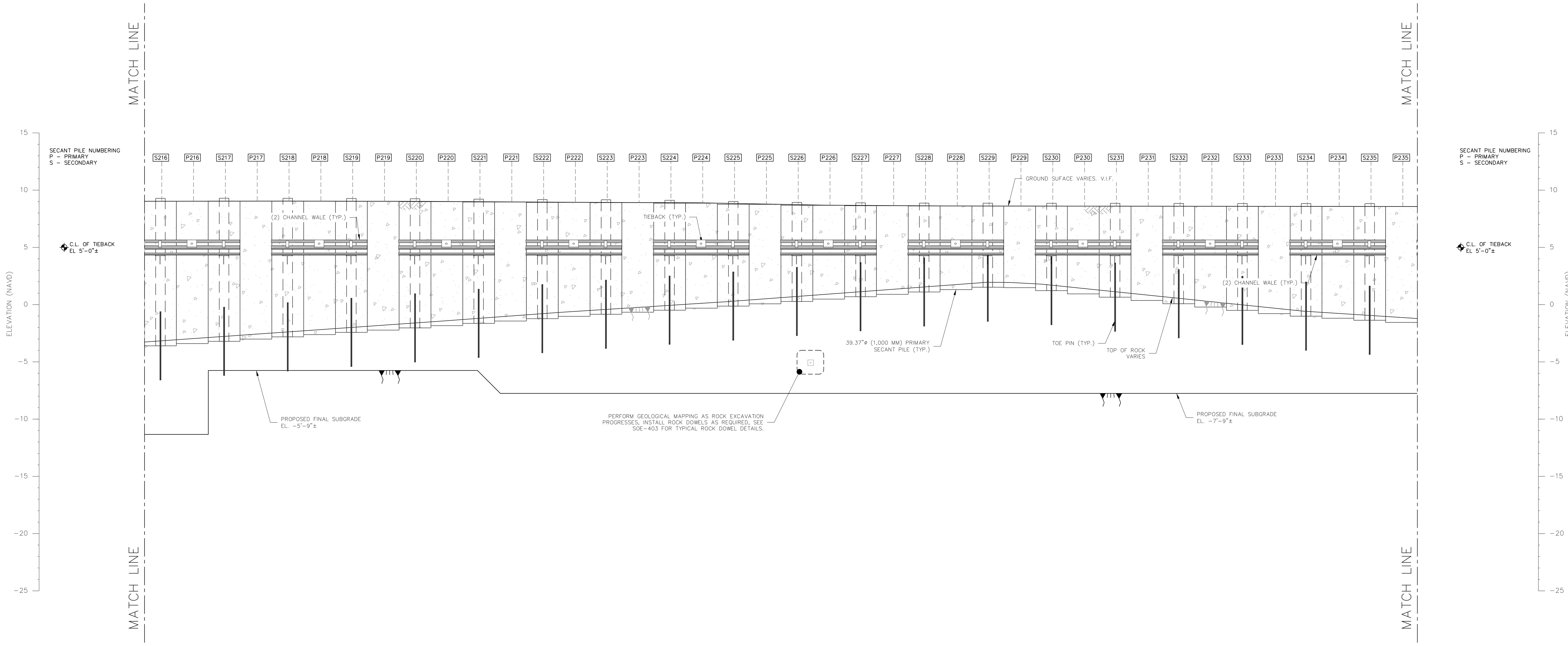


Key Plan N

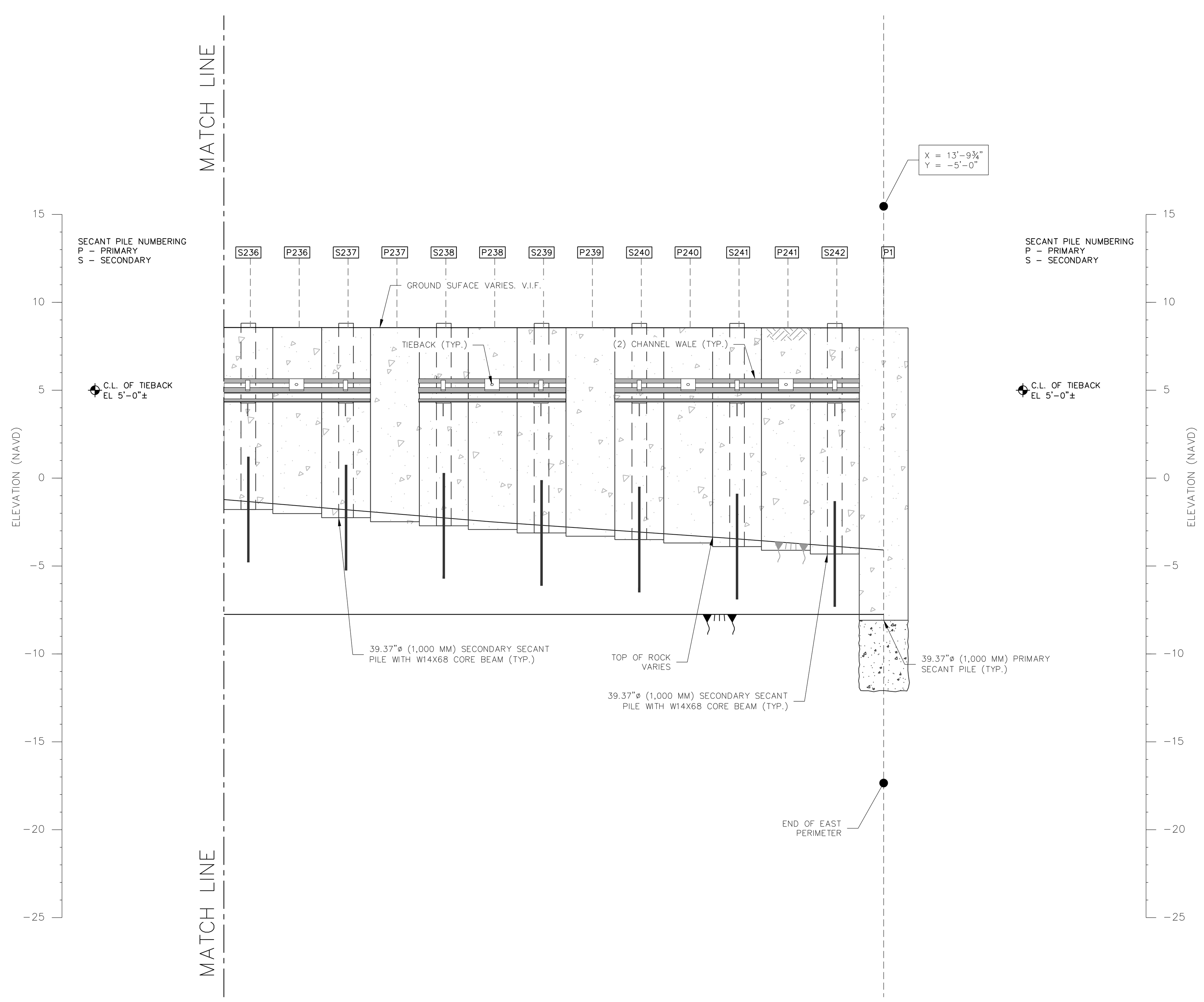
SUPPORT OF EXCAVATION - ELEVATIONS (SHEET 5 OF 6)

Scale	1/4" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-305.00



4D ELEVATION - EAST PERIMETER
Scale: 1/4" - 1'-0"



4E ELEVATION - EAST PERIMETER
Scale: 1/4" - 1'-0"

NOTES

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Seal

1	03/31/2017	50% CD

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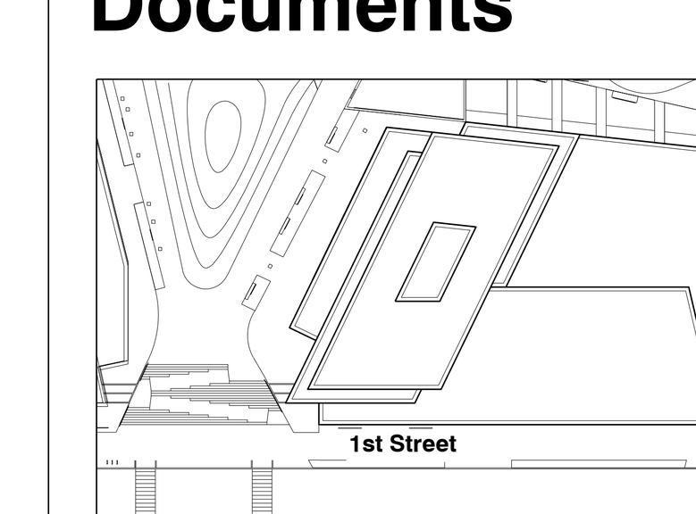
50% Construction Documents



Key Plan

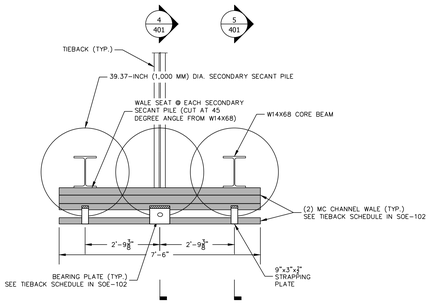
N

SUPPORT OF EXCAVATION - ELEVATIONS (SHEET 6 OF 6)

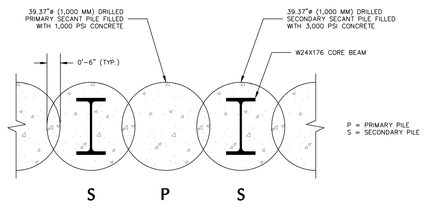
Scale 1/4" = 1'-0"
Job No. 170296504
Issuing Firm LE
Drawn By ZW

SOE-306.00

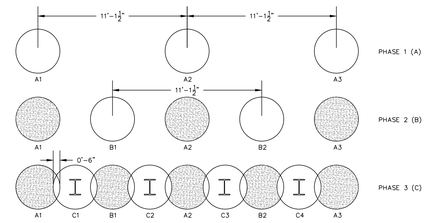
Plot Date:



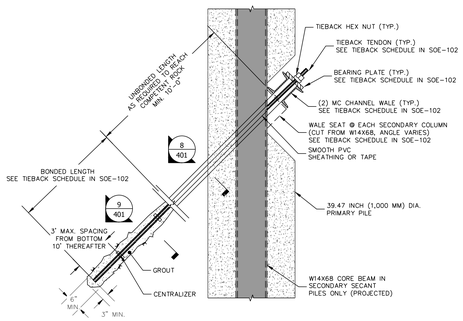
1 PLAN DETAIL - TYPICAL SECANT PILES WITH TIEBACK
Scale: 1/2" = 1'-0"



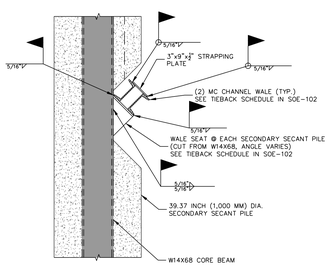
2 PLAN DETAIL - TYPICAL CANTILEVER SECANT PILES
Scale: 1/2" = 1'-0"



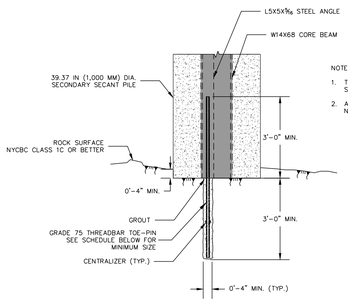
3 PLAN DETAIL - SECANT PILES SEQUENCEING
Scale: 1/2" = 1'-0"



4 SECTION DETAIL - TYPICAL SECANT WALL @ TIEBACK
Scale: 1/2" = 1'-0"



5 SECTION DETAIL - TYPICAL SECANT WALL @ CORE BEAM
Scale: 1/2" = 1'-0"

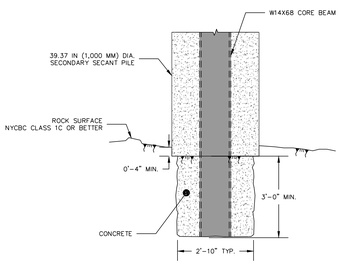


NOTES FOR DETAIL 6 & 7:

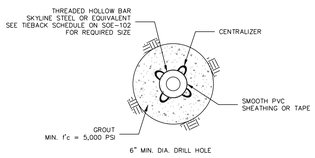
1. THE ROCK SURFACE SHALL BE PREPARED TO PROVIDE A CLEAN, UNIFORM SURFACE PRIOR TO PLACEMENT OF STEEL OR CONCRETE.
2. A ROCK SOCKET EXTENDING A MINIMUM OF 3 FEET INTO ROCK MEETING NYCBC CLASS 1C OR BETTER MAY BE PROVIDED IN LIEU OF TOE-PINS.

TOE-PIN SCHEDULE	
SECONDARY SECANT PILE DESIGNATION	TOE-PIN BAR SIZE
S1 – S39	NA
S40 – S128	#18 GRADE 75 THREADBAR
S129 – S242	#14 GRADE 75 THREADBAR

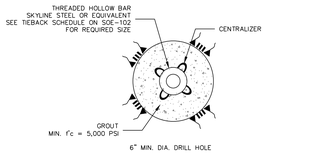
6 SECTION DETAIL - TYPICAL SECANT PILES WITH TOE-PIN
Scale: 1/2" = 1'-0"



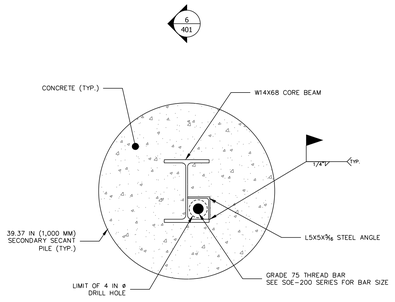
7 ALTENATIVE DETAIL AT BOTTOM OF SECANT PILES (ROCK SOCKET)
Scale: 1/2" = 1'-0"



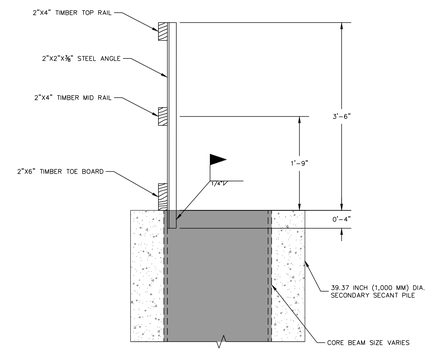
8 DETAIL - TIEBACK FREE LENGTH CROSS-SECTION (TYP.)
Scale: NTS



9 DETAIL - TIEBACK BOND LENGTH CROSS-SECTION (TYP.)
Scale: NTS



10 PLAN DETAIL - SECANT PILES WITH TOE PIN
Scale: 1/2" = 1'-0"



11 SECTION DETAIL - GUARDRAIL (TYP.)
Scale: 1/2" = 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-200 SERIES FOR TYPICAL SECTIONS.
4. SEE SOE-300 SERIES FOR ELEVATIONS.
5. SEE SOE-501 & 502 FOR MONITORING PLANS.

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New York, NY 10036

Davis Brody Bond, LLP
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1 New York Plaza - Suite 4200
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212.633.4700

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Selldorf Architects
860 Broadway, 2nd Floor
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New York, NY 10001
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131 West 35th Street, 4th Floor
New York, NY 10001
212.324.6315

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Philip Habib & Associates
102 Madison Avenue, 11th Floor
New York, NY 10016
212.929.5656

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212.868.9090

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Vidaris
360 Park Avenue South, 15th Floor
New York, NY 10010
212.689.5389

Sustainability & Energy Modeling
Atelier 10
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New York, NY 10003
212.254.4500

Landscape Architect
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80 Maiden Lane, Suite 1901
New York, NY 10038
212.487.3272

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158 West 29th Street
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Natural Systems Utilities
2 Clerico Lane Bldg. 1
Hillsborough, NJ 08844
908.359.5501

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Acoustic Consultant
Longman Lindsey
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New York, NY 10001
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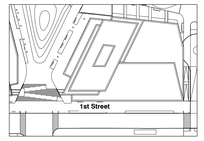
Davis Brody Bond

Seal

1	03/31/2017	50% CD

NOT FOR CONSTRUCTION

50% Construction Documents



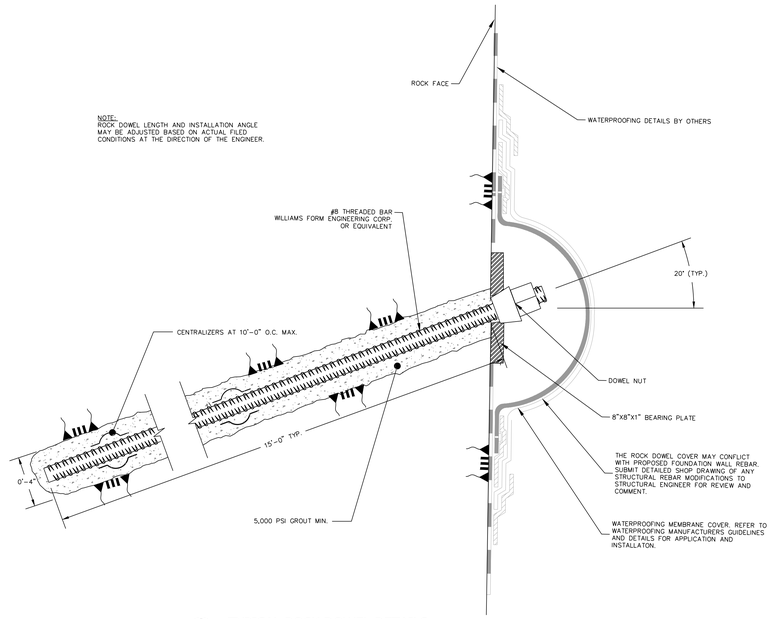
Key Plan N

SUPPORT OF EXCAVATION - DETAILS (SHEET 1 OF 2)

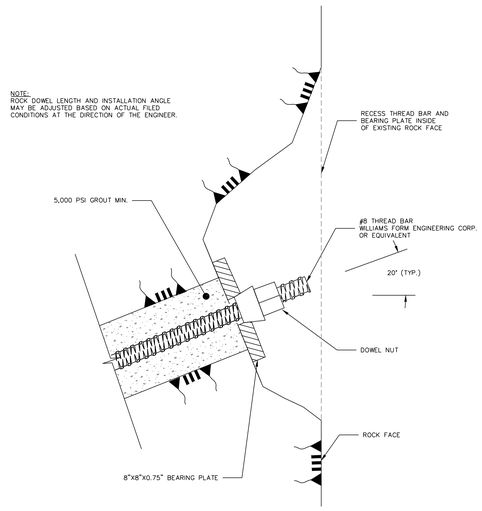
Scale	AS SHOWN
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-401.00

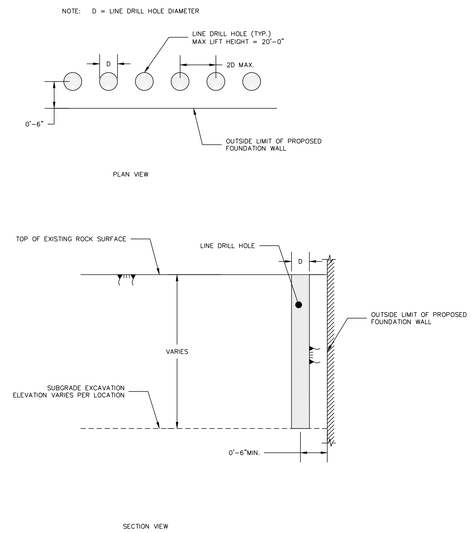
Plot Date:



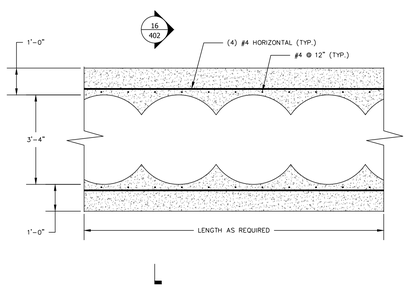
12 TYPICAL ROCK DOWEL DETAILS
Scale: 3" = 1'-0"



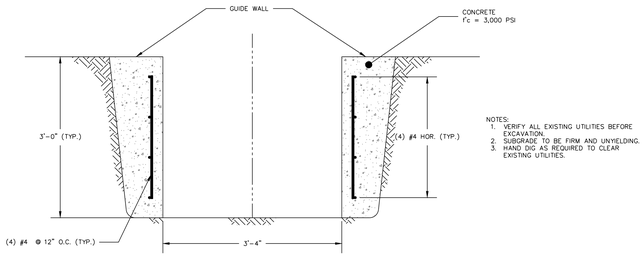
13 RECESSED ROCK DOWEL BEARING PLATE (OPTIONAL)
Scale: 3" = 1'-0"



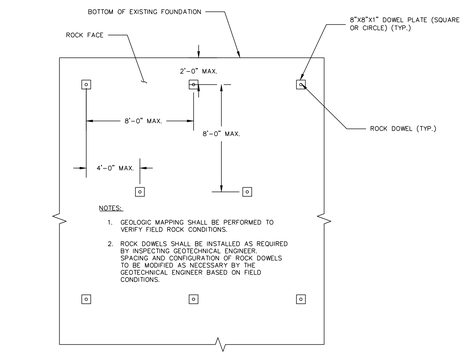
14 TYPICAL LINE DRILL DETAILS
Scale: 1" = 1'-0"



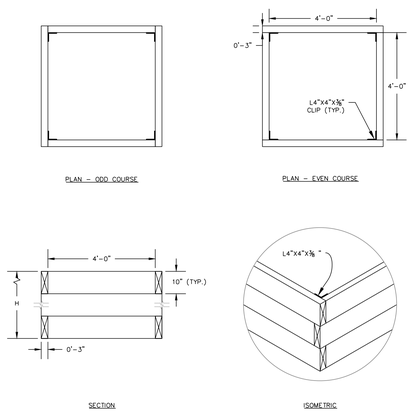
15 PLAN DETAIL - TYPICAL GUIDE WALL
Scale: 1/2" = 1'-0"



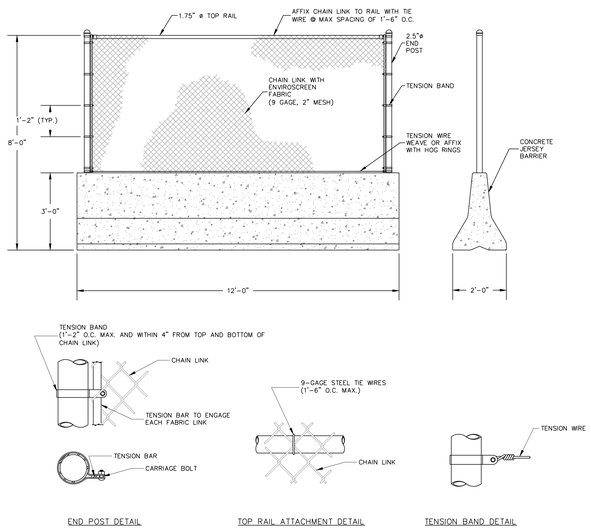
16 SECTION DETAIL - TYPICAL GUIDE WALL
Scale: 1" = 1'-0"



17 ELEVATION DETAIL - TYPICAL ROCK DOWEL LAYOUT
Scale: 1/4" = 1'-0"



18 TYPICAL SHEETED PIT DETAILS
Scale: 1/2" = 1'-0"



19 TYPICAL CONSTRUCTION FENCE DETAILS
Scale: 1/2" = 1'-0"

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
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Queens, NY 11102

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C/O Royal Realty Corp.
One Bryant Park
New York, NY 10036

Davis Brody Bond, LLP
Architects & Planners
1 New York Plaza - Suite 4200
New York, NY 10004
212.633.4700

Interior Designer
Selldorf Architects
860 Broadway, 2nd Floor
New York, NY 10003
212.219.9571

Structural Engineer
Severud Associates
469 Seventh Avenue, 9th Floor
New York, NY 10018
212.986.3700

Mechanical/ Electrical/ Plumbing Engineers
Jaros Baum & Bolles
80 Pine Street #12
New York, NY 10005
212.530.9300

Civil & Geotechnical Engineers
Langan
21 Pennsylvania Plaza
New York, NY 10001
212.479.5400

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McLaren Engineering Group
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New York, NY 10001
212.324.6315

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New York, NY 10016
212.929.5656

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Atelier 10
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New York, NY 10003
212.254.4500

Landscape Architect
Starr Whitehouse
80 Maiden Lane, Suite 1901
New York, NY 10038
212.487.3272

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158 West 29th Street
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908.359.5501

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Lothrop Associates - Trace Pool Design
333 Westchester Avenue
White Plains, NY 10604
914.495.4290

Acoustic Consultant
Longman Lindsey
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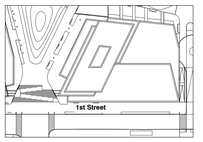
50% Construction Documents



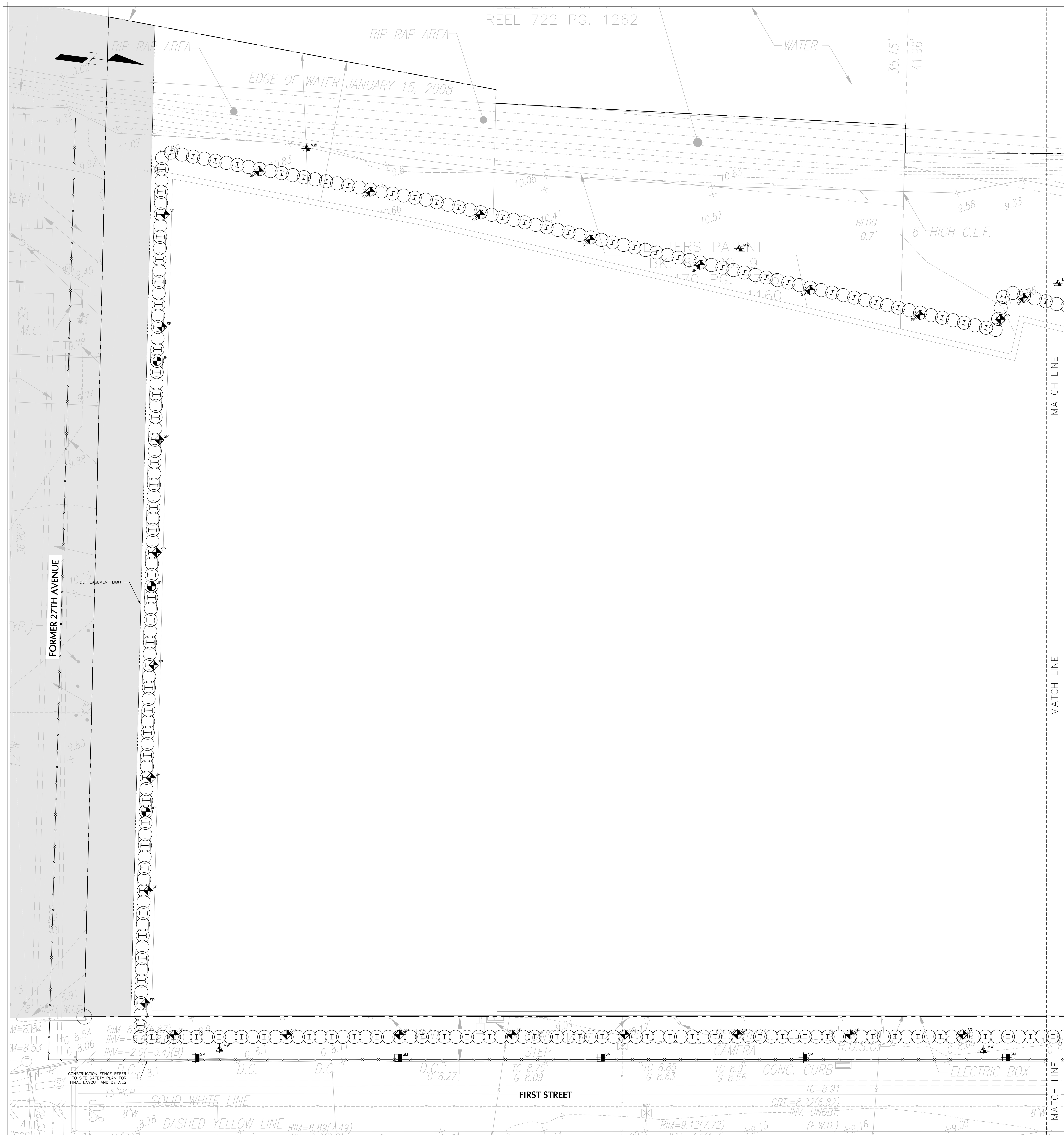
Key Plan

SUPPORT OF EXCAVATION - DETAILS (SHEET 2 OF 2)

Scale	AS SHOWN
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-402.00

Plot Date:



NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-103 & 104 FOR LAYOUT PLANS.
4. SEE SOE-200 SERIES FOR TYPICAL SECTIONS.
5. SEE SOE-300 SERIES FOR ELEVATIONS.
6. SEE SOE-400 SERIES FOR DETAILS.
7. EXISTING CONDITIONS TAKEN FROM "HALLETTS POINT BUILDING 2 AND 3, BOUNDARY AND TOPOGRAPHIC SURVEY" PREPARED BY CONTROL POINT ASSOCIATES INC. PC, DATED JUNE 3, 2016, REVISED NOVEMBER 2, 2016.
8. PROPOSED FOUNDATION PLAN WERE REPRODUCED FROM "FO100.00, FOUNDATION FRAMING PLAN – BUILDING 3" AND "FO-100.00 FOUNDATION FRAMING PLAN – BUILDING 2" BY SEVERUD ASSOCIATES, DATED MARCH 31, 2017.

LEGEND

- PROPERTY LINE
- APPROXIMATE LOCATION OF CONSTRUCTION FENCE
- EXTENTS OF DEP EASEMENT
- APPROXIMATE LIMITS OF DEP EASEMENT
- SP SURVEY MONITORING POINT
- SM SURFACE MARKER
- IP INCLINOMETER
- MW MONITORING WELL

GRAPHIC SCALE 0 2' 4' 8' 16'

Halletts Point Building 3

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Architects & Planners
1 New York Plaza - Suite 4200
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212.633.4700

Interior Designer
Selldorf Architects
860 Broadway, 2nd Floor
New York, NY 10003
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Structural Engineer
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21 Pennsylvania Plaza
New York, NY 10001
212.479.5400

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New York, NY 10001
212.324.6315

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212.868.9090

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New York, NY 10010
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New York, NY 10003
212.254.4500

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80 Maiden Lane, Suite 1901
New York, NY 10038
212.487.3272

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Seal

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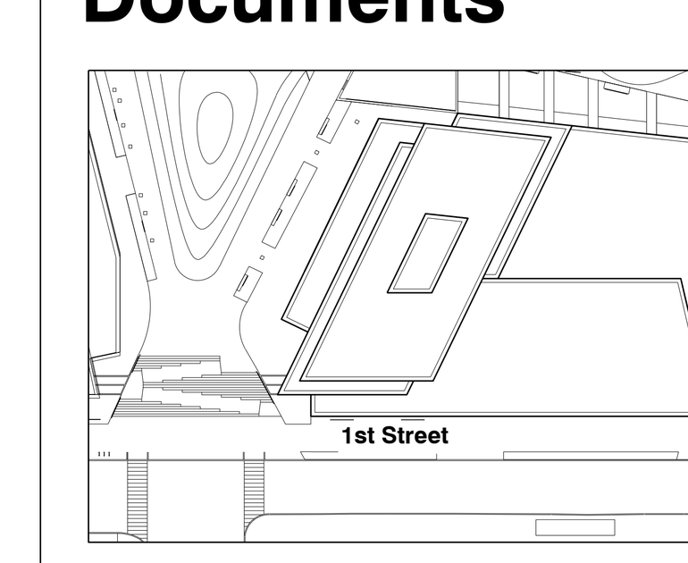
50% Construction Documents



Key Plan

N

SUPPORT OF EXCAVATION - MONITORING PLAN (PART 1)

Scale 1/8" = 1'-0"
Job No. 170296504
Issuing Firm LE
Drawn By ZW

SOE-501.00

Plot Date: 3/17/2016 4:22:16 PM

NOTES

1. SEE SOE-001 FOR GENERAL NOTES.
2. SEE SOE-101 & 102 FOR GENERAL PLANS.
3. SEE SOE-103 & 104 FOR LAYOUT PLANS.
4. SEE SOE-200 SERIES FOR TYPICAL SECTIONS.
5. SEE SOE-300 SERIES FOR ELEVATIONS.
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LEGEND

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- APPROXIMATE LOCATION OF CONSTRUCTION FENCE
- SP — SURVEY MONITORING POINT
- SM — SURFACE MARKER
- IP — INCLINOMETER
- MW — MONITORING WELL

0 2' 4' 8' 16'
GRAPHIC SCALE

Plot Date: 3/17/2016 4:22:16 PM

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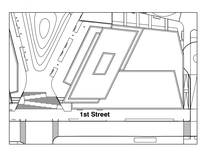

Key Plan N

SUPPORT OF EXCAVATION - MONITORING PLAN (PART 2)

Scale	1/8" = 1'-0"
Job No.	170296504
Issuing Firm	LE
Drawn By	ZW

SOE-502.00

APPENDIX D

Construction Health and Safety Plan (CHASP)

May 17, 2017

SITE-SPECIFIC CONSTRUCTION HEALTH AND SAFETY PLAN

Halletts Point Building 2
Halletts Point Building 3
Site No. C241192
26-40 1st Street
Astoria, Queens, New York

Prepared for:

HALLETTS BUILDING 2 SPE LLC AND
HALLETTS BUILDING 3 SPE LLC
One Bryant Park
New York, New York 10036

Remedial Engineering, P.C.
Environmental Engineers

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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(Continued)

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(Continued)

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FIGURES

APPENDICES

1.0 INTRODUCTION

This Site-specific Construction Health and Safety Plan (HASP) has been prepared in accordance with 29 FR 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) & 1926.62 OSHA guidelines. It addresses all activities to be performed during the implementation of the Interim Remedial Measure (IRM) Work Plan (IRMWP) and Remedial Action Work Plan (RAWP) activities at the Halletts Point Building 2 and the 26th Avenue street stub (Tax Block 916, Lot 10, and Tax Block 913, Lot 100, respectively); and Halletts Point Building 3 and the 27th Avenue street stub (Tax Block 916, Lot 1, and Tax Block 490, Lot 250, respectively), in Astoria, Queens, New York (Site). The Site address is collectively referred to as 26-40 1st Street, Astoria, New York. The HASP will be implemented by the designated Site Health and Safety Officer (SHSO) during work at the Site. This HASP attempts to identify all potential hazards at the Site; however, site conditions are dynamic and new hazards may appear constantly. Personnel must remain alert to existing and potential hazards as site conditions change and protect themselves accordingly.

Compliance with this HASP is required of all persons and subcontractors who perform work at, or enter the Site. The content of this HASP may change or undergo revisions based upon additional information made available to health and safety personnel, monitoring results, or changes in the technical scope of work. Any changes proposed must be reviewed and approved by the Project Principal, Corporate Health and Safety Manager (CHSM), with the SHSO implementing the changes to the HASP.

Upon entering the Site, all visitors are required to sign in. All visitors entering the Exclusion Zone (EZ) (defined in Section 8.1.1), the Contamination Reduction Corridor (CRC) (defined in Section 8.1.2), or the Remediated Zone (RZ) (defined in Section 8.1.3) will be required to read and comply with the applicable provisions of this HASP, which visitors must sign and acknowledge. Occasional site visitors (inspectors, owners, etc.) do not need to comply with the training and medical monitoring requirements if they sign a statement acknowledging that they have received Site-specific health and safety training and will comply with the applicable requirements of the HASP. In the event that a visitor does not adhere to the applicable provisions of this HASP, he or she will be required to leave the Site immediately.

This HASP was developed to address potential environmental hazards that may be encountered during the implementation of the proposed remedial action. During all phases of Site work, the Contractor shall be responsible for monitoring general Site conditions and for safety hazards associated with Site redevelopment (i.e. excavation, support of excavation, etc.) including the preparation of a Site-specific HASP pertaining to the redevelopment construction.

1.1 Scope of Work

The scope of work will involve Roux Associates, Inc. subcontracting drilling companies, disposal companies, utility locating companies, land surveying companies, and/or analytical testing laboratories for the purpose of investigating environmental conditions at the Site as well as excavation contractors during the construction phase of the project. Roux Associates, Inc. will complete some combination, or all, of the scope of work detailed below:

- Initial site inspections;
- Oversight of utility mark-out activities and ground penetrating radar, if warranted;
- Soil excavation oversight;
- Oversight of soil boring activities;
- Soil disposal activities;
- Implementation of Community Air Monitoring Program; and
- Construction oversight activities.

Roux Associates, Inc. will contract the drilling company to request a utility mark-out through the state One-Call System at least 4 days prior to the scheduled drilling event. If this mark-out is not sufficient to identify the utilities in the area where drilling activities are to occur, Roux Associates, Inc. will contract and oversee an independent utility mark-out service company to identify potential underground utilities in the area of concern.

Roux Associates, Inc. will contract a licensed company to load, transport, and dispose of waste materials at approved disposal facilities. Roux Associates will oversee the loading and check all paperwork for completeness. Roux Associates, Inc. personnel will NEVER sign any disposal and

transportation documentation; the insured or insurance carrier will be responsible for signing all disposal and transportation paperwork.

Roux Associates, Inc. will conduct, sampling, and remediation activities as required. Roux Associates, Inc. will conduct these activities using Roux Associates, Inc.-owned or vendor-rented field equipment. Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust, and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan or CAMP. Results will be regularly reported to the NYC Office of Environmental Remediation.

Roux Associates, Inc. will oversee excavation activities during the construction phase of the project and perform CAMP monitoring and trucking oversight.

1.2 Emergency Numbers

Provided below is a list of telephone numbers for use in the event of an emergency onsite.

1.2.1 Emergency Phone Numbers

911 Service is available for emergency calls in New York City. More specific numbers for additional services are listed below.

Type	Name	Telephone Numbers
Police	New York Police Department 114th Precinct 34-16 Astoria Boulevard South	(718) 626 9311
Fire		911
Ambulance/Medical Service		911
National Response Center		(800) 424-8802
Poison Control Center		(800) 526-8816
USEPA (Region II)		(212) 637-5000
NYSDEC Emergency Spill Response		(800) 457-7362
Hospital	Mount Sinai Queens Hospital	(718) 932-1000

Type	Name	Telephone Numbers
Roux Associates' Office Health and Safety Manager	Joseph Gavin	O: (631) 232-2600 C: (516) 754-6671
The Durst Organization, Inc.	Eric Deuser, LEED AP	O: (212) 257-6612

The route to Mount Sinai Queens Hospital, located at 25-10 30th Avenue is shown in Figure 1.

1.2.2 Project Management/Health and Safety Personnel

Title	Contact	Phone	Cell
General Superintendent	TBD		
Site Superintendent	TBD		
Assistant Site Superintendent	TBD		
Corporate Safety Supervisor	TBD		

TBD – To Be Determined

1.2.3 Other Important Phone Numbers

New York City Emergency Response Team.....911

Project Field Office Trailer.....TBD

1.2.4 Directions to Mount Sinai Queens Hospital

Mount Sinai Queens Hospital
25-10 30th Avenue
Queens, New York 11102

Directions from the Site to Mount Sinai Queens Hospital

1. From Site, head south on 1st Street toward 27th Avenue
2. Take the 1st left onto 27th Avenue
3. Take the first right onto 8th Street
4. Take the second left onto 30th Avenue

Directions to the hospital are included in Figure 1.

1.3 Emergency Equipment

Emergency Equipment List to be kept on Site:

- First Aid Kits
- ABC Fire Extinguisher
- Absorbent Boom Emergency Spill Equipment
- Absorbent Pads
- Air Horns
- Oil Dry
- Eye Wash

2.0 HEALTH AND SAFETY STAFF

This section briefly describes all Site personnel and their health and safety responsibilities relating to the implementation of the IRM and RAWP to be implemented at the Site. All personnel are responsible for ensuring compliance with the HASP.

2.1 General Superintendent (GS) - TBD

- Has the overall responsibility for the health and safety of Site personnel;
- Ensures that adequate resources are provided to the field health and safety staff to carry out their responsibilities as outlined below.

2.2 Corporate Health and Safety Manager (CHSM) - TBD

- Implements the HASP.
- Performs or oversees site-specific training and approves revised or new safety protocols or field operations.
- Coordinates revisions of this HASP with Project Superintendent.
- Responsible for the development of new task safety protocols and procedures and resolution of any outstanding safety issues which may arise during the conduction of site work.
- Reviews and approves all health and safety training and medical surveillance records for personnel and subcontractors.

2.3 Site Health and Safety Officer (SHSO) - TBD

- Directs and coordinates health and safety monitoring activities.
- Ensures that field teams utilize proper personal protective equipment (PPE).
- Conducts initial onsite specific training prior to personnel and/or subcontractors commencing work.
- Conducts and documents periodic safety briefings.
- Completes and maintains Accident/Incident Report Forms.
- Ensures that field team members comply with this HASP. Completes and maintains Accident/Incident Report Forms.
- Immediately notifies the GS and CHSM of all accident/incidents.

- Communicates at the end of each day to the designated representative the tasks completed, the next day's planned activities, any third party issues, changes of work plans and/or changes in level of PPE.

- Maintains contact with subcontractors.

- Determines upgrade or downgrade of personal protective equipment (PPE) based on Site conditions and/or real time monitoring results.

- Ensures that monitoring instruments are calibrated daily or as manufacturer's instructions determine.

- Reports to the CHSM to provide summaries of field operations and progress.

- Submits and maintains health and safety field log books, daily safety logs, training logs, air monitoring result reports, and weekly safety report.

2.4 Field Personnel and Subcontractors

- Reports any unsafe or potentially hazardous conditions to the SHSO.

- Maintains knowledge of the information, instructions, and emergency response actions contained in the HASP.

- Complies with rules, regulations, and procedures as set forth in this HASP and any revisions that are instituted.

- Prevents admittance to work Site by unauthorized personnel.

3.0 SITE BACKGROUND

Building 2 and Building 3 are collectively referred to as 26-40 1st Street in Astoria, Queens County, New York 11102 (Tax Block 916, Lot 10, and Tax Block 913, Lot 100, respectively) (Site). A Site Location Map depicting the Site is provided as Figure 2.

Currently, the Site is fenced and is being used as a construction staging area for the adjacent Building 1 site redevelopment. The Site is located in an area zoned as Residential and Commercial.

3.1 Site Description and Setting

The Site limits include up to the approximate limits of the proposed bulkhead line and the waterfront esplanade area (within Block 490 Lot 250 and Block 913 Lot 100) encompassing an area of approximately 2.98 acres. The Site is located in an urban and developed area. The Site is bordered by Whitey Ford Field to the north, Block 490 Lot 1 to the south, the East River to the west, and 1st Avenue to the east. The surrounding properties are currently used for a combination of park space, high density residential housing, manufacturing and commercial. The nearest residential property is located southeast of the Site (diagonally across 1st Street and 27th Avenue).

3.2 Site History

The Site was historically occupied by various commercial, industrial, and utility establishments, including an apparent coal gasification plant, a coal-fired electric generating station, several stone cutting and polishing establishments, machine works, a lumber yard, a manufacturer of masonry building blocks, a manufacturer of hampers, and a scaffold manufacturer.

The property, identified as 26-02 1st Street (Lot 10), is associated with the NYSDEC Spill No. 9811649, which was assigned to the above address on December 16, 1998. The spill incident involved approximately 3 gallons of antifreeze to leak from a backhoe located in the street. No sewers or waterways were affected and the spill was declared closed by the NYSDEC on February 3, 2003. Based on the status of the spill and location in the street the spill is not considered an environmental concern.

In addition, the property identified as Waterfront, located at 27th Avenue and 1st Street is associated with NYSDEC Spill #0203472, which was assigned during bulkhead construction on July 2, 2002.

A tank was struck and leaked into the waterway. The spill was declared closed by the NYSDEC on March 7, 2003.

3.3 Summary of Environmental Conditions

Environmental conditions at the Site are summarized below.

1. Groundwater flow is generally from east to west beneath the Site towards the East River;

2. Depth to bedrock is variable and was observed at depths ranging from 9 to 23 feet during the 2014 RI;

3. The stratigraphy of the Site, from the surface down, consists of historic fill underlain by bedrock;

4. Soil samples collected during the 2014 RI showed widespread detections of SVOCs above Part 375 Restricted Residential SCOs especially within the western property extent and within the center of Block 916 Lot 1 and isolated exceedances for metals were detected above Part 375 Restricted Residential SCOs mostly in shallow soils at various locations throughout the site;

5. Groundwater samples collected during the 2014 RI showed VOCs were detected at concentrations above AWQSGVs in two monitoring wells located downgradient of the former manufactured gas tanks, SVOCs were detected in groundwater throughout block 916 lot 1 above the AWQSGVs with the highest concentrations detected downgradient of the former MGP and several metals including iron, manganese, selenium, and sodium were detected at concentrations above AWQSGVs in both filtered and unfiltered groundwater samples throughout the Site and Dieldrin was the only pesticide detected in groundwater at concentrations above AWQSGVs;

6. Soil vapor samples collected during the RI showed all soil vapor samples contained low-level detections of both petroleum-related VOCs and chlorinated VOCs. Tetrachloroethene (PERC) is the prominent chlorinated VOC of concern detected throughout block 916 lots 1 and 10.

4.0 WASTE DESCRIPTION/CHARACTERIZATION

This section provides a brief summary of the wastes that are potentially present at the Site.

4.1 General

The following information is presented in order to identify the types of materials that may be encountered at the Site. The detailed information on these materials was obtained from:

- Sax's Dangerous Properties of Industrial Materials – Lewis Eight Edition
- Chemical Hazards of the Workplace – Proctor/Hughes
- Condensed Chemical Dictionary – Hawley
- Rapid Guide to Hazardous Chemical in the Workplace – Lewis 1990
- NIOSH Pocket Guide to Chemical Hazards – 1996
- ACGIH TLV Values and Biological Exposure Indices – OSHA 29 CFR 1910.1000

4.2 Chemical Data Sheets

The following is a listing of chemicals that may potentially be present in soils and groundwater at the Site based on previous soil sampling results and historic operations conducted at or adjacent to the Site.

VOCs	SVOCs/PAHs	Metals
Chloroform	Anthracene	
	Naphthalene	Chromium
	Pyrene	Copper
	Indeno(l ,2,3-cd)pyrene	Lead
	Benzo[a]anthracene	Mercury
	Benzo[a]pyrene	Nickel
	Benzo[b]fluoranthene	Silver
	Chrysene	Zinc
	Dibenzo[a,h]anthracene	
	Fluoranthene	
	Fluorene	
	Dibenzofuran	
	Phenanthrene	

4.2.1 Contaminants of Concern

Soil and groundwater contaminants that may be encountered during excavation and foundation construction activities include both organic and inorganic compounds. The chemical hazards posed by the Site are VOCs, SVOCs and metals.

- Waste Types

Liquid	☒	Solid	☒	Gas	☐
Sludge	☐	Semi-Solid	☐	Other (describe) _____	

- Waste Characteristics

Corrosive	☐	Ignitable	☐	Volatile	☒
Radioactive	☐	Inert	☐	Toxic	☒

- Waste Containment

Pit	☒	Pond	☐	Sedimentation trap	☐
Lake	☐	Process Vessel	☐	Tank	☒
Piping	☐	Drum	☐	Other	☐

5.0 HAZARD ASSESSMENT

The potential to encounter chemical hazards is dependent upon the work activity performed (intrusive versus non-intrusive) and the duration and location of the work activity. Such hazards could include inhalation and/or skin contact with chemicals/gases that could cause: dermatitis, skin burns, being overcome by vapors or asphyxiation.

Physical hazards that may be encountered during Site work include: heat and cold stress, exposure to excessive noise, loss of limbs, being crushed, head injuries, punctures, cuts, falls, electrocution, bruises, and other physical hazards due to motor vehicle operation, heavy equipment, and power tools.

Biological hazards may exist during Site activities. These hazards include exposure to insect bites/stings and bloodborne pathogens.

Prior to the beginning of each new phase of work, an activity hazard analysis will be prepared by the SHSO with assistance from the CHSM. The analysis will address the hazards for each activity performed in the phase and will present the procedures and safeguards necessary to eliminate the hazards or reduce the risk. The Activity Hazard Analysis Sheets are located in Appendix A and Job Safety Analysis (JSA) sheets are provided as Appendix K.

Note: Hazard assessment is documented in section 5.4.

5.1 Chemical Hazards

The potential for personnel and subcontractors to be exposed to chemical hazards may occur during the following tasks:

- Excavation Activities
- Dewatering of the excavation
- Installation of foundation piles
- Installation of sheet piling and shoring
- Decontamination station activities (equipment)

For chronic and acute toxicity data, refer to Summary of Toxicological Data in Table 3 for further details on compound characteristics.

5.1.1 Exposure Pathways and Assessment

Exposure to these compounds during ongoing activities may occur through inhalation of contaminated dust particles, inhalation of VOCs, SVOCs, and by way of dermal absorption and accidental ingestion of the contaminant by either direct or indirect cross-contamination activities.

Inhalation of contaminated dust particles (VOCs, SVOCs, and inorganics) can occur during adverse weather conditions (high or changing wind directions) or during operations that may generate airborne dust such as excavation and loading of contaminated soils. Dust control measures such as applying water to roadways and excavations will be implemented where visible dust is generated in accordance with the remediation contractor's work plans. Where dust control measures are not feasible or effective, respiratory protection will be used (see Section 9.2.2 for monitoring procedures and action levels).

5.1.2 Operational Action Levels

A decision-making protocol for an upgrade in levels of protection and/or withdrawal of personnel from an area based on atmospheric hazards will be determined by continuous air monitoring by our Industrial Hygienist and safety personnel.

5.1.3 Additional Precautions

Dermal absorption or skin contact with chemical compounds is possible during intrusive activities at the Site. The use of PPE in accordance with Section 8.2 and strict adherence to proper decontamination procedures should significantly reduce the risk of skin contact.

The potential for accidental ingestion of potentially hazardous chemicals is expected to be remote when good hygiene practices are used.

5.2 Physical Hazards

A variety of physical hazards may be present during Site activities. These hazards include typical construction activities: operation of motor vehicles and heavy equipment, the use of power and

hand tools, roping and rigging of steel sheeting, walking on objects, tripping over objects, working on surfaces which have the potential to promote falling, skin burns, crushing of fingers, toes, limbs, head injuries caused by falling objects, temporary loss of one's hearing and/or eyesight. The referenced hazards are not unique and are generally familiar to most workers at construction sites. An Activity Hazard Analysis shall be submitted to the Construction Supervisor prior to the beginning of each phase of work (i.e., definable task). Task specific safety requirements for each phase will be covered during safety briefings. Activity Hazard Analysis summaries are contained in Appendix A.

5.2.1 Noise

Noise is a potential hazard associated with operation of heavy equipment, power tools, pumps, and generators. High noise equipment operators will be evaluated at the discretion of the SHSO. Employees with an 8-hour time weighted average exposure exceeding 85 dB[-]A will be included in the hearing conservation program in accordance with 29 CFR 1910.95 and 1926.52.

It is mandated that employees working around heavy equipment or using power tools that dispense noise levels exceeding 90 dB[-]A are to wear hearing protection that shall consist of earplugs or protective earmuffs.

5.2.2 Heat Stress

Heat stress is a significant potential hazard associated with the use of protective equipment in a hot weather environment. The human body is designed to function at a certain internal temperature. When metabolism or external sources (fire or hot summer day) cause the body temperature to rise, the body seeks to protect itself by triggering cooling mechanisms. The SHSO will monitor the air temperature (as described later in this section) to determine potential adverse effects the weather can cause onsite personnel. Excess heat is dissipated by two means:

- Changes in blood flow to dissipate heat by convection, which can be seen as "flushing" or reddening of the skin in extreme cases.
- Perspiration, which is the release of water through skin and sweat glands. While working in hot environments, evaporation of perspiration is the primary cooling mechanism.

Protective clothing worn to guard against chemical contact effectively stops the evaporation of perspiration. Thus, the use of protective clothing increases heat stress problems.

The major disorders due to heat stress are heat cramps, heat exhaustion, and heat stroke. Heat cramps are painful spasms that occur in the skeletal muscles of workers who sweat profusely in the heat and may drink large quantities of water, but fail to replace the body's lost salts or electrolytes. Drinking water while continuing to lose salt tends to dilute the body's extracellular fluids. Soon, water seeps by osmosis into active muscles and causes pain. Muscles fatigued from work are usually most susceptible to cramps.

Extreme weakness or fatigue, dizziness, nausea, and headache characterize heat exhaustion. In serious cases, a person may vomit or lose consciousness. The skin is clammy and moist, complexion pale or flushed, and body temperature normal or slightly higher than normal. The treatment is to rest in a cool place and replacement of body water lost by perspiration. Mild cases may recover spontaneously with this treatment; severe cases may require care for several days. There are no permanent effects.

Heat stroke is a very serious condition caused by the breakdown of the body's heat-regulating mechanisms. The skin is very dry and hot with red mottled or bluish appearance. Unconsciousness, mental confusion, and/or convulsions may occur. Without quick and adequate treatment, the result can be death or permanent brain damage. As a first aid treatment, the person should be moved to a cool place. Body heat should be reduced artificially, but not too rapidly, by soaking the person's clothes in water and fanning them.

Steps that can be taken to reduce heat stress are:

- Acclimate the body. Allow a period of adjustment to make further heat exposure endurable.
- Drink more liquids to replace the body water lost during sweating.
- Take frequent breaks to rest and recover from the effects of heat stress.
- Wear personal cooling devices. These are two basic designs: units with pockets for holding frozen packets and units that circulate fluid from a reservoir through tubes to different parts of the body. Both designs can be in the form of a vest, jacket, or coverall. Some circulating units also have a cap for cooling the head.
- Wear long cotton underwear under chemical protective clothing. The cotton will absorb perspiration and will hold it close to the skin. This will provide the body with the maximum cooling available from the limited evaporation that takes place beneath chemical resistant clothing. It also allows for rapid cooling of the body when the protective clothing is removed.

Heat stress is a significant hazard associated with using protective equipment in hot weather environments. Local weather conditions may produce a situation that requires restricted work schedules in order to protect employees.

Appendix B contains procedures for heat stress; these will be used as a guideline and to provide additional information.

5.2.3 Cold Stress

Cold temperatures are a significant potential hazard. Examples of cold temperature hazards are frostbite and hypothermia.

Frostbite is the most common injury resulting from exposure to cold. The extremities of the body are most often affected. The signs of frostbite are:

- The skin turns white or grayish-yellow.
- Pain is sometimes felt early but subsides later. Often there is no pain.
- The affected parts feel intensely cold and numb.

Hypothermia is characterized by shivering, numbness, drowsiness, muscular weakness, and a low internal body temperature when the body feels extremely cold. This can lead to unconsciousness and death. With both frostbite and hypothermia, the affected areas need to be warmed quickly. Immersion in warm water is an effective means of warming the affected areas quickly. In such cases, medical assistance will be sought.

To prevent these effects from occurring, persons working in the cold should wear adequate clothing and reduce the time spent in the cold area. The SHSO will monitor this and determine the appropriate time personnel should spend in adverse weather conditions.

Additional information about Cold Stress Control Guidelines is provided in Appendix C.

5.2.4 Lockout/Tagout

The remediation contractor will develop a lockout/tagout plan in the event of the repair of electrical, pneumatic, hydraulic, mechanical systems, per OSHA requirements under 29 CFR 1910.147.

5.2.5 Excavation Safety

All excavation work will be accomplished in strict conformance with 29 CFR 1926 .650 - 652. Site and safety controls will be implemented to insure both the safety of the person(s) excavating and all general personnel as specified in Appendix D.

5.2.6 Confined Space Entry

The remediation contractor and its subcontractor's personnel will not be permitted to enter confined spaces at any time until the space has been thoroughly evaluated and all provisions of 29 CFR 1910.146 are satisfied.

5.3 Biological Hazards

The biological hazards, which have the potential to cause adverse health effects, are from exposure to domestic flies, mosquitoes, insects, and bloodborne pathogens. The Activity Hazard Analysis (Appendix A) suggests controls for various hazards to be potentially encountered onsite.

5.3.1 Insect Stings

Stings from insects are often painful, cause swelling, and can be fatal if a severe allergic reaction such as anaphylactic shock occurs. If a sting occurs, the stinger should be scraped out of the skin, opposite of the sting direction. The area should be washed with soap and water followed by an ice pack.

Those individuals susceptible to severe allergic reaction to bee stings should carry on their person their own medication and the SHSO should be notified. If the victim has a history of allergic reaction, he should be taken to the nearest medical facility. If the victim has medication to reverse the effects of the sting, it should be taken immediately.

If the victim experiences a severe reaction, a constricting band should be placed between the sting and the heart. The bitten area should be kept below the heart if possible. A physician should be contacted immediately for further instructions.

5.3.2 Bloodborne Pathogens

The majority of the occupational tasks onsite will not involve a significant risk of exposure to blood, blood components, or body fluids. The highest risk of acquiring any bloodborne pathogen for employees onsite will be following an injury. When administering first aid care, there are potential hazards associated with bloodborne pathogens that cause diseases such as Human Immunodeficiency Virus (HIV), Hepatitis A (HAV), Hepatitis B (HBV), Hepatitis C (HCV), or the Herpes Simplex Virus (HSV). An employee who has not received the appropriate certification should never perform first aid and/or CPR.

In order to minimize any potential pathogen exposure, all employees should use the hand washing facilities on a regular basis. The decontamination area will provide an adequate supply of water, soap, and single use towels for hand washing. Additionally, the following universal precautions should be followed to prevent further potential risk:

- Direct skin or mucous membrane contact with blood should be avoided.
- Open skin cuts or sores should be covered to prevent contamination from infectious agents.
- Body parts should be washed immediately after contact with blood or body fluids that might contain blood, even when gloves or other barriers have been used.
- Gloves and disposable materials used to clean spilled blood shall be properly disposed of in an approved hazardous waste container.
- First aid responders shall wear latex or thin mil nitrile gloves when performing any procedure risking contact with blood or body substances.
- Safety glasses will be worn to protect the eyes from splashing or aerosolization of body fluids.
- A CPR mask will be worn when performing CPR to avoid mouth-to-mouth contact.
- Work gloves will be worn to minimize the risk of injury to the hands and finger when working on all equipment with sharp or rough edges.
- Never pick up broken glass or possible contaminated material with your unprotected hands.

5.4 Hazard Assessment

Task	Hazards	Risk of Exposure
Mobilization/ Demobilization	Inhalation/Skin Contact	Low
	Heat Stress/Cold Stress	Low
	Noise	Moderate
	Physical Injury	High
Decontamination/ Dewatering	Inhalation/Skin Contact	Moderate
	Heat Stress/Cold Stress	Moderate
	Physical Injury	Moderate
	Noise	Moderate
Earthwork/Drilling	Inhalation/Skin Contact	Low
	Heat Stress/Cold	Moderate
	Stress Noise	Moderate
	Physical Injury	High
Sheeting and Shoring	Inhalation/Skin Contact	Moderate
	Heat Stress/Cold Stress	Moderate
	Noise	High
	Physical Injury	High

Activity	Hazard	Action Taken
Excavating	Struck by Ground Stability	Safe work zone with clearance
	Hearing Loss	Inspection by competent person Ear Protection
Trucking	Struck by	Traffic control by flagmen
	Contamination/ Decontamination	(wash down)
Formwork Installation	Falls	All personnel will be 100% fall protected at a height of 6' or more
Rebar Installation	Impalement	All rebar with impalement potential will be properly protected
Concrete Installation	Burns	All personnel will wear proper attire (long sleeves, long pants, boots, gloves)

Activity	Hazard	Action Taken
	Eye Damage	All personnel will utilize eye protection when working with concrete

General Conditions:

1. Hard hats will be worn at all times;
2. Eye protection will be worn at all times;
3. Steel-toed and shanked safety boots will be worn at all times; and
4. Hearing protection will be used when required.

All other safety requirements are as per OSHA 1926 – NYDOB – NYDOT

6.0 TRAINING

This section details the training requirement for all personnel working on the Site.

6.1 General Health and Safety Training

In accordance with the remediation contractor's corporate policies, and pursuant to 29 CFR 1910.120, all Site workers that will be involved with intrusive activities or other Site activities that would require work with impacted material shall, at the time of the job assignment, have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations. At a minimum, the training shall have consisted of instruction in the topics outlined in this HASP. Personnel who have not met the requirements for initial training will not be allowed to work in any Site activities that could potentially result in exposure to chemical or physical hazards. Completion of a 40-hour Health and Safety Training Course for Hazardous Waste Operations or an approved equivalent will fulfill the requirements of this section. In addition to the required initial training, each employee shall have received three days of directly supervised on-the-job training. This training will address the duties the employees are expected to perform.

Based on the dynamic conditions that will be present at the Site, portions of the Site will be established in which the risk of exposure to impacted materials will be prevented by removal of the impacted material and/or the installation of engineering controls, creating a "remediated zone." Remediation activities may be occurring on other portions of the Site where the risk for exposure has not been mitigated (non-remediated zone). Forty-hour training will not be required for workers within the remediated zone, but an additional SHSO will be assigned to oversee workers within that area and perform air monitoring as necessary to assure that the workers in the remediated zone are not exposed to hazardous material. No intrusive work will be performed within the remediated zone while untrained workers are present. A detailed description of the establishment procedures for the remediated zone is provided in Section 8.1.4.

The remediation contractor has the responsibility of ensuring that the personnel assigned to this project comply with these requirements. Written certification of completion of the required training will be provided to the Project Manager.

6.2 Manager/Supervisor Training

In accordance with 29 CFR 1910.120, onsite management and supervisors who will be directly responsible for, or who supervise employees engaged in hazards waste operations shall receive training as required by Section 6.1 of the HASP. Also, an additional 8 hours of specialized training on managing such operations are required prior to job assignment.

6.3 Annual Eight-Hour Refresher Training

Annual 8-hour refresher training will be required of all hazardous waste Site field personnel in order to maintain their qualifications for fieldwork. The following topics will be reviewed: toxicology, respiratory protection, including air-purifying devices and self-contained breathing apparatus (SCBA), medical surveillance, decontamination procedures, and personnel protective clothing. In addition, topics deemed necessary by the remediation contractor's Health and Safety Director may be added to the above list.

6.4 Site-Specific Training

Prior to commencement of field activities, the SHSO or CHSM will provide Site-specific training to all personnel assigned to the Site for remedial/construction activities. Site personnel will receive training that will specifically address the activities, procedures, monitoring, and equipment for Site operations. It will include Site and facility layout, hazards, first aid equipment locations and emergency services at the Site, and will highlight all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand and to reinforce their responsibilities regarding safety and operations for their particular activity.

6.5 Onsite Safety Meetings

Daily safety meetings will be presented each morning to discuss potential safety concerns for the upcoming activities. At a minimum, at least one formal safety meeting will be conducted daily, or when a new crew begins work, by the appropriate field supervisors or foremen for all workers. A copy of the daily safety meeting will be provided to the PM and onsite Owner's Representative.

The briefings will also provide a forum to facilitate conformance with safety requirements and to identify performance deficiencies related to safety during daily activities or as a result of safety audits by the remediation contractor or other involved parties.

6.6 First Aid and CPR

The SHSO will identify those individuals having first aid and CPR training in order to ensure that emergency medical treatment is available during field activities. The training will be consistent with the requirements of the American Red Cross. Certification and appropriate training documentation will be kept with the Site personnel records.

6.7 Additional Training

The CHSM may require additional or specialized training throughout the project. Such training may include the safe operation of heavy or power tool equipment or hazard communication training or other topic, as deemed appropriate.

6.8 Subcontractor Training

All subcontractor personnel involved with intrusive work or other activities that could result in exposure to impacted material (work within the EZ or CRZ) shall have completed the 40-hour training requirement and meet the medical surveillance requirements found in Section 7.1. Subcontractor training shall be performed in accordance with 29 CFR 1910.120 and HASP specifications. In certain unique situations (e.g., mechanical failure of equipment), the non-trained individual performing emergency repairs may be allowed, at the discretion of the SHSO, to perform repairs within the EZ when no intrusive activities are being performed and provisions have been made to mitigate potential exposure.

Visitors onsite must be made aware of the hazards onsite in a Site-specific safety briefing and sign a statement indicating that they will comply with the applicable requirements of this HASP.

7.0 MEDICAL SURVEILLANCE PROCEDURES

This section provides a description of the medical surveillance procedures required for all Site workers involved with remediation or other intrusive work.

7.1 General

A Medical Surveillance Program has been established as part of this plan and is included in Appendix F. The remediation contractor and subcontractor personnel performing remediation work at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120(f) and 1926.62 CFR. A physician's medical release for work will be confirmed by the SHSO before an employee can begin Site activities. Such examinations shall include a statement as to the worker's present health status, the ability to work in a hazardous environment (including any required PPE, which may be used during temperature extremes), and the worker's ability to wear respiratory protection.

Table 1, "Medical Data Sheet/Field Team Review," will be completed by all permanent, onsite personnel and will be kept in the administrative trailer during the conduct of Site operations. Completion is required in addition to compliance with the remediation contractor's Health and Safety Program. This data sheet will accompany any personnel when medical assistance is needed or if transport to hospital facilities is required.

8.0 SITE CONTROL, PERSONAL PROTECTIVE EQUIPMENT, AND COMMUNICATIONS

This section provides a detailed description of the Site control measures, personal protective equipment and communications procedures to be implemented at the Site.

8.1 Site Control

Based on the Site history and field-testing, hazardous material may exist onsite. A four-zone approach will be employed in order to prevent the spread of contamination from the disturbed areas onsite and to protect non-remediation (non-trained) workers from exposure to hazardous materials. The four-zones include the EZ, the CRZ, the Remediated Zone (RZ) and the Support Zone (SZ). A stepped remedial approach will be managed and the zones modified as the work progresses. Each of the areas will be defined through the use of control barricades and/or construction/hazard fencing. A clearly marked delineation between the zones will be maintained. Signage will be posted to further identify and delineate these areas.

8.1.1 Exclusion Zone

All areas where excavation and handling of contaminated materials take place are considered the EZ. This zone will be clearly delineated by hay bales or construction fence. Safety tape may be used as a secondary delineation within the EZ. The zone delineation markings may be opened in areas for varying lengths of time to accommodate equipment operation or specific construction activities. The SHSO may establish more than one EZ where different levels of protection may be employed or where different hazards exist. Personnel are not allowed in the EZ without:

- A buddy (co-worker).
- Appropriate PPE,
- Medical authorization, and
- Training certification.

Occasional visitors within this area of the Site are addressed in Sections 1.0 and 6.9.

8.1.2 Contamination Reduction Zone

A CRZ is established between the EZ and the SZ. The CRZ contains the Contamination Reduction Corridor (CRC) and provides an area for decontamination of personnel and equipment. The CRZ

will be used for general Site entry and egress, in addition to access for heavy equipment and emergency support services. Personnel are not allowed in the CRZ without:

- A buddy (co-worker),
- Appropriate PPE,
- Medical authorization, and
- Training certification.

Occasional visitors within this area of the Site are addressed in Sections 1.0 and 6.9.

8.1.3 Remediated Zone

A Remediated Zone (RZ) is established in portions of the Site where the remediation has been completed and only general construction work remains to be performed. Setup of the RZ consists of implementing several measures designed to reduce the risk of workers' exposure and prevent non-trained workers from entering the non-remediated zone. Non-trained workers will work only in areas where the potential for exposure has been minimized by installing a 3-inch concrete slab (mud mat), a minimum 6 mil vapor barrier, and/or the installation of a minimum six inches of clean fill over any potentially impacted soils in the RZ. The remediated zone will then be separated from the non-remediated zone by installing and maintaining temporary plywood or other construction fences along the boundary between the two zones. If potentially impacted material is uncovered in the RZ, all non-trained workers will be removed and the SHSO will assess the potential risks. If, at any other time the risk of exposure increases while non-trained workers are present in the RZ, the non-trained workers will be removed. At all times, when non-trained workers are present in the RZ, air monitoring for the presence of VOCs will be conducted in the RZ, as well as at the fence line of the non-remediated zone.

8.1.4 Support Zone

The SZ is an uncontaminated area that will be the field support area for Site operations. The SZ will contain the temporary office trailers and provides for field team communications and staging for emergency response. Appropriate sanitary facilities and safety equipment will be located in this zone. Potentially contaminated personnel or materials are not allowed in this zone. The only exception will be appropriately packaged/decontaminated and labeled samples. Meteorological

conditions will be observed and noted from this zone, as well as those factors pertinent to heat and cold stress.

8.2 Personal Protective Equipment

Provided below is a description of the basic PPE requirements for onsite workers.

8.2.1 General

The level of protection worn by field personnel will be enforced by the SHSO. Levels of protection for general operations are provided below and are defined in this section. Levels of protection may be upgraded at the discretion of the SHSO. All decisions on the level of protection will be based upon a conservative interpretation by the SHSO of the information provided by air monitoring results, environmental results, and other appropriate information. Any changes in the level of protection shall be recorded in the health and safety field logbook.

8.2.2 Personal Protective Equipment Specifications

Although not anticipated, any tasks requiring Level B PPE will utilize the following equipment:

- Positive-pressure, full-facepiece, self-contained breathing apparatus (SCBA) or positive-pressure, supplied air respirator with escape SCBA (NIOSH approved)
- Disposable coveralls (Tyvek, Poly-coated Tyvek or Saranex)
- Gloves, inner: latex or nitrile
- Gloves, outer: nitrile or neoprene
- Chemical resistant boots over the work boots.
- Steel- toed, steel-shanked work boots
- Hard hat
- Hearing protection (as needed)
- Boot covers (as needed)

For tasks requiring Level C PPE, the following equipment may be used in any combination:

- Full-face, air-purifying, canister-equipped respirators (NIOSH approved) utilizing Organic Vapor/Acid Gas and P-100 filters (half-face if approved by the SHSO)
- Disposable coveralls (Tyvek, Poly-coated Tyvek or Saranex) as required

- Gloves, inner: latex or nitrile as required
- Gloves, outer: nitrile or neoprene as required
- Chemical resistant boots over the work boots as required
- Steel- toed, steel-shanked work boots
- Hard hat
- Hearing protection (as needed)
- Safety glasses (if half-mask is utilized)
- Boot covers (as needed)

The Minimum level of PPE for entry onto the Site is Level D PPE. The following equipment shall be used:

- Work uniform (long pants, sleeved shirt)
- Hard hat
- Steel- toed, steel-shanked work boots
- Safety glasses
- Boot covers (as needed)
- Hearing protection (as needed)
- Reflective safety vest

Modified Level D PPE consists of the following:

- Regular Tyvek coveralls (Poly-coated Tyvek as required)
- Outer gloves: leather, cotton, neoprene or nitrile (as required)
- Inner gloves: latex or nitrile (doubled) as required
- Chemical resistant boots over work boots (as required)
- Steel-toed, steel-shanked work boots
- Hard hat
- Safety glasses

- Hearing protection as needed
- Reflective safety vest

8.2.3 Initial Levels of Protection

Levels of protection for the proposed scope of work may be upgraded or downgraded depending on direct-reading instruments or personnel monitoring. The following are the initial levels of protection that shall be used for each planned field activity:

Activity	Initial level of PPE
Mobilization/Demobilization	D
Decontamination/Dewatering	D
Excavation	D/C (Based on Monitoring)
Sheeting/Shoring	D
Asphalt and Concrete Work	D
Earthwork	D
Site Restoration	D

8.3 Communications

While working in level C/B respiratory protection, personnel may find that communication becomes more difficult to accomplish. Distance and space further complicate this. In order to address this problem, electronic instruments, mechanical devices, or hand signals will be used as follows:

Telephones – Mobile telephones will be carried by designated personnel for communication with emergency support services/facilities. Separate hard-wired telephone lines will be established in the field office trailers.

Radios – Two-way radios will be utilized onsite for communication between field personnel in areas where visual contact cannot be maintained and where hand signals cannot be employed.

Air Horn – Available as posted in the Site trailer. An additional air horn will be located in the SZ to alert field personnel to an emergency situation. The emergency signal will be the sharp blasts of the air horn.

Hand Signals – This communication method will be employed by members of the field team, along with use of the buddy system. Signals become especially important when in the vicinity of heavy moving equipment and when using Level B respiratory equipment. The signals shall become familiar to the entire field team before Site operations commence and will be reinforced and reviewed during site-specific training.

Signal:	**Meaning:**
Hand gripping throat	Out of air; can't breathe
Grip partner's wrist	Leave area immediately; no debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm all right; I understand
Thumbs down	No; Unable to understand you, I'm not all right

9.0 MONITORING PROCEDURES

This section provided as description of the monitoring procedures that will be implemented while performing the remediation and foundation construction activities at the Site.

9.1 General

Ambient air monitoring will be conducted in the various work areas by the remediation contractor during all intrusive tasks, or as mandated by the SHSO. Monitoring will be performed to verify the adequacy of respiratory protection, to aid in Site layout, and to document worker exposure. If air monitoring in these areas indicates the presence of potentially hazardous materials, control measures will be implemented in accordance with the remediation contractor's work plans. All monitoring instruments shall be operated by qualified personnel only and will be calibrated daily prior to use or more often, as necessary. No intrusive activity will be performed without the presence of the SHSO or designated approved substitute, and without air monitoring. When a "remediated zone" has been established, additional monitoring will be conducted within this area to prevent non-trained workers from exposure to any hazardous materials that could potentially migrate from within the EZ. Air monitoring will be performed in conjunction with the OSHA 29 CFR1926.62 lead in construction air monitoring protocols.

9.2 Exclusion Zone Monitoring

9.2.1 Instrumentation

The following monitoring instruments supplied by the remediation contractor will be available for use during field operations as necessary. There will be a minimum of one of each piece of equipment on the Site at all times:

- Photoionization Detector (PID): with 10.6 EV probe or equivalent.
- Multi-Gas Meter: Combustible Gas Indicator (CGI)/Oxygen (O_2)/Hydrogen Sulfide (H_2S)/Carbon Monoxide (CO) Meter, (e.g., MSA Trimeter) – for Confined Space Entry, or when the SHSO deems necessary.
- Dust/Particulate Monitor (DM): DR4000 or equivalent.

A PID shall be used to monitor VOCs in active work areas, during intrusive activities. VOCs shall also be measured upwind of the work areas to determine background concentrations.

A CGI/O2 meter shall be used to monitor for combustible gases and oxygen content during confined space entry or when the HSO deems necessary.

A particulate monitor shall be used to measure concentrations of dust and particulate matter.

Calibration records shall be documented and recorded daily and included in the daily air monitoring report. This report will be specific to work area monitoring. All instruments shall be calibrated before and after each daily use in accordance with the manufacturer's procedures.

9.2.2 Action Levels

Action levels for the upgrading of PPE requirements in the HASP will apply to all Site work during remediation and foundation construction activities at the Site. Action levels are for known contaminants using direct reading instruments in the Breathing Zone (BZ) for VOCs and particulates, and at the source for combustible gases. The BZ will be determined by the SHSO, but is typically 4 to 5 feet above the work area surface or elevation.

An air horn will be readily available in the Site trailer. An additional air horn will be located in the work area to alert Site Workers to an emergency situation. In the event of an emergency or the need to upgrade the level of personal protection, sharp blasts of the air horn will be sounded.

If the level of respiratory protection needs to be upgraded, the Contractor will immediately contact the Construction Manager and Owner's Representative.

9.2.3 Monitoring During Field Activities

Intrusive Operations – Continuous Personnel Breathing Zone Air Monitoring will be performed by the SHSO during implementation of all intrusive activities at the Site. The highest reading will be recorded on the daily air-monitoring log every 30 minutes during intrusive activities. Real-time monitoring for all onsite activities will be accomplished as follows (prior to the start of daily activities an upwind background reading will be taken and recorded):

- Monitoring of VOCs in and around the work zones.
- Monitoring for particulates in and around the work zones.

The frequency of monitoring may be modified by the SHSO after consultation with the Project Manager. The rationale for any modification must be documented in the HASP.

A PID and/or flame ionization detector (FID) equipped organic vapor meter will be utilized to monitor the BZ.

Excavation/Confined Space Operations – Monitoring will be performed during all excavations. A PID and/or FID and a DM shall be utilized to monitor the breathing zone when in the area being excavated. A CGI/O_2 meter shall be used to monitor the confined space for the presence of combustible gases/oxygen deficiency, CO, and H_2S.

9.3 Meteorological Monitoring

The remediation contractor will obtain at a minimum, the daily temperature, wind direction, wind speed and rain accumulations from the onsite meteorological station. This information will be used to assist with the determination of daily health and safety measures, and locations of both work zone and perimeter monitoring devices. All meteorological data will be kept in a daily record.

10.0 SAFETY CONSIDERATIONS

This section provides a detailed description of the general Site safety considerations as well as the safety procedures for certain specific activities.

10.1 General

In addition to the specific requirements of this HASP, common sense should be used at all times.

The following general safety rules and practices will be in effect at the Site.

- Signs will be posted around the perimeter of the Site (STATING: RESTRICTED AREA – AUTHORIZED PERSONNEL ONLY). In addition, hay bales will be utilized to delineate the work zones. Caution tape may be used for secondary marking or delineation. These items will restrict/control unauthorized visitors, but not hinder emergency services if needed.

- All open excavations, trenches, and obstacles will be properly barricaded in accordance with Site needs and requirements. Proximity to traffic ways, both pedestrian and vehicular, and location of the open excavation, trench, or obstacle will determine these needs.

- All excavation and other Site work will be planned and performed with consideration for underground utilities.

- Smoking and ignition sources in the vicinity of potentially flammable or contaminated material are strictly prohibited.

- Drilling, boring, and use of cranes and drilling rigs, erection of towers, movement of vehicles and equipment, and other activities will be planned and performed with consideration for the location, height, and relative position of aboveground utilities and fixtures, including signs, lights, canopies, buildings and other structures and construction, and natural features such as trees, boulders, bodies of water, and terrain.

- When working in areas where flammable vapors may be present, particular care shall be exercised with tools and equipment that may be sources of ignition. All tools and equipment provided must be properly bonded and/or grounded.

- Approved and appropriate safety equipment (as specified in this HASP), such as eye protection, hard hats, foot protection, and respirators, must be worn in areas where required. In addition, eye protection must be worn when sampling soil or water that may be contaminated.

- All site personnel may be called upon to use respirator protection in some situations. Fit testing will be necessary for all persons using respirators. The criteria for facial hair will be determined by the SHSO. In general, the guideline is that facial hair cannot impede the fit of the respirator.

- No smoking, eating, chewing tobacco, gum chewing, applying cosmetics or drinking will be allowed outside the SZ.

- Contaminated tools and hands must be kept away from the face.
- Personnel must use personal hygiene safe guards (washing up) prior to eating and drinking and at the end of the shift.
- All soil or groundwater samples collected from the Site must be treated and handled as though the samples are contaminated.
- Persons with long hair and/or loose-fitting clothing that could become entangled in power equipment must take adequate precautions.
- Horseplay is prohibited in the work area.
- Work while under the influence of intoxicants, narcotics, or controlled substances is strictly prohibited.

10.2 Posted Signs

Danger signs will be posted where an immediate hazard exists. Caution signs will be posted to warn against potential hazards and to caution against unsafe practices. Traffic control methods and barricades will be used as needed. Wooden stakes and flagging tape or equally effective material will be used to demarcate all restricted areas.

10.3 Intrusive Operations

The SHSO will be present during all intrusive work activities. Intrusive work is defined as any work being conducted in an area of known contamination that may disturb the impacted material and/or expose the worker to the contaminants. He/she will ensure that appropriate monitoring, levels of protection, and safety procedures are followed. All personnel will keep a safe distance from the edge of the excavation and out of the swing radius of the excavation equipment.

The proximity of water, sewer, electrical lines, and other subsurface utilities will be identified prior to intrusive operations. Properly sized containment systems will be utilized and consideration of the potential volume of liquid or waste disposed during Site operations will be discussed with the Project Manager to minimize the quantity of stored aqueous materials. Emergency evacuation procedures and the location of safety equipment will be established prior to start-up operations. The use of protective clothing, especially hard hats, boots, and gloves will be mandatory during excavation and other heavy equipment work.

10.4 Dewatering Sampling

Sampling personnel must wear prescribed protective clothing and equipment including eye protection, chemical resistant gloves and splash aprons (where appropriate) when sampling soils and liquids. Sample bottles are to be labeled prior to sampling to ease decontamination. Personnel must be aware of the location of emergency equipment, including spill containment materials prior to sampling. Personnel are to practice contamination avoidance at all times, as well as to utilize the buddy system and maintain communications with the SHSO.

10.5 Sample Handling

Personnel responsible for handling of samples will wear the prescribed level of protection. Samples are to be identified as to their hazard and packaged as to prevent spillage or breakage. Any unusual sample conditions shall be noted. Laboratory personnel and all field personnel shall be advised of sample hazard levels and the potential contaminants present. This can be accomplished by a phone call to the lab coordinator and/or including a written statement with the samples reviewing lab safety procedures in handling in order to assure that the practices are appropriate for the suspected contaminants in the sample.

10.6 Heavy Equipment Decontamination

Equipment will be dry decontaminated in the EZ first. This shall consist of the gross removal of the contaminated material from the augers, buckets, wheels, blades, etc., using hand tools. If wet decontamination is required, the equipment will be taken to the designated decontamination pad. Personnel performing the decontamination of equipment shall use the prescribed level of protection. Initially, this task usually employs modified Level D as described in Section 8.2.2. The equipment decontamination shall be restricted to authorized personnel only. Special consideration will be given to wind speed and direction. Downwind areas are to be kept free of personnel to avoid unnecessary exposure to potential airborne contamination.

11.0 DECONTAMINATION AND DISPOSAL PROCEDURES

This section details the specific decontamination and waste disposal procedures to be implemented at the Site during the remediation/foundation construction phase.

11.1 Contamination Prevention

Contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include:

Personnel

- Do not walk through areas of obvious or known contamination.
- Do not directly handle or touch contaminated materials.
- Make sure that there are no cuts, or tears or other signs of damage to PPE.
- Fasten all closures in suits; cover with tape, if necessary.
- Particular care should be taken to protect any skin injuries.
- Stay upwind of airborne contaminants.
- Do not carry cigarettes, cosmetics, gum, etc., into contaminated areas.

Sampling/Monitoring

- When required by the SHSO, cover instruments with clear plastic, leaving openings for sampling ports.
- Bag sample containers prior to emplacement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of potentially impacted material that comes in contact with heavy equipment (e.g., tires, augers).
- If contaminated tools are to be placed on non-contaminated equipment for transport to a decontamination area, plastic should be used to keep the equipment clean.
- Dust control measures, including water misting, will be used on roads inside the Site boundaries, as described in the remediation contractor's work plans.

11.2 Personnel Decontamination

All personnel shall pass through an outlined decontamination procedure when exiting the EZ at each location. The procedure is outlined in Appendix E. A field wash for equipment and PPE shall be set up and maintained for all persons exiting the EZ. The system will include a wash and rinse for all disposable clothing and boots worn in the EZ. As necessary, equipment and facilities will be available for personnel to wash their hands, arms, neck and face before entering the SZ.

11.3 Equipment Decontamination

All potentially contaminated equipment used at the Site will be decontaminated to prevent contaminants from leaving the Site. Heavy equipment will be decontaminated at the decontamination pad and inspected by the SHSO or designated individual before it leaves the Site. A certificate of decontamination will be issued for each piece of equipment that has been inspected before it leaves the Site. The decontamination area will provide for the containment of all wastewater from the decontamination process. Respirators, airline and any other PPE that comes in contact with contaminated materials shall pass through a field wash on the decontamination pad and a final, thorough decontamination at the end of the day. All decontamination rinse water will be collected and managed in accordance with the Technical Specifications.

11.4 Decontamination During Medical Emergencies

If emergency life-saving first aid and/or medical treatment are required, normal decontamination procedures may need to be abbreviated or omitted. The Site SHSO or designee will accompany contaminated victims to the medical facility to advise on matters involving decontamination, when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment, or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed, a plastic barrier between the individual and clean surfaces should be used to help prevent contaminating the inside of ambulances and/or medical personnel. Outer garments are then removed at the medical facility. No attempt will be made to wash or rinse the victim, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material, which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems (ambulatory) or injuries, the normal decontamination procedures will be followed. Note that heat stroke requires prompt treatment to prevent irreversible damage or death. Protective clothing must

be promptly removed. Less serious forms of heat stress also require prompt attention and removal of protective clothing immediately. Unless the victim is obviously contaminated, decontamination should be omitted or minimized and treatment begun immediately.

11.5 Disposal Procedures

A system of segregating all waste will be developed by the SHSO.

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. All potentially contaminated materials (e.g., clothing, gloves, etc.) will be bagged or drummed as necessary, labeled and segregated for disposal. All non-contaminated materials shall be collected and bagged for appropriate disposal as domestic waste.

All excavated soils will be stabilized, as necessary for moisture control, and direct loaded to transport vehicles for immediate offsite disposal at an Owner-approved permitted waste treatment/disposal facility. All transport vehicles will be properly decontaminated prior to departing the Site.

All encountered construction water, storm water and decontamination water will be collected and managed in accordance with the Technical Specifications.

12.0 EMERGENCY PLAN

Should an emergency occur, the emergency plan, outlined in this section, will be understood by the remediation contractor and all subcontractors prior to the start of work. The emergency plan will be available for use at all times during Site work. The plan provides the phone numbers for the fire, police, ambulance, hospital, poison control centers and directions to the hospital from the Site. This information is to be found in Section 1.2 of the HASP and shall be conspicuously posted in the job's construction Site trailer.

Various individual Site characteristics will determine preliminary actions taken to assure that this emergency plan is successfully implemented in the event of a Site emergency. Careful consideration must be given to the proximity of neighborhood housing or places of employment and to the relative possibility of Site release of vapors that could affect the surrounding community.

The emergency coordinator/project manager shall make contact with local fire, police, and other emergency units prior to beginning work onsite. In these contacts, the emergency coordinator will inform the emergency units about the nature and duration of work expected to the Site and the type of contaminants and possible health or safety effects of emergencies involving these contaminants. At this time, the emergency coordinator and the emergency response units shall make necessary arrangements to be prepared for any emergencies that could occur.

The emergency coordinator shall implement the contingency plan whenever conditions at the Site warrant such action. The coordinator will be responsible for coordination of the evacuation, emergency treatment and transport of Site personnel as necessary, and notification of emergency response units and the appropriate management staff.

In cases where the project manager is not available, the SHSO shall serve as the alternate emergency coordinator.

The SHSO, during an emergency, will perform air monitoring as needed, as well as lend assistance and provide health and safety information to responding emergency personnel.

Site Personnel will endeavor to keep non-essential personnel away from the incident until the appropriate emergency resources arrive. At that time, the responders will take control of the Site. Site personnel may be asked to lend assistance to emergency personnel such as during evacuations, help with the injured, etc.

12.1 Evacuation

Evacuation procedures will be discussed prior to the start of work and periodically during safety meetings. In the event of an emergency situation such as fire, or explosion, an air horn or other appropriate device will be sounded for three (3) sharp blasts indicating the initiation of evacuation procedures. The emergency evacuation route shall be clearly posted in the crew, contractor's, and all other office trailers. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The SHSO or project manager must ensure that access for emergency equipment is provided and that all combustion apparatuses have been shut down once the alarm has been sounded. All Site personnel will assemble in the CSC, or nearest safe location. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency.

12.2 Personnel Injury

Emergency first aid shall be applied onsite as appropriate. If necessary, the individual shall be decontaminated and transported to the nearest hospital. The SHSO will supply medical data sheets to medical personnel and complete the accident/incident reports in accordance with Section 13.5 of the HASP.

The ambulance/rescue squad shall be contacted for transport as necessary in an emergency. However, since some situations may require transport of an injured party by other means, the injured person shall be escorted to the hospital. A map to this facility is shown in Figure 1.

12.3 Accident/Incident Reporting

As soon as first aid and/or emergency response needs have been met, the following parties are to be contacted by telephone:

	Office	Cell
General Superintendent	TBD	
Safety Supervisor	TBD	
Site Safety Officer	TBD	
Owners Representative	TBD	
Owner's Onsite Representative	TBD	

Written confirmation of verbal reports are to be submitted within 24 hours. The report form entitled "Accident Investigation Report" (Appendix J) is to be used for this purpose. All representatives contacted by telephone are to receive a copy of this report. If the employee involved is not an employee of the remedial contractor, his employer shall receive a copy of the report.

For reporting purposes, the term accident refers to fatalities, lost-time injuries, restricted duty, medical treatment, spill, or exposure to hazardous materials (radioactive materials, toxic materials, explosive or flammable materials), fire, explosion, property damage, or potential occurrence of the above.

Any information released from the health care provider, which is not deemed confidential patient information, is to be attached to the appropriate form. Any medical information, which is released by patient consent, is to be filed in the individual's medical record and treated as confidential.

12.3 Personnel Exposure

Skin and Eye Contact:	Use copious amounts of soap and water. Wash/rinse affected area thoroughly, and then provide appropriate medical attention. Eyes should be rinsed for 15 minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or, if necessary, decontaminate/transport to hospital.
Ingestion:	Decontamination and transport to emergency medical facility.
Puncture Wound or Laceration:	Decontamination and transport to emergency medical facility.

12.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project manager will determine if work can continue without sacrificing the health and safety of all field workers. Some of the items to be considered prior to determining if work should continue are:

- Potential for heat stress and heat-related injuries;
- Potential for cold stress and cold-related injuries;
- Treacherous weather-related conditions;
- Limited visibility and;
- Electrical storm potential.

Site activities will be limited to daylight hours and acceptable weather conditions. Inclement working conditions include heavy rain, fog, high winds, and lightning. Observe daily weather reports and evacuate if necessary in case of inclement weather conditions.

13.0 LOGS, REPORTS AND RECORD KEEPING

The following is a summary of required health and safety logs, reports, and record keeping for this project.

13.1 Daily Operations Log

A daily operations log shall be completed by the SHSO and reviewed by the project manager, with a copy provided to the owner's onsite representative. The original will be kept in the project file. See Appendix I.

13.2 Medical And Training Records

The employer keeps medical and training records. The subcontractor employer must provide verification of training and medical qualifications to the SHSO. The SHSO will keep a log of personnel meeting appropriate training and medical qualifications for Site work. The log will be kept in the project file. The remediation contractor will maintain medical records in accordance with 29 CFR 1910.20.

13.3 Onsite Log

The SHSO or project manager will keep a log of onsite personnel daily. A copy of these logs will be given to the Project Coordinator and owner's onsite representative upon request. Originals will be kept in the project file.

13.4 Exposure Records

Any personal monitoring results, laboratory reports, calculations, and air sampling data sheets are part of an employee exposure record. These records will be kept by the remediation contractor in accordance with 29 CFR 1910.20 and 29 CFR 1926.62.

13.5 Accident/Incident Reports

An accident/incident report must be completed following procedures given in Appendix J. The originals will be sent to the remediation contractor for maintenance. Copies will be distributed as stated. A copy of all completed forms will be kept in the project file.

13.6 OSHA Form 300

An OSHA Form 300 (Log of Occupational Injuries and Illnesses) will be kept at the Site. All reportable injuries or illnesses will be recorded on this form. At the end of the project, the original will be sent to the owner's representative for maintenance. Subcontractor employers must also meet the requirements of maintaining an OSHA 300 form for their company. An OSHA informational poster is provided as Appendix L.

13.7 Training Logs

The Training Logs will be completed by the SHSO and submitted to the project manager prior to allowing personnel onsite.

13.8 Daily Safety Logs

The Daily Safety Log form in Appendix H will be completed daily by the SHSO and submitted to the project manager and owner's onsite representative.

13.9 Air Monitoring Log

The Air Monitoring Log form in Appendix I will be completed by the SHSO and submitted to the Project Construction Supervisor or project manager and owner's onsite representative.

13.10 Weekly Safety Reports

The Weekly Safety Reports will be completed by the SHSO and submitted to the owner's onsite representative.

13.11 Close-Out Safety Report

At the completion of the work, the remediation contractor will submit a closeout Safety Report that will include all logs and reports generated during the project. The report will be signed and dated by the SHSO and submitted to the Safety Manager and/or owner's onsite representative.

14.0 SANITATION AT TEMPORARY WORK STATIONS

Provisions shall be made for access to portable sanitary systems. Provisions are required for the removal of accumulated waste products within those units.

If a commercial/industrial laundry is used to clean or laundered clothing that is potentially contaminated, they shall be informed of the potential harmful effects of exposure to hazardous substances related to the affected clothing.

Personnel and subcontractors assigned to the Site shall follow decontamination procedures described in the HASP or as directed by the SHSO. This will generally include, at a minimum, Site-specific training in cleanup, personal hygiene requirements, and the donning/doffing of protective equipment/clothing.

15.0 FIELD TEAM REVIEW

Each Site worker shall sign this section after Site-specific training is completed and before being permitted to work at the Site.

Site/Project: 26-40 1st Avenue
Astoria, New York 11102

Date	Name	Signature	Company

SHSO CERTIFICATION OF HOSPITAL DIRECTIONS

Name of SHSO:

Date:

This is to certify that on_____, I personally drove the route to Mount Sinai Queens Hospital as listed in the HASP. The Map Routing and Directions were/were not as listed in the plan. Listed below were conditions that resulted in different directions.

TBD
Site Health and Safety Officer

_____

16.0 APPROVALS

By their signature, the undersigned certify that this Construction Health and Safety Plan (HASP) is approved and will be utilized at the project Site located at 26-40 1st Avenue, Astoria, New York 11102.

General Superintendent	Date
Site Superintendent	Date
Assistant Site Superintendent	Date
Corporate Safety Supervisor	Date
Site Health and Safety Officer	Date

TABLE

1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at the Site

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,1,1-Trichloroethane	71-55-6	TWA 350 ppm STEL 440 ppm C 440 ppm	C 350 ppm (1900 mg/m^3) [15-minute]	TWA 350 ppm (1900 mg/m^3)	700 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, lassitude (weakness, exhaustion), central nervous system depression, poor equilibrium; dermatitis; cardiac arrhythmias;	Eyes, skin, central nervous system, cardiovascular system, liver	Colorless liquid with a mild, chloroform-like odor. BP: 165°F UEL: 12.5% LEL: 7.5%
1,1,2-Trichloroethane	79-00-5	TWA 10 ppm	Ca TWA 10 ppm (45 mg/m^3) [skin]	TWA 10 ppm (45 mg/m^3) [skin]	Ca [100 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; central nervous system depression; liver, kidney damage; dermatitis; [potential occupational carcinogen]	Eyes, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, chloroform-like odor. BP: 237°F UEL: 15.5% LEL: 6%
1,1-Dichloroethane	75-34-3	TWA 100 ppm	TWA 100 ppm (400 mg/m^3)	TWA 100 ppm (400 mg/m^3)	3000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation skin; central nervous system depression; liver, kidney, lung damage	Skin, liver, kidneys, lungs, central nervous system	Colorless, oily liquid with a chloroform-like odor. BP: 135°F Fl.P: 2°F UEL: 11.4% LEL: 5.4%
1,1-Dichloroethene	75-35-4	TWA 5 ppm	Ca (lowest feasible concentration)	TWA 1ppm	Ca [N.D.]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, throat; dizziness, headache, nausea, dyspnea (breathing difficulty); liver, kidney disturbance; pneumonitis; [potential occupational carcinogen]	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid or gas (above 89°F) with a mild, sweet, chloroform-like odor. BP: 89°F Fl.P: -2°F UEL: 15.5% LEL: 6.5% Class IA Flammable Liquid
1,2,4-Trimethylbenzene	95-63-6	None established	TWA 25 ppm (125mg/m^3)	None established	N.D.	Inhalation; ingestion; skin and/or eye contact	Eye, skin, nose, and throat, resp syst irritation; bronchitis; hypochromic anemia; headache, drowsiness, weakness, dizziness, nausea, incoordination, vomit, confusion; chemical pneumonitis	Eyes, skin, resp sys, CNS, blood	Clear, colorless liquid with a distinctive, aromatic odor BP: 337°F FL.P: 112°F UEL: 6.4% LEL: 0.9% Class II Flammable liquid
1,2,4-Trimethylbenzene	95-63-6	TWA 25 ppm (125 mg	TWA 25 ppm (125 mg/m^3)	None established	N.D.	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, fatigue, dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system, blood	Clear, colorless liquid with a distinctive, aromatic odor. BP: 337°F Fl.P: 112°F UEL: 6.4% LEL: 0.9% Class II Flammable Liquid
1,2-Dichlorobenzene	95-50-1	TWA 25 ppm STEL 50 ppm	C 50 ppm (300 mg/m^3)	C 50 ppm (300 mg/m^3)	200 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; liver, kidney damage; skin blisters	Eyes, skin, respiratory system, liver, kidneys	Colorless to pale-yellow liquid with a pleasant, aromatic odor. [herbicide] BP: 357°F Fl.P: 151°F UEL: 9.2% LEL: 2.2% Class IIIA Combustible Liquid
1,2-Dichloroethane	107-06-2	TWA 10 ppm	Ca TWA 1 ppm (4 mg/m^3) STEL 2 ppm (8 mg/m^3)	TWA 50 ppm C 100 ppm 200 ppm [5-minute maximum peak in any 3 hours]	Ca [50 ppm]	inhalation, ingestion, skin absorption, skin and/or eye contact	Irritation eyes, corneal opacity; central nervous system depression; nausea, vomiting; dermatitis; liver, kidney, cardiovascular system damage; [potential occupational carcinogen]	Eyes, skin, kidneys, liver, central nervous system, cardiovascular system	Colorless liquid with a pleasant, chloroform-like odor. [Note: Decomposes slowly, becomes acidic & darkens in color.] BP: 182°F Fl.P: 56°F UEL: 16% LEL: 6.2% Class IB Flammable Liquid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
1,2-Dichloroethene (total)	540-59-0	TWA 200 ppm (790 m	TWA 200 ppm (790 mg/m^3)	TWA 200 ppm (790 mg/m^3)	1000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; central nervous system depression	Eyes, respiratory system, central nervous system	Colorless liquid (usually a mixture of the cis & trans isomers) with a slightly acrid, chloroform-like odor BP: 118-140°F Fl.P: 36-39°F UEL: 12.8% LEL: 5.6% Class IB Flammable Liquid
1,3,5-Trimethylbenzene	108-67-8	None established	TWA 25 ppm (125mg/m^3)	None established	N.D.	Inhalation; ingestion; skin and/or eye contact	Eye, skin, nose, and throat, resp syst irritation; bronchitis; hypochromic anemia; headache, drowsiness, weakness, dizziness, nausea, incoordination, vomit, confusion; chemical pneumonitis	Eyes, skin, resp sys, CNS, blood	Clear, colorless liquid with a distinctive, aromatic odor BP: 329°F FL.P: 122°F Class II Flammable liquid
1,3,5-Trimethylbenzene	108-67-8	TWA 25 ppm (125 mg	TWA 25 ppm (125 mg/m^3)	None established	N.D	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system, blood	Clear, colorless liquid with a distinctive, aromatic odor. BP: 329°F Fl.P: 122°F Class II Flammable Liquid
1,4-Dichlorobenzene	106-46-7	TWA 10 ppm	Ca	TWA 75 ppm (450 mg/m^3)	Ca [150 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Eye irritation, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Liver, respiratory system, eyes, kidneys, skin	Colorless or white crystalline solid with a mothball-like odor. [insecticide] BP: 345°F Fl.P: 150°F LEL: 2.5% Combustible Solid
2,4-Dimethylphenol	105-67-9	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system, mouth, throat, stomach; dizziness, weakness, fatigue, nausea, headache; systemic damage; moderate to severe eye injury.	Skin, CVS, eyes, CNS	Clear, colorless liquid with a faint ether or chloroform-like odor BP: 178°F
2-Butanone (MEK)	78-93-3	TWA 200 ppm (590 mg/m^3) STEL 300 ppm (885 mg/m^3)	TWA 200 ppm (590 mg/m^3) STEL 300 ppm (885 mg/m^3)	TWA 200 ppm (590 mg/m^3)	3000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a moderately sharp, fragrant, mint- or acetone-like odor. BP: 175°F Fl.P: 16°F UEL(200°F): 11.4% LEL(200°F): 1.4% Class IB Flammable Liquid
Acenaphthene	83-32-9	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Brown solid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Acetone	67-64-1	TWA 200 ppm STEL 500 ppm	TWA 250 ppm (590 mg/m^3)	TWA 1000 ppm (2400 mg/m^3)	2500 ppm [10%LEL]	inhalation, ingestion, skin and/or eye contact	Irritation eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a fragrant, mint-like odor BP: 133°F Fl.P: 0°F UEL: 12.8% LEL: 2.5% Class IB Flammable Liquid
Anthracene	65996-93-2	TWA 0.2 mg/m^3	Ca TWA 0.1 mg/m^3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m^3 (benzene-soluble fraction)	Ca [80 mg/m^3]	inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids
Antimony	7440-36-0	TWA 0.5 mg/m^3	TWA 0.5 mg/m^3	TWA 0.5 mg/m^3	50 mg/m^3 (as Sb	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, mouth; cough; dizziness; headache; nausea, vomiting, diarrhea; stomach cramps; insomnia; anorexia; unable to smell properly	Eyes, skin, respiratory system, cardiovascular system	Silver-white, lustrous, hard, brittle solid; scale-like crystals; or a dark-gray, lustrous powder. BP: 2975°F
Arsenic (inorganic)	7440-38-2 (metal)	TWA 0.01 mg/m3	Ca C 0.002 mg/m3 [15-min]	TWA 0.010 mg/m3	Ca [5 mg/m3 (as As)]	Inhalation; ingestion; skin absorption; skin and/or eye contact	Ulceration of nasal septum, dermatitis, GI disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]	Liver, kidneys, skin, lungs, lymphatic sys	Metal: sliver-gray or tin-white, brittle, odorless solid BP: sublimes
Asbestos	1332-21-4	TWA 0.1 f/cc	Ca 100,000 fibers/m3	TWA 0.1 fiber/cm3	Ca [IDLH value has not been determined]	Inhalation; ingestion; skin and/or eye contact	Asbestosis (chronic exposure), dyspnea, interstitial fibrosis, restricted pulmonary function, finger clubbing, irritation eyes, [potential occupational carcinogen]	Respiratory system, eyes,	White or greenish (chrysotile), blue (crocidolite), or gray-green (amosite), fibrous, odorless solids. BP: decomposes
Asphalt fumes	8052-42-4	TWA 0.5 mg/m^3(fumes)	Ca C 5 mg/m3 [15 min]	None established	Ca [IDLH value has not been determined]	Skin absorption; inhalation; skin and/or eye contact	Irritation eyes, resp sys	Eyes, respiratory system	Black or dark brown cement-like substance Combustible solid
Barium	7440-39-3	TWA 0.5 mg/m3	None established	TWA 0.5 mg/m3	None established	Inhalation, ingestion, skin contact	Irritation skin, respiratory system, (	Skin, eyes, respiratory system	Yellow white powder BP: 1640 C
Benzene	71-43-2	TWA 0.5 ppm STEL 2.5 ppm	Ca TWA 0.1 ppm STEL 1 ppm	TWA 1 ppm STEL 5 ppm	Ca [500 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]	Eyes, skin, respiratory system, blood, central nervous system, bone marrow	Colorless to light yellow liquid with an aromatic odor [Note: Solid below 42 °F] BP: 176°F Fl.Pt = 12°F LEL: 1.2% UEL: 7.8% Class B Flammable liquid
Benzo[a]anthracene	56-55-3	None established	None established	None established	None established	Inhalation; ingestion; skin absorption; skin and/or eye contact	Irritation eyes, skin, respiratory system, CNS	Skin	Pale Yellow crystal, solid BP: 438 C

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Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Benzo[a]pyrene	50-32-8	None established	TWA 0.1 mg/m3	TWA 0.2 mg/m3	None established	Inhalation; ingestion; skin absorption; skin and/or eye contact	POISON. This material is an experimental carcinogen, mutagen, tumorigen, neoplastigen and teratogen. It is a probable carcinogen in humans and a known human mutagen. IARC Group 2A carcinogen. It is believed to cause bladder, skin and lung cancer. Exposure to it may damage the developing foetus. May cause reproductive damage. Skin, respiratory and eye irritant or burns.	Skin, eye, bladder, lung, reproductive	Yellow crystals or powder [found in cigarette smoke, coal tar, fuel exhaust gas and in many other sources] BP: 495 C
Benzo[b]fluoranthene	205-99-2	None established	TWA 0.1 mg/m3	TWA 0.2 mg/m3	None established	Inhalation; ingestion; skin and/or eye contact	No data were identified on the toxicity of benzo[b]fluoranthene to humans. Based on results of studies in animals, IARC concluded that benzo[b]fluoranthene is possibly carcinogenic to humans	Respiratory system, skin, bladder, kidneys	Off-white to tan powder
Benzo[k]fluoranthene	207-08-9	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory tract, gastrointestinal; fatal if swallowed, inhaled, absorbed through the skin; vomiting, nausea, diarrhea	Lungs, respiratory system	Yellow crystals BP: 480 C
Beryllium	7440-41-7 (metal)	TWA 0.002 mg/m^3	Ca C 0.0005 mg/m^3	TWA 0.002 mg/m^3 C 0.005 mg/m^3 (30 minutes) with a maximum peak of 0.025 mg/m^3	Ca [4 mg/m^3 (as Be)]	inhalation, skin and/or eye contact	Berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis; [potential occupational carcinogen]	Eyes, skin, respiratory system	Metal: A hard, brittle, gray-white solid. BP: 4532°F
Bis(2-ethylhexyl) phthalate	117-81-7	TWA 5 mg/m^3	TWA 5 mg/m^3 STEL 10 mg/m^3 (do not exceed during andy 15-minute work period)	TWA 5 mg/m^3	None established	inhalation, skin and/or eye contact	Irritation eyes, skin, nose, throat; affect the nervous system and liver; damage to male reproductive glands	Eyes, skin, nose, respiratory system, nervous system, reproductive system, liver	Colorless to light colored, thick liquid with slight odor
Butane	106-97-8	TWA 1000 ppm	TWA 800 ppm (1900 mg/m^3)	None established	None established	inhalation, skin and/or eye contact (liquid)	Drowsiness, narcosis, asphyxia; liquid: frostbite	central nervous system	Colorless gas with a gasoline-like or natural gas odor. BP: 31°F UEL: 8.4% LEL: 1.6% Flammable Gas
Cadmium	7440-43-9 (metal)	TWA 0.01 mg/m^3	Ca	TWA 0.005 mg/m^3	Ca [9 mg/m^3 (as Cd)]	inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	respiratory system, kidneys, prostate, blood	Metal: Silver-white, blue-tinged lustrous, odorless solid. BP: 1409°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Carbon Disulfide	75-15-0	TWA 1 ppm	TWA 1 ppm (3 mg/m^3) STEL 10 ppm (30 mg/m^3) [skin]	TWA 20 ppm C 30 ppm 100 ppm (30-minute maximum peak)	500 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Dizziness, headache, poor sleep, lassitude (weakness, exhaustion), anxiety, anorexia, weight loss; psychosis; polyneuropathy; Parkinson-like syndrome; ocular changes; coronary heart disease; gastritis; kidney, liver injury; eye, skin burns; dermatitis; reproductive effects	central nervous system, peripheral nervous system, cardiovascular system, eyes, kidneys, liver, skin, reproductive system	Colorless to faint-yellow liquid with a sweet ether-like odor. BP: 116°F Fl.P: -22°F UEL: 50.0% LEL: 1.3% Class IB Flammable Liquid
Chlorobenzene	108-90-7	TWA 10 ppm	None established	TWA 75 ppm (350 mg/m^3)	1000 ppm	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eyes, skin, respiratory system, central nervous system, liver	Colorless liquid with an almond-like odor BP: 270°F Fl.P: 82°F UEL: 9.6% LEL: 1.3%
Chloroethane	75-00-3	TWA 100ppm	Handle with caution in the workplace	TWA 1000 ppm (2600 mg/m^3)	3800 ppm [10%LEL]	inhalation, skin absorption (liquid), ingestion (liquid), skin and/or eye contact	Incoordination, inebriation; abdominal cramps; cardiac arrhythmias, cardiac arrest; liver, kidney damage	Liver, kidneys, respiratory system, cardiovascular system, central nervous system	Colorless gas or liquid (below 54°F) with a pungent, ether-like odor. BP: 54°F Fl.P: NA (Gas) -58°F (Liquid) UEL: 15.4% LEL: 3.8%
Chloroform	67-66-3	TWA 10 ppm	Ca STEL 2 ppm (9.78 mg/m^3) [60-minute]	C 50 ppm (240 mg/m^3)	Ca [500 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Liver, kidneys, heart, eyes, skin, central nervous system	Colorless liquid with a pleasant odor BP: 143°F
Chromium	7440-47-3	TWA 0.5 mg/m^3 (metal and Cr III compounds) TWA 0.05 mg/m^3 (water-soluble Cr IV compounds) TWA 0.01 mg/m^3 (insoluble Cr IV compounds)	TWA 0.5 mg/m^3	TWA 1 mg/m^3	250 mg/m^3 (as Cr)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin; lung fibrosis (histologic)	Eyes, skin, respiratory system	Blue-white to steel-gray, lustrous, brittle, hard, odorless solid. BP: 4788°F
Chrysene; Phenanthrene; Pyrene; Coal tar pitch volatiles	65996-93-2	TWA 0.2 mg/m3	Ca TWA 0.1 mg/m^3 (cyclohexane-extractable fraction)	TWA 0.2 mg/m^3 (benzene-soluble fraction)	Ca [80 mg/m^3]	Inhalation, skin and/or eye contact	Dermatitis, bronchitis, [potential occupational carcinogen]	Respiratory system, skin, bladder, kidneys	Black or dark-brown amorphous residue. Combustible Solids
cis-1,2-Dichloroethene	158-59-2	TWA 200 ppm	TWA 200 ppm	TWA 200 ppm	None established	inhalation, skin absorption, ingestion	Harmful if swallowed, inhaled, or absorbed through skin. Irritant. Narcotic. Suspected carcinogen	Skin	Colorless liquid BP: 60 C Fl.P: 4 C UEL: 12.8% LEL: 9.7 %
Copper	7440-50-8	TWA 0.2mg/m^3 (fume) 1 mg/m^3 (dusts and mists)	TWA 1 mg/m^3	TWA 1 mg/m^3	100 mg/m^3 (as Cu)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, respiratory system; cough, dyspnea (breathing difficulty), wheezing	Eyes, skin, respiratory system, liver, kidneys (increase(d) risk with Wilson's disease)	Noncombustible Solid in bulk form, but powdered form may ignite. BP: 4703°F
Dibenzo[a,h]anthracene	53-70-3	None established	None established	None established	None established	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin	Eyes, skin; skin photosensitization.	Colorless crystalline powder BP: 524°C

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1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Diesel Fuel #2	68476-34-6	None established	None established	Designated as an OSHA Select Carcinogen	None established	ingestion, skin and/or eye contact	Kidney damage; potential lung damage; suspected carcinogen; irritation of eyes, skin, respiratory tract; dizziness, headache, nausea; chemical pneumonitis (from aspiration of liquid); dry, red skin; irritant contact dermatitis; eye redness, pain.	Eyes, skin, kidneys	Clear yellow brown combustible liquid; floats on water; distinct diesel petroleum hydrocarbon odor. BP: 356-716°F Fl.P: 154.4-165.2°F LEL: 0.6% UEL: 7.0%
Ethylbenzene	100-41-4	TWA 100 ppm STEL 125 ppm	TWA 100 ppm (435 mg/m^3) STEL 125 ppm (545 mg/m^3)	TWA 100 ppm (435 mg/m^3)	800 ppm [10%LEL]	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with an aromatic odor. BP: 277°F Fl.P: 55°F UEL: 6.7% LEL: 0.8% Class IB Flammable Liquid
Fluoranthene	206-44-0	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible burns; heart and liver injury, pulmonary edema, respiratory arrest, gastrointestinal disturbances.	Heart, liver, lungs.	Yellow needles.
Fluorene	86-73-7	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Irritation skin, digestive tract	Skin	White crystals BP: 563°F
Fuel Oil #2	68476-30-2	TWA 100mg/m^3 (aerosol and vapor, as total hydrocarbons)	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; CNS effects; nausea, vomiting, headache, cramping, dizziness, weakness, loss of coordination,, drowsiness; kidney, liver damage	Eyes, skin, CNS	Clear or yellow to red oily liquid, kerosene-like odor BP: 347 - 689 °F UEL:5-6% LEL: 0.7-1.0%
Gasoline	8006-61-9	TWA 300 ppm STEL 500 ppm	Carcinogen	None established	Ca [IDLH value has not been determined]	Skin absorption; inhalation; ingestion; skin and/or eye contact	Eyes and skin irritation, mucous membrane; dermatitis; headache; listlessness, blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis; possible liver, kidney damage [Potential occupational carcinogen]	Eyes, skin, respiratory system, CNS, Liver, Kidneys	Clear liquid with a characteristic odor, aromatic Fl.Pt = -45°F LEL = 1.4% UEL = 7.6% Classs 1B Flammable Liquid
Hexachlorobutadiene	87-68-3	TWA 0.02 ppm	Ca TWA 0.02 ppm (0.24 mg/m^3) [skin]	None established	Ca [N.D.]	inhalation, skin absorption, ingestion, skin and/or eye contact	In animals: irritation eyes, skin, respiratory system; kidney damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, kidneys	Clear, colorless liquid with a mild, turpentine-like odor. BP: 419°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Hydrogen Sulfide	7783-06-4	TWA (10 ppm) STEL (15 ppm) (adopted values for which changes are proposed in the NIC)	C 10 ppm (15 mg/m^3) [10-minute]	C 20 ppm 50 ppm [10-minute maximum peak]	100 ppm	inhalation, skin and/or eye contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, central nervous system	Colorless gas with a strong odor of rotten eggs. BP: -77°F UEL: 44.0% LEL: 4.0% Flammable Gas
Indeno[1,2,3-cd]pyrene	193-39-5	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible human carcinogen (skin); weakness; affect liver, lung tissue, renal tissue; impariment of blood forming tissue	Skin	Fluorescent green-yellow crystalline solid BP: 536 C
Indeno[1,2,3-cd]pyrene	193-39-5	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; possible human carcinogen (skin); weakness; affect liver, lung tissue, renal tissue; impariment of blood forming tissue	Skin	Yellowish crystal solid BP: 536 C
Isopropylbenzene	98-82-8	TWA 50 ppm	TWA 50 ppm (245 mg/m^3) [skin]	TWA 50 ppm (245 mg/m^3) [skin]	900 ppm [10%LEL]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eyes, skin, respiratory system, central nervous system	Colorless liquid with a sharp, penetrating, aromatic odor. BP: 306°F Fl.P: 96°F UEL: 6.5% LEL: 0.9%
Kerosene	8008-20-6	TWA 200 mg/m^3	TWA 100 mg/m^3	None established	IDLH value has not been determined	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eyes, skin, respiratory system, central nervous system	Colorless to yellowish, oily liquid with a strong, characteristic odor. BP: 347-617°F Fl.P: 100-162°F UEL: 5% LEL: 0.7% Class II Combustible Liquid
Lead	7439-92-1	TWA 0.05 mg/m^3	TWA (8-hour) 0.050 mg/m^3	TWA 0.050 mg/m^3	100 mg/m^3 (as Pb)	inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	A heavy, ductile, soft, gray solid. BP: 3164°F Noncombustible Solid in bulk form

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Manganese	7439-96-5 (metal)	TWA 0.2 mg/m^3	TWA 1 mg/m^3 STEL 3 mg/m^3	C 5 mg/m^3	500 mg/m^3 (as Mn)	inhalation, ingestion	Manganism; asthenia, insomnia, mental confusion; metal fume fever: dry throat, cough, chest tightness, dyspnea (breathing difficulty), rales, flu-like fever; low-back pain; vomiting; malaise (vague feeling of discomfort); lassitude (weakness, exhaustion); kidney damage	respiratory system, central nervous system, blood, kidneys	A lustrous, brittle, silvery solid. BP: 3564°F
Mercury (organo) alkyl compounds (as Hg)	7439-97-6	TWA 0.01 mg/m^3 STEL 0.03 mg/m^3 [skin]	TWA 0.01 mg/m^3 STEL 0.03 mg/m^3 [skin]	TWA 0.01 mg/m^3 C 0.04 mg/m^3	2 mg/m^3 (as Hg)	inhalation, skin absorption, ingestion, skin and/or eye contact	Paresthesia; ataxia, dysarthria; vision, hearing disturbance; spasticity, jerking limbs; dizziness; salivation; lacrimation (discharge of tears); nausea, vomiting, diarrhea, constipation; skin burns; emotional disturbance; kidney injury; possible teratogenic effects	Eyes, skin, central nervous system, peripheral nervous system, kidneys	Appearance and odor vary depending upon the specific (organo) alkyl mercury compound
Mercury compounds [except (organo) alkyls] (as Hg) Mercury	7439-97-6	TWA 0.025 mg/m^3 (elemental and inorganic forms)	Hg Vapor: TWA 0.05 mg/m^3 [skin] Other: C 0.1 mg/m3 [skin]	TWA 0.1 mg/m^3	10 mg/m^3 (as Hg)	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eyes, skin, respiratory system, central nervous system, kidneys	Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.] BP: 674°F
Methyl tert-butyl ether (MTBE)	1634-04-4	TWA 50 ppm	No established REL	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, mucous membrane, respiratory; dizziness, nausea, headache, intoxication	Eyes, skin, mucous membrane, respiratory system, central nervous system	Colorless liquid BP: 55.2 C
Methylene Chloride	75-09-2	TWA 50 ppm, A3 - suspected human carcinogen	Ca	TWA 25 ppm STEL 125 ppm	Ca [2300 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numbness, tingle limbs; nausea; [potential occupational carcinogen]	Eyes, skin, cardiovascular system, central nervous system	Colorless liquid with a chloroform-like odor BP: 104°F UEL: 23% LEL: 13%
Metals Remediation Compound (MRC): Glycerol Tripolylactate Sorbitol Cysteinate Lactic Acid Glycerol	201167-72-8 444618-64-8 50-21-5 56-81-5	None established	None established	None established	None established	inhalation, ingestion, skin absorption, skin and/or eye contact	Irritation eyes, skin, respiratory tract	Behavioral (headache), gastrointestinal tract, reproductive system	Viscous amber gel/liquid; strong amine/sulfur odor
Naphtha (coal tar)	8030-30-6	None established	TWA 100 ppm (400 mg/m^3)	TWA 100 ppm (400 mg/m^3)	1000 ppm [10%LEL]	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose; dizziness, drowsiness; dermatitis; in animals: liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Reddish-brown, mobile liquid with an aromatic odor BP: 320-428°F Fl.P: 100-109°F Class II Combustible Liquid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Naphthalene	91-20-3	TWA 2 ppm STEL 15 ppm	TWA 10 ppm (50 mg/m^3) STEL 15 ppm (75 mg/m^3)	TWA 10 ppm (50 mg/m^3)	250 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage	Eyes, skin, blood, liver, kidneys, central nervous system	Colorless to brown solid with an odor of mothballs. BP: 424°F Fl.P: 174°F UEL: 5.9% LEL: 0.9%
n-Butylbenzene	104-51-8	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; CNS depression, lung damage; nausea, vomiting, headache, dizziness, weakness, loss of coordination, blured vision, drowsiness, confusion, disorientation	Eyes, skin,repiratory system, central nervous system	Colorless liquid with a sweet odor BP: 183 C Fl.P: 59 C UEL: 5.8% LEL: 0.8%
Nickel	7440-02-0 (Metal)	TWA 1.5 mg/m^3 (elemental) TWA 0.1 mg/m^3 (soluble inorganic compounds) TWA 0.2 mg/m^3 (insoluble inorganic compounds) TWA 0.1 mg/m^3 (Nickle subsulfide)	Ca TWA 0.015 mg/m^3	TWA 1 mg/m^3	Ca [10 mg/m^3 (as Ni)]	inhalation, ingestion, skin and/or eye contact	Sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Nasal cavities, lungs, skin	Metal: Lustrous, silvery, odorless solid. BP: 5139°F
Nitrobenzene	98-95-3	TWA 1 ppm	TWA 1 ppm (5 mg/m^3) [skin]	TWA 1 ppm (5 mg/m^3) [skin]	200 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; anoxia; dermatitis; anemia; methemoglobinemia; in animals: liver, kidney damage; testicular effects	Eyes, skin, blood, liver, kidneys, cardiovascular system, reproductive system	Yellow, oily liquid with a pungent odor like paste shoe polish. BP: 411°F Fl.P: 190°F LEL(200°F): 1.8%
n-Propylbenzene	103-65-1	None established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Harmful if swallowed, Irritation eyes, skin, digestive tract, respiratory tract, central nervous system	Eyes, skin, central nervous system, respiratory system	colorless or light yellow liquid BP: 159 C Fl.P: 47 C UEL: 6% LEL: 0.8%
Petroleum hydrocarbons(Petroleum distillates)	8002-05-9	None established	TWA 350 mg/m^3 C 1800 mg/m^3 [15 min]	TWA 500 ppm (2000 mg/m^3)	1,100 [10% LEL]	Inhalation; ingestion; skin and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, drowsiness, headache, nausea; dried/cracked skin; chemical pneumonitis	CNS, eyes, respiratory system, skin	Colorless liquid with a gasoline or kerosene-like odor BP: 86-460°F Fl. Pt = -40 to -86°F UEL: 5.9% LEL: 1.1% Flammable liquid
Phenol	108-95-2	TWA 5 ppm	TWA 5 ppm (19 mg/m^3) C 15.6 ppm (60 mg/m^3) [15-minute] [skin]	TWA 5 ppm (19 mg/m^3) [skin]	250 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine; cyanosis; liver, kidney damage; skin burns; dermatitis; ochronosis; tremor, convulsions, twitching	Eyes, skin, respiratory system, liver, kidneys	Colorless to light-pink, crystalline solid with a sweet, acrid odor. BP: 359°F UEL: 8.6% LEL: 1.8%

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
p-Isopropyltoluene	99-87-6	None established	None established	None established	None established	inhalation, skin absorption, eye contact	Irritation skin	CNS, skin	Colorless, clear liquid, sweetish aromatic odor BP: 350.8°F Class III Flammable liquid
Regenox Part A: Sodium Percarbonate Sodium Carbonate Monohydrate Silicic Acid Silica Gel	15630-89-4 5968-11-6 7699-11-6 63231-67-4	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation respiratory tract, mucous membranes, nose, throat, eyes, skin; gastrointestinal disturbance	Respiratory system, eyes, skin	Odorless, white, powder [Note: Self-accelerating decomposition with oxygen release starts at 50° C]
Regenox Part B: Silicic Acid, Sodium Salt, Sodium Silicate; Silica Gel; Ferrous Sulfate; Water	1344-09-8 63231-67-4 7720-78-7 7732-18-5	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation respiratory tract, mucous membranes, nose, throat, eyes, skin, mouth, esophagus and stomach	Respiratory system, eyes, skin, gastrointestinal tract	Odorless, Blue/Green, liquid [Note: Oxides of carbon and silicon may be formed when heated to decomposition]
sec-Butylbenzene	135-98-8	None established	None established	None established	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, upper airway; central nervous system, headache, dizziness; gastrointestinal disturbance	Respiratory system, central nervous system, eyes, skin;	Colorless liquid BP: 344°F Fl.P: 126 °F UEL: 6.9% LEL: 0.8% Combustible liquid
Selenium	7782-49-2	TWA 0.2 mg/m^3	TWA 0.2 mg/m^3	TWA 0.2 mg/m^3	1 mg/m^3 (as Se)	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eyes, skin, respiratory system, liver, kidneys, blood, spleen	Amorphous or crystalline, red to gray solid. [Note: Occurs as an impurity in most sulfide ores.] BP: 1265°F
Silver	7440-22-4 (metal)	TWA 0.1 mg/m^3 (metal, dust, fumes) TWA 0.01 mg/m^3 (Soluble compounds, as Ag)	TWA 0.01 mg/m^3	TWA 0.01 mg/m^3	10 mg/m^3 (as Ag)	inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	Metal: White, lustrous solid BP: 3632°F
Slop Oil	69029-75-0	None established	None established	None established	None established	Inhalation; ingestion	Irritation eyes, skin, gastrointestinal tract	Eyes, skin, gastrointestinal tract	Clear light to dark amber liquid, with mild hydrocarbon odor. BP: >500°F Fl.P : 250°F
Sulfuric Acid	7664-93-9	TWA 0.2 mg/m^3	TWA 1 mg/m^3	TWA 1 mg/m^3	15 mg/m^3	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; pulmonary edema, bronchitis; emphysema; conjunctivitis; stomatis; dental erosion; eye, skin burns; dermatitis	Eyes, skin, respiratory system, teeth	Colorless to dark-brown, oily, odorless liquid. BP: 554°F Noncombustible Liquid
tert-Butylbenzene	98-06-6	None established	None established	None established	None established	inhalation, skin absorption, ingestion,	Eye and respiratory irritant; CNS depression; liver or kidney damage	Respiratory system, central nervous system, eyes, liver, kidney	Colorless liquid with an aromatic odor BP: 168 - 169 C Fl.P: 34 C UEL:5.6 % LEL: 0.8 %

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm (STEL) listed as A3, animal carcinogen	Ca Minimize workplace exposure concentrations	TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm	Ca [150 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a mild, chloroform-like odor. BP: 250°F Noncombustible Liquid
Toluene	108-88-3	TWA 20 ppm	TWA 100 ppm (375 mg/m^3) STEL 150 ppm (560 mg/m^3)	TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)	500 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage	Eyes, skin, respiratory system, central nervous system, liver, kidneys	Colorless liquid with a sweet, pungent, benzene-like odor. BP: 232°F Fl.P: 40°F UEL: 7.1% LEL: 1.1% Class IB Flammable Liquid
trans-1,2-Dichloroethene	156-60-5	TWA 200 ppm	None established	TWA 200 ppm STEL 250 ppm (skin)	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Narcotic. Irritation eyes, skin, respiratory tract, mucous membrane; CNS depression.	Respiratory tract, mucous membrane, eyes, skin, CNS	Colorless liquid with a fruity pleasant odor BP: 48°C Fl.P 6C UEL: 12.8% LEL: 9.7%
Trichloroethene	79-01-6	TWA 10 ppm STEL 25 ppm	Ca	TWA 100 ppm C 200 ppm 300 ppm (5-minute maximum peak in any 2 hours)	Ca [1000 ppm]	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]	Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system	Colorless liquid (unless dyed blue) with a chloroform-like odor. BP: 189°F UEL(77°F): 10.5% LEL(77°F): 8%
Vinyl Chloride	75-01-4	TWA 1 ppm	Carcinogen	TWA 1 ppm C 5 ppm [15-minute]	Ca [IDLH value has not been determined]	inhalation, skin, and/or eye contact (liquid)	Lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Liver, central nervous system, blood, respiratory system, lymphatic system	Colorless gas or liquid (below 7°F) with a pleasant odor at high concentrations. BP: 7°F UEL: 33.0% LEL: 3.6% Flammable Gas
Xylene (m, o & p isomers)	108-38-3, 95-47-6, 106-42-3	TWA 100 ppm (435 mg/m^3) STEL 150 ppm	TWA 100 ppm (435 mg/m^3)	TWA 100 ppm (435 mg/m^3)	900 ppm	Skin absorption, inhalation, ingestion, skin, and/or eye contact	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys	Colorless liquid with an aromatic odor BP: 282°F, 292°F, 281°F Fl. Pt. 82°F, 90°F, 81°F LEL: 1.1%, 0.9%, 1.1% UEL: 7.0%, 6.7%, 7.0% Classs C Flammable Liquid
Zinc	7440-66-6	TWA 10 mg/m3 (Inhalable fraction)	None established	TWA 10 mg/m3 (for zinc oxide fume)	None established	skin and/or eye contact, inhalation, ingestion	Irritation eyes, skin, respiratory tract; gastrointestinal disturbances	Eyes, skin, respiratory system	Bluish gray solid BP: 1664.6°F Flammable

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present
1-02 26th Avenue, Astoria, New York

References

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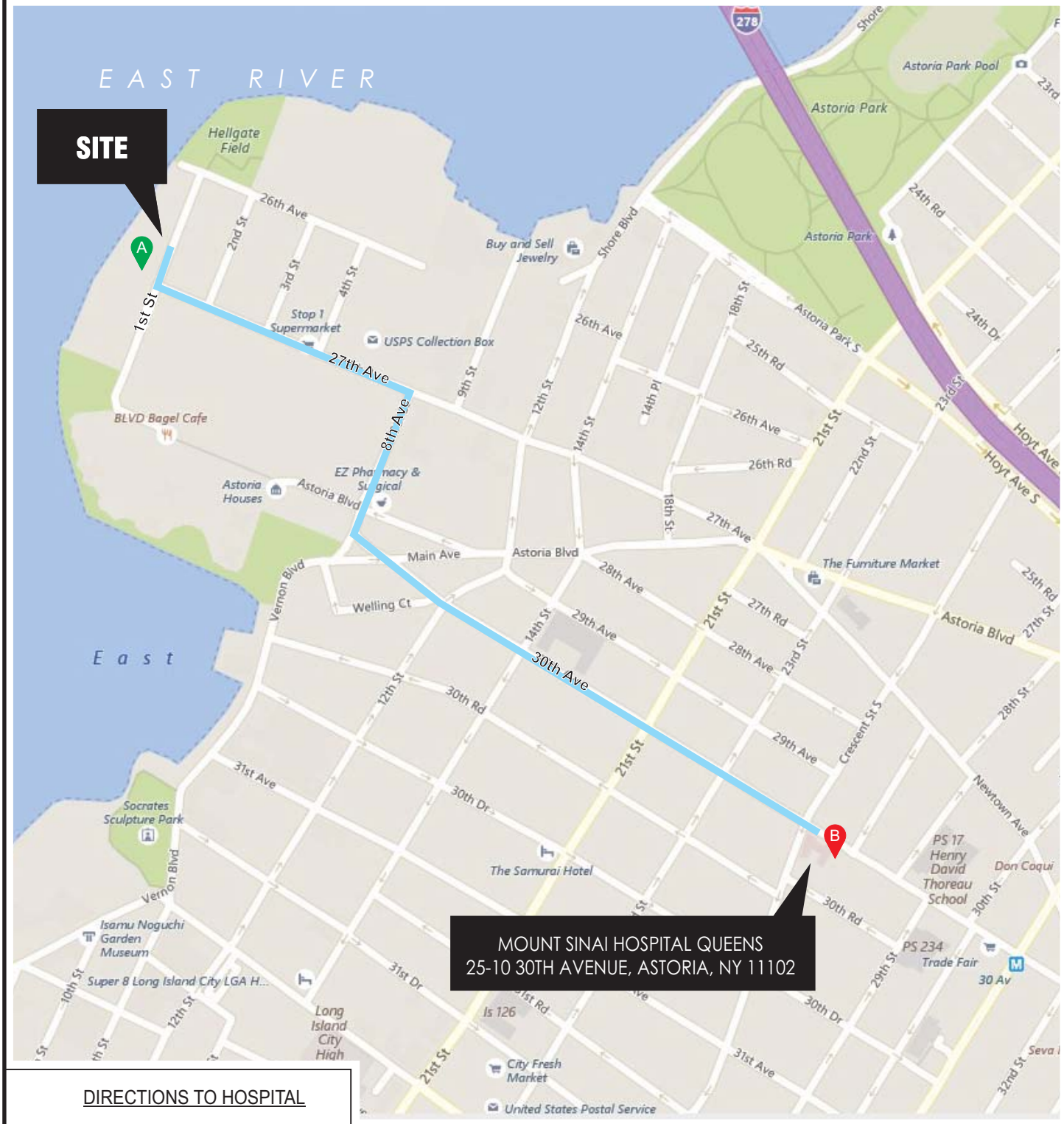
Sax, N.I. and R.J. Lewis. 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
Guide to Occupational Exposure Values. 2008. American Conference of Governmental Industrial Hygienists (ACGIH).
NIOSH Pocket Guide to Chemical Hazards. 2005. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health

Abbreviations:

ACGIH – American Conference of Governmental Industrial Hygienists.
BP – boiling point at 1 atmosphere, °F
C – Ceiling, is a concentration that should not be exceeded during and part of the working exposure.
Ca - considered by NIOSH to be a potential occupational carcinogen
CAS# Chemical Abstracts Service registry number which is unique for each chemical.
Fl. Pt. – Flash point
IDLH - Immediately Dangerous to Life and Health concentrations represent the maximum concentration from which, in the event of respirator failure, one could escape within 30 minutes without a respirator and without experiencing any escape-impairing or irreversible health effects.
LEL – Lower explosive (flammable) limit in air, % by volume (at room temperature)
mg/m^3 – Milligrams of substance per cubic meter of air
NIOSH -National Institute for Occupational Safety and Health.
OSHA – Occupational Safety and Health Administration
PEL - OSHA Permissible Exposure Limit (usually) a time weighted average concentration that must not be exceeded during any 8 hour work shift of a 40 hr work week.
ppm – parts per million
REL – NIOSH Recommended Limit indicated a time weighted average concentration that must not be exceeded during any 10 hour work shift of a 40 hr work week
STEL – Short-term exposure limit
TLV -ACGIH Threshold Limit Values (usually 8 hour time weighted average concentrations).
TWA – 8-hour, time-weighted average
UEL – Upper explosive (flammable) limit in air, % by volume (at room temperature)

FIGURES

1. Hospital Route Map
2. Site Location Map



DIRECTIONS TO HOSPITAL

A 1-1st Street, Astoria, New York

Head toward 27th Avenue on 1st Street

Turn left onto 27th Avenue
0.1 mi.

Turn right onto 8th Street
0.2 mi.

Turn left onto 30the Avenue
0.5 mi.

B Arrive at 30th Avenue, hospital is on right

N

0.1 Mile

Title:

HOSPITAL ROUTE MAP

MOUNT SINAI HOSPITAL QUEENS
25-10 30TH AVENUE
ASTORIA, NY 11102

Prepared for: HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial
Remedial Engineering, P.C.
ENVIRONMENTAL ENGINEERS

Compiled by: V.S.	Date: 17MAY17	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	1
Project Mgr.: W.S.	Project No.: 1338.0010Y000	
File: 1338.0010Y160.01.CDR		

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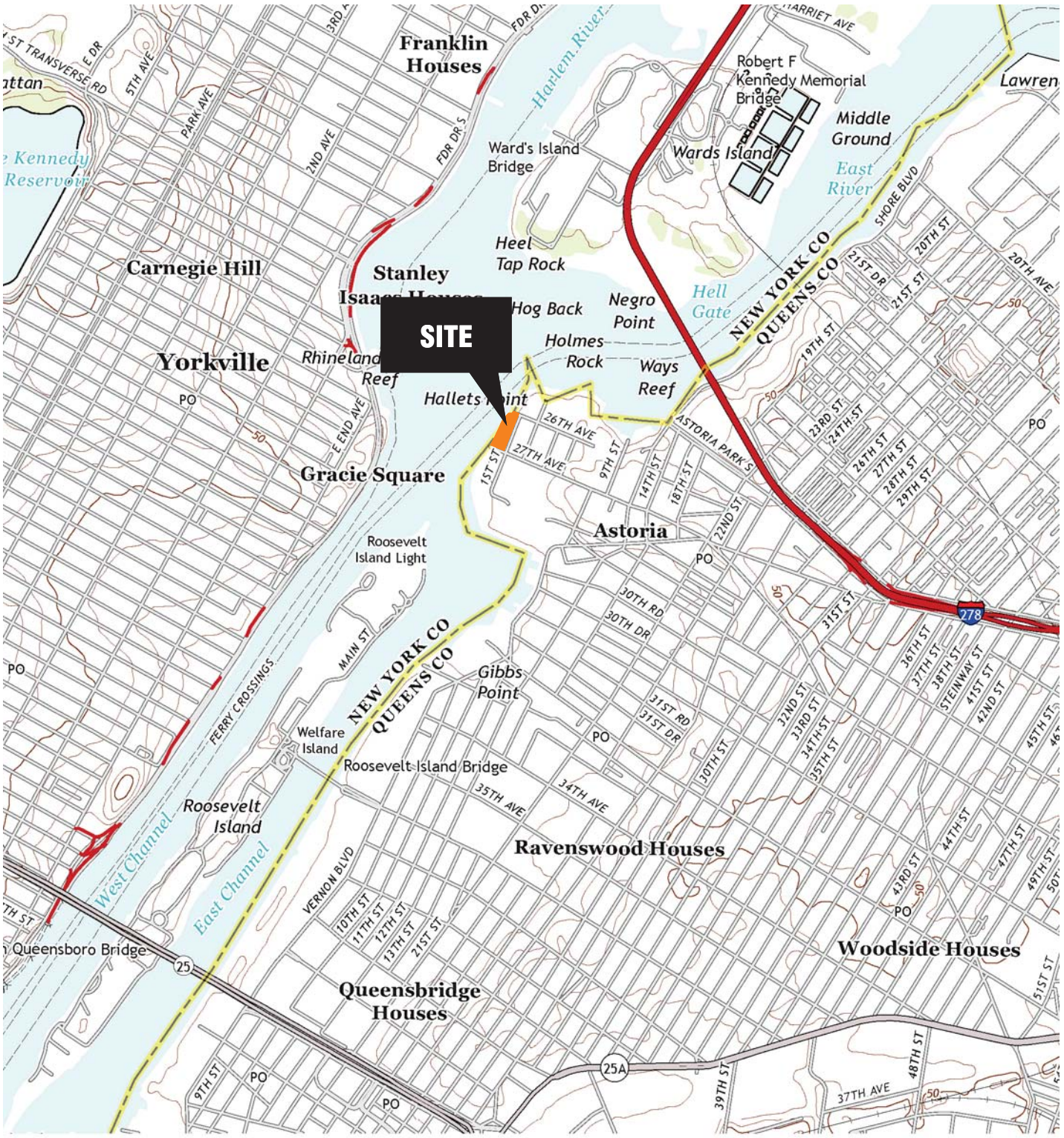

QUADRANGLE LOCATION

SOURCE:
USGS; 2013, Central Park, NY-NJ
7.5 Minute Topographic Quadrangle

N

0 2000'

Title:

SITE LOCATION MAP

BUILDINGS 2 AND 3 - BCP SITE NO. C24119
26-40 1ST STREET, ASTORIA, NEW YORK

Prepared for:
HALLETTS BUILDING 2 SPE LLC
HALLETTS BUILDING 3 SPE LLC

Remedial Engineering, P.C. ENVIRONMENTAL ENGINEERS	Compiled by: K.S.	Date: 17MAY17	FIGURE 2
	Prepared by: G.M.	Scale: AS SHOWN	
	Project Mgr.: K.S.	Project No.: 1338.0010Y008	
	File: 1338.0010Y160.02.CDR		

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APPENDICES

A. Material Safety Data Sheets (MSDS)
B. Heat Stress Guidelines
C. Cold Stress Guidelines
D. Excavation Check List and Procedures E.
Example Decontamination Station Layout F.
Accident/Incident Report OSHA 3000 G. Medical
Surveillance Program
H. Daily Safety Logs
I. Air Monitoring Log
J. Accident Investigation Report
K. Job Safety Analysis (JSAs)
L. OSHA Poster
M. Health and Safety Near/Loss - Loss (Incident)
Notification Flow Chart

Material Safety Data Sheets (MSDS)

Safety data for selenium

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms:
Molecular formula: Se
CAS No: 7782-49-2
EC No:

Physical data

Appearance: dark grey to dark red powder or crystals
Melting point: 144 C
Boiling point: 685 C
Vapour density:
Vapour pressure:
Specific gravity: 4.81
Flash point:
Explosion limits:
Autoignition temperature:

Stability

Stable. Incompatible with strong acids, strong oxidizing agents and most common metals. Combustible.

Toxicology

This is a trace element in foods, and appears to be required by the body at very low levels. At higher levels it is a poison. Highly toxic - may be fatal if inhaled, ingested or absorbed through skin. Note low LD50 value below. Irritant.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
IVN-RAT LD50 6 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R26 R27 R28.

Personal protection

Safety glasses; gloves. Effective ventilation.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Material Safety Data Sheet
Mercury, 99.999%

ACC# 96252

Section 1 - Chemical Product and Company Identification

MSDS Name: Mercury, 99.999%
Catalog Numbers: AC193480000, AC193480500
Synonyms: Colloidal mercury; Hydrargyrum; Metallic mercury; Quick silver; Liquid silver
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
7439-97-6	Mercury	99.999	231-106-7

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: silver liquid.
Danger! Corrosive. Harmful if inhaled. May be absorbed through intact skin. Causes eye and skin irritation and possible burns. May cause severe respiratory tract irritation with possible burns. May cause severe digestive tract irritation with possible burns. May cause liver and kidney damage. May cause central nervous system effects. This substance has caused adverse reproductive and fetal effects in animals. Inhalation of fumes may cause metal-fume fever. Possible sensitizer.
Target Organs: Blood, kidneys, central nervous system, liver, brain.

Potential Health Effects
Eye: Exposure to mercury or mercury compounds can cause discoloration on the front surface of the lens, which does not interfere with vision. Causes eye irritation and possible burns. Contact with mercury or mercury compounds can cause ulceration of the conjunctiva and cornea.
Skin: May be absorbed through the skin in harmful amounts. May cause skin sensitization, an allergic reaction, which becomes evident upon re-exposure to this material. Causes skin irritation and possible burns. May cause skin rash (in milder cases), and cold and clammy skin with cyanosis or pale color.
Ingestion: May cause severe and permanent damage to the digestive tract. May cause perforation of the digestive tract. May cause effects similar to those for inhalation exposure. May cause systemic effects.
Inhalation: Causes chemical burns to the respiratory tract. Inhalation of fumes may cause metal fume fever, which is characterized by flu-like symptoms with metallic taste, fever, chills, cough, weakness, chest pain, muscle pain and increased white blood cell count. May cause central nervous system effects including vertigo, anxiety, depression, muscle incoordination, and emotional instability. Aspiration may lead to pulmonary edema. May cause systemic effects. May cause

respiratory sensitization.
Chronic: May cause liver and kidney damage. May cause reproductive and fetal effects. Effects may be delayed. Chronic exposure to mercury may cause permanent central nervous system damage, fatigue, weight loss, tremors, personality changes. Chronic ingestion may cause accumulation of mercury in body tissues. Prolonged or repeated exposure may cause inflammation of the mouth and gums, excessive salivation, and loosening of the teeth.

Section 4 - First Aid Measures

Eyes: Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).
Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Destroy contaminated shoes.
Ingestion: Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid immediately. Wash mouth out with water.
Inhalation: Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Do NOT use mouth-to-mouth resuscitation. If breathing has ceased apply artificial respiration using oxygen and a suitable mechanical device such as a bag and a mask.
Notes to Physician: The concentration of mercury in whole blood is a reasonable measure of the body-burden of mercury and thus is used for monitoring purposes. Treat symptomatically and supportively. Persons with kidney disease, chronic respiratory disease, liver disease, or skin disease may be at increased risk from exposure to this substance.
Antidote: The use of d-Penicillamine as a chelating agent should be determined by qualified medical personnel. The use of Dimercaprol or BAL (British Anti-Lewisite) as a chelating agent should be determined by qualified medical personnel.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Water runoff can cause environmental damage. Dike and collect water used to fight fire. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.
Extinguishing Media: Substance is nonflammable; use agent most appropriate to extinguish surrounding fire. Use water spray, dry chemical, carbon dioxide, or appropriate foam.
Flash Point: Not applicable.
Autoignition Temperature: Not applicable.
Explosion Limits, Lower: Not available.
Upper: Not available.
NFPA Rating: (estimated) Health: 3; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8.
Spills/Leaks: Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Avoid runoff into storm sewers and ditches which lead to waterways. Clean up

spills immediately, observing precautions in the Protective Equipment section. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Remove contaminated clothing and wash before reuse. Minimize dust generation and accumulation. Keep container tightly closed. Do not get on skin or in eyes. Do not ingest or inhale. Use only in a chemical fume hood. Discard contaminated shoes. Do not breathe vapor.
Storage: Keep container closed when not in use. Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances. Keep away from metals. Store protected from azides.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.
Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Mercury	0.025 mg/m3 TWA; Skin - potential significant contribution to overall exposure by the cutaneous r oute	0.05 mg/m3 TWA (vapor) 10 mg/m3 IDLH	0.1 mg/m3 Ceiling

OSHA Vacated PELs: Mercury: 0.05 mg/m3 TWA (vapor)
Personal Protective Equipment
Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin: Wear appropriate protective gloves to prevent skin exposure.
Clothing: Wear appropriate protective clothing to prevent skin exposure.
Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance: silver
Odor: odorless
pH: Not available.
Vapor Pressure: 0.002 mm Hg @ 25C
Vapor Density: 7.0
Evaporation Rate: Not available.
Viscosity: 15.5 mP @ 25 deg C
Boiling Point: 356.72 deg C
Freezing/Melting Point:-38.87 deg C
Decomposition Temperature: Not available.
Solubility: Insoluble.

Specific Gravity/Density:13.59 (water=1)
Molecular Formula: Hg
Molecular Weight:200.59

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: High temperatures, incompatible materials.
Incompatibilities with Other Materials: Metals, aluminum, ammonia, chlorates, copper, copper alloys, ethylene oxide, halogens, iron, nitrates, sulfur, sulfuric acid, oxygen, acetylene, lithium, rubidium, sodium carbide, lead, nitromethane, peroxyformic acid, calcium, chlorine dioxide, metal oxides, azides, 3-bromopropyne, alkynes + silver perchlorate, methylsilane + oxygen, tetracarbonylnickel + oxygen, boron diiodophosphide.
Hazardous Decomposition Products: Mercury/mercury oxides.
Hazardous Polymerization: Will not occur.

Section 11 - Toxicological Information

RTECS#:
CAS# 7439-97-6: OV4550000
LD50/LC50:
Not available.

Carcinogenicity:
CAS# 7439-97-6: Not listed by ACGIH, IARC, NTP, or CA Prop 65.

Epidemiology: Intraperitoneal, rat: TDLo = 400 mg/kg/14D-I (Tumorigenic - equivocal tumorigenic agent by RTECS criteria - tumors at site of application).
Teratogenicity: Inhalation, rat: TCLo = 1 mg/m3/24H (female 1-20 day(s) after conception) Effects on Embryo or Fetus - fetotoxicity (except death, e.g., stunted fetus).
Reproductive Effects: Inhalation, rat: TCLo = 890 ng/m3/24H (male 16 week(s) pre-mating) Paternal Effects - spermatogenesis (incl. genetic material, sperm morphology, motility, and count).; Inhalation, rat: TCLo = 7440 ng/m3/24H (male 16 week(s) pre-mating) Fertility - post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants).
Mutagenicity: Cytogenetic Analysis: Unreported, man = 150 ug/m3.
Neurotoxicity: The brain is the critical organ in humans for chronic vapor exposure; in severe cases, spontaneous degeneration of the brain cortex can occur as a late sequela to past exposure.
Other Studies:

Section 12 - Ecological Information

Ecotoxicity: Fish: Rainbow trout: LC50 = 0.16-0.90 mg/L; 96 Hr; UnspecifiedFish: Bluegill/Sunfish: LC50 = 0.16-0.90 mg/L; 96 Hr; UnspecifiedFish: Channel catfish: LC50 = 0.35 mg/L; 96 Hr; UnspecifiedWater flea Daphnia: EC50 = 0.01 mg/L; 48 Hr; Unspecified In aquatic systems, mercury appears to bind to dissolved matter or fine particulates, while the transport of mercury bound to dust particles in the atmosphere or bed sediment particles in rivers and lakes is generally less substantial. The conversion, in aquatic environments, of inorganic mercury cmpd to methyl mercury implies that recycling of mercury from sediment to water to air and back could be

a rapid process.
Environmental: Mercury bioaccumulates and concentrates in food chain (concentration may be as much as 10,000 times that of water). Bioconcentration factors of 63,000 for freshwater fish and 10,000 for salt water fish have been found. Much of the mercury deposited on land, appears to revaporize within a day or two, at least in areas substantially heated by sunlight.
Physical: All forms of mercury (Hg) (metal, vapor, inorganic, or organic) are converted to methyl mercury. Inorganic forms are converted by microbial action in the atmosphere to methyl mercury.
Other: No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series:
CAS# 7439-97-6: waste number U151.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	DOT regulated - small quantity provisions apply (see 49CFR173.4)	MERCURY
Hazard Class:		8
UN Number:		UN2809
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA
CAS# 7439-97-6 is listed on the TSCA inventory.
Health & Safety Reporting List
None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
CAS# 7439-97-6: Section 5
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
CAS# 7439-97-6: 1 lb final RQ; 0.454 kg final RQ
SARA Section 302 Extremely Hazardous Substances
None of the chemicals in this product have a TPQ.
SARA Codes
CAS # 7439-97-6: immediate, delayed.
Section 313
This material contains Mercury (CAS# 7439-97-6, 99.999%),which is subject to the reporting

requirements of Section 313 of SARA Title III and 40 CFR Part 373.

Clean Air Act:

CAS# 7439-97-6 (listed as Mercury compounds) is listed as a hazardous air pollutant (HAP).

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

CAS# 7439-97-6 is listed as a Priority Pollutant under the Clean Water Act. CAS# 7439-97-6 is listed as a Toxic Pollutant under the Clean Water Act.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 7439-97-6 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

WARNING: This product contains Mercury, a chemical known to the state of California to cause developmental reproductive toxicity.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

T

Risk Phrases:

R 23 Toxic by inhalation.

R 33 Danger of cumulative effects.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 7 Keep container tightly closed.

WGK (Water Danger/Protection)

CAS# 7439-97-6: 3

Canada - DSL/NDSL

CAS# 7439-97-6 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A, E.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 7439-97-6 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 6/15/1999

Revision #5 Date: 3/16/2007

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the

possibility of such damages.

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
100 Bureau Drive, Mail Stop 232
Gaithersburg, Maryland 20899-232

MSDS Coordinator: Carmen S. Davis
Phone: (301) 975-6776
ChemTrec: 1-800-424-9300

SRM Number: 991
MSDS Number: 991
SRM Name: Lead–206 Assay and Isotopic Solution

Date of Issue: 31 August 2004
FAX: (301) 926-4751
E-mail: SRMMSDS@nist.gov

SECTION I. MATERIAL IDENTIFICATION

Material Name: Lead–206 Assay and Isotopic Standard

Description: The isotopic composition:

^{204}Pb, Atom Percent	< 0.0003
^{206}Pb, Atom Percent	99.979
^{207}Pb, Atom Percent	0.008 ± 0.001
^{208}Pb, Atom Percent	0.013 ± 0.001

SRM 991 consists of a solution of lead nitrate sealed in quartz ampoules. Each ampoule contains a nominal 15 g of solution, 0.5 N in nitric acid.

Other Designations: **Lead Nitrate** (lead dinitrate; lead (II) nitrate; lead (II) salt; lead nitrate crystal) in **Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engraver's acid

Name	Chemical Formula	CAS Registry Number
Lead Nitrate	$Pb(NO_3)_2$	10099-74-8
Nitric Acid	HNO_3	7697-37-2

DOT Classification: Corrosive Liquid, Poisonous
N.O.S. (Nitric Acid and Lead Compounds) UN 2922

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration	Exposure Limits and Toxicity Data
Lead Nitrate (Inorganic fumes as Pb)		ACGIH TLV-TWA: 0.05 mg/m^3
$Pb(NO_3)_2$	106 mg/kg	OSHA TLV-TWA (8 hours): 50 µg/m^3
Pb	66 mg/kg	OSHA Action Level (8 hours): 30 µg/m^3
		Woman, Oral: TD_{LO}: 450 mg/kg/6 yrs
		Rat, Intravenous: LD_{50}: 93 mg/kg
		Mouse, Intraperitoneal: LD_{50}: 74 mg/kg
Nitric Acid	0.5 N	ACGIH TLV-TWA: 2 mg/kg or 5 mg/m^3
		OSHA TLV-TWA: 2 mg/kg or 5 mg/m^3
		Human, Oral: LD_{LO}: 430 mg/kg

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Lead Nitrate
Appearance and Odor: a white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; pungent odor	**Appearance and Odor:** solid, translucent, colorless to yellow crystals
Relative Molecular Mass: 63.02	**Relative Molecular Mass:** 331.21
Boiling Point: 83 °C	**Boiling Point:** not applicable
Freezing Point: -42 °C	**Melting Point:** not available
Density: 1.05 g/mL (10 % nitric acid)	**Density:** 4.53 g/mL
Water Solubility: soluble	**Water Solubility (@ °C):** 38 %
Solvent Solubility: miscible in ether	**Solvent Solubility:** alcohol, alkali, ammonia; **insoluble** in concentrated nitric acid

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this lead nitrate/nitric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: Not applicable **Method Used:** Not applicable **Autoignition Temperature:** Not applicable

Flammability Limits in Air (Volume %): **UPPER:** Not applicable
LOWER: Not applicable

Unusual Fire and Explosion Hazards: Iron nitrate is a negligible fire hazard; however, it is an oxidizer that may ignite or explode on contact with combustible materials. Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: __X__ **Stable** _____ **Unstable**

Stable at normal temperature and pressure.

Conditions to Avoid: Avoid contact with moisture and incompatible materials.

Incompatibility (Materials to Avoid): Lead nitrate is incompatible with combustible materials, metal salts, reducing agents, and acids. Keep nitric acid away from organic materials, plastics, rubber, and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide.

See Section IV: "Unusual Fire and Explosion Hazards".

Hazardous Decomposition or Byproducts: Hazardous decomposition of lead nitrate and/or nitric acid can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO_2), nitrous oxide (N_2O), as well as nitric acid mist or vapor.

Hazardous Polymerization: ____ **Will Occur** __X__ **Will Not Occur**

SECTION VI. HEALTH HAZARD DATA

Route of Entry: __X__ **Inhalation** __X__ **Skin** __X__ **Ingestion**

Health Hazards (Acute and Chronic): Nitric Acid: Nitric acid may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Lead and Lead Nitrate: Inhalation of large amounts of lead may cause a metallic taste, thirst, a burning sensation in the mouth and throat, excessive salivation, abdominal pain with severe colic, vomiting, diarrhea, fatigue, sleep disturbances, irritability, loss of concentration, oliguria, visual failure, paresthesias, muscle pain and weakness, and convulsions. Liver effects may include enlargement with tenderness and jaundice. The fatal dose of absorbed lead is approximately 0.5 grams. Pathological findings include gastrointestinal inflammation and renal tubular degeneration.

Repeated exposure to low levels of lead salts may result in an accumulation in the body tissues and exert an adverse effect on the blood, nervous system, heart, endocrine and immune system, kidneys, and the reproductive system. Early stages of lead poisoning, may be evidenced by anorexia, weight loss, constipation, apathy or irritability, occasional vomiting, fatigue, headache, weakness, metallic taste in the mouth, gingival lead line in persons with poor dental hygiene, and anemia. Loss of recently developed motor skills is generally observed only in children. More advanced stages of poisoning may be characterized by intermittent vomiting, irritability and nervous, myalgia of the arms, legs, joints and abdomen, paralysis of the extensor muscles with wrist and/or foot drop. Irreversible kidney damage has been associated with industrial exposure. Rarely, inorganic nitrates may be converted to nitrites by nitrate-reducing bacteria in the digestive tact, resulting in methemoglobinemia. Symptoms of methemoglobinemia may include cyanosis, headache, weakness, dizziness, lightheadedness, ataxia, shallow respiration, drowsiness, nausea, vomiting, confusion, lethargy, stupor, dyspnea, convulsion, and coma. Reproductive effects have been exhibited in both males and females. Lead crosses the placenta and may affect the fetus causing birth defects, mental retardation, behavioral disorders, and death during the first year o childhood. Animal studies indicate that reproductive effects may be additive if both parents are expose to lead.

Skin contact may cause irritation; repeated or prolonged contact may cause dermatitis. Eye contact with lead nitrate may cause irritation; repeated or prolonged contact may cause conjunctivitis.

Medical Conditions Generally Aggravated by Exposure: Lead Nitrate: blood system disorders, gastrointestinal disorders, nervous system disorders, and respiratory disorders

Nitric Acid: eye disorders, skin disorders, respiratory disorders, and allergies

Listed as a Carcinogen/Potential Carcinogen (Lead Nitrate):

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	____	X
In the International Agency for Research on Cancer (IARC) Monographs	X	____
By the Occupational Safety and Health Administration (OSHA)	____	X

NOTE: The IARC classifies lead and inorganic lead compounds as Group 2B, *Possible Carcinogenic to Humans.*

Listed as a Carcinogen/Potential Carcinogen (Nitric Acid):

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	____	X
In the International Agency for Research on Cancer (IARC) Monographs	____	X
By the Occupational Safety and Health Administration (OSHA)	____	X

EMERGENCY AND FIRST AID PROCEDURES:

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 minutes. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration by qualified personnel. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. If the exposed person is responsive, give one or two glasses of milk or water to drink. Obtain medical assistance immediately.

> **NOTE (Nitric Acid):** Wash affected skin areas with 5 % solution of sodium bicarbonate ($NaHCO_3$). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. **DO NOT** give the exposed person bicarbonate to neutralize the material.

TARGET ORGAN(S) OF ATTACK: **Lead Nitrate:** nervous system, kidneys; teratogen
Nitric Acid: skin, teeth, eyes, and upper respiratory tract

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for non-routine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas.

> **NOTE:** Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store this material in its original bottle at room temperature.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Nitric Acid*, 18 March 2004.
MDL Information Systems, Inc., MSDS *Lead Nitrate*, 18 March 2004.
MDL Information Systems, Inc., MSDS *Lead*, 18 March 2004.
Certificate 991 *Lead–206 Assay and Isotopic Standard*; National Institute of Standards and Technology, U.S. Department of Commerce: Gaithersburg, MD (2004).

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified value for this material is given in the NIST Certificate of Analysis.

Safety data for chromium

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: chromium metal, chrome, alpaste RRA 030
Molecular formula: Cr
CAS No: 7440-47-3
EC No: 231-157-5

Physical data

Appearance: very hard silvery grey metal
Melting point: 1900 C
Boiling point: 2640 C
Vapour density:
Vapour pressure: 1 mm Hg at 1616 C
Specific gravity: 7.14
Flash point:
Explosion limits:
Autoignition temperature:

Stability

Stable. Incompatible with carbonates, strong bases, mineral acids, lithium, sulfur dioxide, strong acids.

Toxicology

In powdered form may act as a human carcinogen. Not expected to pose a risk to health in the massive (lump) form. Typical TLV (dust) 0.5 mg/m3.

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R23 R24 R25 R36 R37 R38 R45 (applies to powdered material only).

Transport information

Non-hazardous for air, sea and road freight.

Personal protection

Avoid exposure to dust.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S26 S28 S36 S37 S39 S45 S53 (applies to powdered material only).

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Material Safety Data Sheet

According to EC-directive 91/155/EEC

1. Identification of substance

Product details:	**Barium**
Usage:	getter material
Manufacturer / Supplier:	ALVATEC Production and Sales GesmbH Friesacher Straße 3 A-9330 Treibach-Althofen, Austria Tel.: +43/4262/26441321

Emergency information: http://www.who.int/ipcs/poisons/centre/directory/en/

2. Composition / Data on components

Chemical characterization:	Barium (Ba)
CAS-Number:	7440-39-3
UN-Number:	1400
EINECS-Number:	231-149-1

3. Hazards identification

Hazard designation:	Xi Irritant
Information pertaining to particular dangers for man and environment:	R 14 reacts violently with water. R 31 Contact with acids liberates toxic gases. R 36/R 37/R 38 Irritating to eyes, respiratory system and skin.

4. First aid measures

General information:	Instantly remove any clothing soiled by the product.
After inhalation:	Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist. Seek immediate medical advice.
After skin contact:	Instantly wash with water and soap and rinse thoroughly. Seek immediately medical advice.
After eye contact:	Rinse opened eyes for several minutes under running water and consult the doctor.
After swallowing:	Seek immediate medical advice.

5. Fire fighting measures

Suitable extinguishing agents:	Extinguishing powder, dry sand.
Unsuitable agents:	Water; water containing agents; Carbon dioxide; Halocarbon extinguishers.
Special hazards:	Contact with water releases hydrogen (explosive).
Special protective equipment for extinguishing:	Wear self-contained breathing apparatus.

6. Accidental release measures

Personal safety precautions:	Avoid contact. Keep ignition sources away. Ensure adequate ventilation. Wear protective clothes. Keep unprotected persons away. Supply fresh air.
Measures for environmental protection:	Do not allow the material to be released into the sewerage. Explosion hazard.
Measures of cleaning/ collecting:	Do not flush with water or aqueous cleaning agents. Collect mechanically. Use return systems. Supply fresh air.

7. Handling and storage

Handling:

Information for safe usage:	Handle under dry Argon. Keep container tightly sealed. Ensure adequate ventilation.
Information for fire and explosion protection:	Keep away from ignition - No smoking.

Storage:

Information about storage one common storage Facilities:	Do not store together with strong oxidizing agents, water and acids.
Further conditions:	Keep container dry and well sealed. Store under dry Argon

8. Exposure control and personal protection

General protective measures:	Avoid contact with eyes and skin.
Hygienic measures:	Instantly remove any soiled and impregnated garments. Separate storage of protective clothing.
Protection of hands:	Gloves from Natural latex, Chloroprene, Nitrile, Viton, or Butyl rubber (Level 6, permeation time* > 480 min) *) Permeation times may vary from type and conditions of usage!
Eye protection:	Safety glasses
Body protection:	Protective clothing
Maximum workplace concentration:	Barium and soluble compounds as Ba (mg/m^3) UK WEL 0.5
Breathing equipment:	Use breathing protection with high concentrations.

9. Physical and chemical properties

General Information:	
Form:	solid
Colour:	silver shining
Smell:	odourless
Melting point:	725 °C
Boiling point:	1640 °C (101.3 kPa);
Sublimation point:	367 °C (10^{-4} Pa)
Density:	not determined
Solubility in water:	reacts violently with water

10. Stability and reactivity

Thermal decomposition:	No decomposition if used according to specifications.
Condition to be avoided:	Moisture.
Materials to be avoided:	Oxidizing agents, water, acids, ammonia, halocarbons
Dangerous reactions:	Reacts violently with water.
Dangerous products of reactions or decomposition:	Hydrogen, metal oxide fume
Further information:	Flammable.

11. Toxicological information

Remarks:	To our best knowledge the acute and chronic toxicity of this substance is not known completely.
General information:	Reacts with humidity of the body.
After respiration:	Alkali burns of mucous membrane, airway, lung.
After skin contact:	Alkali burns.
After eye contact:	Alkali burns, hazard of blindness.
After swallowing:	Alkali burns in mouth, fauces, gullet and gastrointestinal tract. (Hazard of perforation)

12. Ecological Information

Ekotoxicological effects:	Harmful effects on aquatic organism by shifting of pH-values.
General notes:	Do not allow undiluted product or large quantities in sewage systems, water or ground!
Water hazard class:	Water hazard class 1 (self-assessment): slightly hazardous

13. Disposal consideration

Precausions:	Watch note in chapter 7 before handling.
EWC-Code:	06 03 13

Consult state, local or national regulations for proper disposal. Hand over to disposers of hazardous waste. Must be specially treated under adherence to official regulations.

14. Transport information

Land transport ADR/RID (cross-border/domestic)

ADR/RID class:	4.3, LQ11
Packaging group:	II
Kemler number:	423
UN-Number:	1400
Designation of Goods:	1400 Barium

Maritime transport IMDG/GGVSea

UN-Number:	1400
IMDG/GGVSea class:	4.3
Packaging group:	II
Correct technical name:	Barium

Air transport ICAO/IATA

UN-Number:	1400
ICAO/IATA class:	4.3
Packaging group:	II
Correct technical name:	Barium

15. Regulatory information

Designation according to EC guidelines

Symbol and Code letter:  Xi Irritant

Risk phrases:
R 14 Reacts violently with water.
R 31 Contact with acids liberates toxic gas.
R 36/R 37/R 38 Irritating to eyes, respiratory system and skin.

Safety phrases:
S 16 Keep away from ignition - No smoking.
S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advise.
S 27 Take off immediately all contaminated clothing.
S 36/S 37/S 39 Wear suitable protective clothing, gloves and eye/face protection.

Water hazard class: 1 (self-assessment): slightly hazardous

Information about limitation of use: For use only by qualified individuals. Restrictions concerning young persons must be observed

16. Other information

General information:
All information is based upon our best present knowledge.
Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.
The user is responsible for the adherence to all safety rules.

Safety data for arsenic

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: arsenic black, arsenicals, arsenic-75, colloidal arsenic, grey arsenic, metallic arsenic
Molecular formula: As
CAS No: 7440-38-2
EINECS No: 231-148-6
Annex I Index No: 033-001-00-X

Physical data

Appearance: grey powder or chunks
Melting point: 817 C
Boiling point:
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 5.727
Flash point:
Explosion limits:
Autoignition temperature:

Stability

Stable. Incompatible with acids, oxidizing agents, halogens. Heat and air-sensitive.

Toxicology

Very toxic. May be fatal if inhaled, swallowed or absorbed through the skin. This is a known human carcinogen. May cause reproductive disorders.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 763 mg kg^{-1}
IPR-RAT LD50 13 mg kg^{-1}
ORL-MUS LD50 145 mg kg^{-1}
IPR-MUS LD50 46 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R23 R25 R50 R53. (Note that according to Annex I, arsenic is not allocated the Risk Phrase R45 - May Cause Cancer - even though arsenic is known to be carcinogenic in humans. It would be wise to handle this material as a carcinogen, and treat it as though Risk Phrase R45 was specified.)

Environmental information

Harmful in the environment - very toxic to aquatic organisms. May cause long-term damage.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 1558. Hazard class: 6.1. Packing group: II

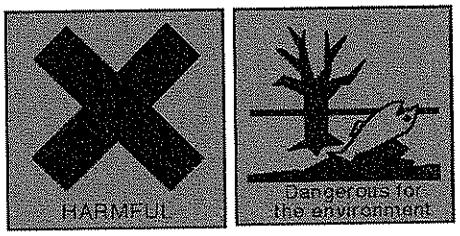
Personal protection

Gloves, safety glasses, good ventilation. Handle as a carcinogen.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S20 S21 S28 S45 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for dibenz(a,h)anthracene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2:5,6-benzanthracene, 1,2:5,6-dibenzanthracene, dibenzo(a,h) anthracene, DBA, 1,2,5,6-DBA
Use: a common pollutant in smoke and used oils
Molecular formula: $C_{22}H_{14}$
CAS No: 53-70-3
EINECS No: 200-181-8
Annex I Index. No: 601-041-00-2

Physical data

Appearance: white to light yellow crystalline solid
Melting point: 266 - 267 C
Boiling point: 524 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.28
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed or inhaled. Experimental carcinogen, tumorigen and neoplastigen. IARC probable human carcinogen.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)
IVN-MUS LDLO 10 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R45 R50 R53.

Environmental information

Harmful in the environment - may cause long-term damage.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Non-hazardous for air, sea and road freight.

Personal protection

Safety glasses, gloves, good ventilation. Handle as a possible carcinogen.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for chrysene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2-benzophenanthrene, benzo(a)phenanthrene, 1,2-benzphenanthrene, coal tar pitch, benz(a)phenanthrene, 1,2,5,6-dibenzonaphthalene
Molecular formula: $C_{18}H_{12}$
CAS No: 218-01-9
EC No: 205-923-4

Physical data

Appearance: crystalline powder
Melting point: 253 C
Boiling point: 448 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}): 1.27
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: insoluble

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Toxic. Confirmed animal carcinogen, possible human carcinogen. Harmful if swallowed, inhaled or absorbed through the skin.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
IPR-MUS LD50 >320 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R45 R46.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 2811. Packing group I. Hazard class 6.1. CDG UK Transport category 1. EMS No 6.1-04.

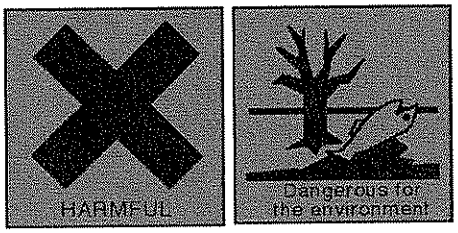
Personal protection

Safety glasses, good ventilation, gloves. Handle as a carcinogen. A COSHH assessment is required.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S3 S7 S9 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for carbazole



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 9-azafluorene, dibenzopyrrole, diphenylenimine, diphenyleneimide, USAF EK-600
Molecular formula: $C_{12}H_9N$
CAS No: 86-74-8
EC No: 201-696-0

Physical data

Appearance: white crystals or light brown powder
Melting point: 245 - 246 C
Boiling point: 335 C
Vapour density:
Vapour pressure: 400 mm Hg at 323 C
Density (g cm^{-3}): 1.1
Flash point: 220 C (closed cup)
Explosion limits:
Autoignition temperature:
Water solubility: negligible

Stability

Stable. Combustible. Incompatible with strong oxidizing agents, nitrogen oxides, potassium hydroxide.

Toxicology

Harmful by inhalation or ingestion. May be harmful in contact with skin. Suspected carcinogen.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LDLO 500 mg kg^{-1}
IPR-MUS LD50 200 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R20 R22 R40 R50 R53.

Environmental information

Very toxic to aquatic organisms - may cause long-term damage in the environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 2811. Hazard class 6.1. Packing group III.

Personal protection

Safety glasses, gloves, good ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S26 S36 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

responsibility for it.

Safety data for dioctyl phthalate

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: bis(2-ethylhexyl)phthalate, phthalic acid bis(2-ethylhexyl) ester, 1,2-benzenecarboxylic acid dioctyl ester, DEHP, phthalic acid dioctyl ester, diethylhexyl phthalate, eviplast 80, eviplast 81, felximel, flexol DOP, good-rite GP 264, hatcol DOP, hercoflex 260, jayflex DOP, kodaflex DOP, mollan O, nuoplaz DOP, octoil, palatinol AH, reomol D 79P, sicol 150, staflex DOP, further trade names
Use: plasticizer for PVC and other resins. Dielectric fluid. Permitted component in food packaging material
Molecular formula: $C_{24}H_{38}O_4$
Structural formula: $C_6H_4(COOCH_2CH(C_2H_5)C_4H_9)_2$
CAS No: 117-81-7
EC No: 204-211-0
Annex I Index No: 607-317-00-9

Physical data

Appearance: colourless liquid
Melting point: -52 C
Boiling point: 384 C
Vapour density:
Vapour pressure:
Specific gravity: 0.9861
Flash point: 215 C (closed cup)
Explosion limits: 0.3% (lower)
Autoignition temperature: 390 C
Viscosity 0.4 poise
Refractive index 1.4848

Stability

Stable. Incompatible with strong oxidizing agents. Combustible.

Toxicology

May be harmful by inhalation, ingestion or skin absorption. Laboratory evidence suggests that high doses during pregnancy may reduce birth weight of lab animals. May have toxic effects on embryo or fetus. Possible carcinogen. Skin, eye and respiratory irritant. Typical occupational TLV 3mg/m3.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
RAT-ORL LD50 31000 mg kg^{-1}
IPR-RAT LD50 30700 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R36 R37 R38 R60 R61.

Environmental information

Biodegrades in water with a half life of 2-3 weeks.

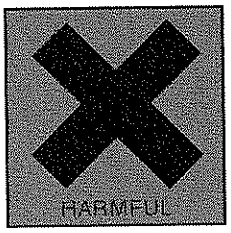
Personal protection

Safety glasses. Adequate ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S45 S53.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for benzo[k]fluoranthene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 8,9-benzofluorathene, 11,12-benzo[k]fluoranthene, benzo(k) fluoranthene, 2,3,1',8'-binapthylene, B(K)F, BKF
Use:
Molecular formula: $C_{20}H_{12}$
CAS No: 207-08-9
EC No:

Physical data

Appearance: yellow crystals
Melting point: 215 - 217 C
Boiling point: ca. 480 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: negligible

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Anticipated human carcinogen. Harmful if swallowed, inhaled or absorbed through the skin.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R20 R21 R22 R45.

Transport information

Personal protection

Safety glasses, gloves, good ventilation. Handle as a carcinogen.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S45 S53.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for benzo[ghi]perylene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,12-benzoperylene, 1,12-benzperylene, benzo(g,h,i)perylene
Use:
Molecular formula: $C_{22}H_{12}$
CAS No: 191-24-2
EINECS No: 205-883-8

Physical data

Appearance: solid
Melting point: 278 C
Boiling point: 500 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: insoluble

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

May be harmful or act as an irritant - toxicology not fully investigated.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R50 R53.

Environmental information

Very toxic to aquatic organisms - may cause long-term damage in the aquatic environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 3077. Hazard class 9. Packing group III.

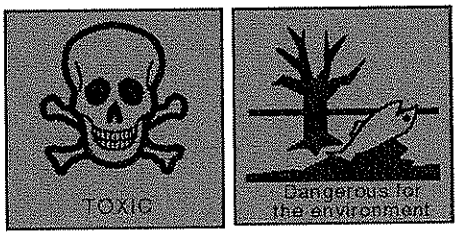
Personal protection

Safety glasses.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S22 S24 S25 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for benzo[b]fluoranthene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 3,4-benzofluoranthene, benz[e]acenaphthanthrylene, 3,4-benz[e] acenaphthanthrylane, 2,3-benzofluoranthene, benzofluoranthrene, benzo[e] fluoranthene
Use:
Molecular formula: $C_{20}H_{12}$
CAS No: 205-99-2
EINECS No: 205-911-9
EC Index No: 601-024-00-4

Physical data

Appearance: off-white to tan powder
Melting point: 163 - 165 C
Boiling point:
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

Toxic. Probable human carcinogen. May act as an irritant.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R45 R50 R53.

Environmental information

Very harmful to aquatic organisms - may cause long-term damage to the environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)

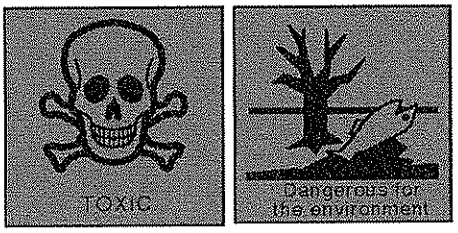
Personal protection

Safety glasses, good ventilation, disposable gloves. Treat as a possible carcinogen.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for benzo(a)pyrene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2-benzopyrene, 6,7-benzopyrene, benzo[a]pyrene, B(a)P, BP, 3,4-benzopyrene, benzo[d,e,f]chrysene, 3,4-benzpyrene, benzpyrene, 3,4-benzylpyrene, 3,4-benz[a]pyrene, 3,4-BP, 3,4-benzopyrene
Molecular formula: $C_{20}H_{12}$
CAS No: 50-32-8
EINECS No: 200-028-5
EU Index No: 601-032-00-3

Physical data

Appearance: yellow crystals or powder [found in cigarette smoke, coal tar, fuel exhaust gas and in many other sources]
Melting point: 176 C
Boiling point: 495 C
Vapour density: 8.7 (air = 1)
Vapour pressure:
Density (g cm^{-3}): 1.351
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility: slight

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

POISON. This material is an experimental carcinogen, mutagen, tumorigen, neoplastigen and teratogen. It is a probable carcinogen in humans and a known human mutagen. IARC Group 2A carcinogen. It is believed to cause bladder, skin and lung cancer. Exposure to it may damage the developing foetus. May cause reproductive damage. May be transferred to nursing infants through mother's milk. Skin, respiratory and eye irritant. May cause changes to the colour and properties of skin. Exposure to sunlight can increase the skin damage caused by this chemical.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
SCU-RAT LD50 50 mg kg^{-1}
IPR-MUS LDLO 500 mg kg^{-1}
IRN-FRG LDLO 11 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R45 R46 R50 R53 R60 R61.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Un No 2811. Packing group III. Hazard class 6.1.

Environmental information

Very toxic in the environment - may cause long-term damage.

Personal protection

Restricted material. Only to be used by trained workers. Prepare a full risk assessment before starting work. Safety glasses, gloves, good ventilation. Handle as a carcinogen. Do not dry sweep spills because of the risk of increasing the amount of airborne material.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)

S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Chemical Database
Benz[A]Anthracene

Identifications

- **CAS Number:** 56-55-3
- **RCRA Waste Number:** U018
- **Synonyms/Related:**
  - 1, 2-Benzanthracene
  - 1, 2-Benzoanthracene
  - 1,2-Benz(a) anthracene
  - 1,2-Benzanthracene
  - 1,2-Benzanthrazen
  - 1,2-Benzanthrazen [German]
  - 1,2-Benzanthrene
  - 1,2-Benzoanthracene
  - 1,2-Benz[a]anthracene
  - 2,3-Benzophenanthrene
  - 2,3-Benzphenanthrene
  - BENZ(A) ANTHRACENE
  - Benz(a) anthracene [Polycyclic aromatic compounds]
  - Benz(a) anthracene [Polycyclic aromatic hydrocarbons]
  - Benzanthracene
  - Benzanthrene
  - Benzo(a) anthracene
  - Benzo(b) phenanthrene
  - Benzoanthracene
  - Benzo[a]anthracene
  - Benzo[a]phenanthrene
  - Benzo[b]phenanthrene
  - Benz[A]Anthracene
  - Naphthanthracene
  - Tetraphene

Related Resources

- **USDOT Hazardous Materials Table 49 CFR 172.101**
  An online version of the USDOT's listing of hazardous materials from 49CFR 172.101. This table can be sorted by proper shipping name, UN/NA ID and/or by primary hazard class/division.
- **2004 ERG (Emergency Response Guidebook)**
  Have you ever wondered what those four digit numbers on the placards on the side of trucks and rail cars mean? Our online 2004ERG will give you your answer. This is an online version of the guidebook produced by the USDOT for first responders during the initial phase of a Dangerous goods/HazMat incident.
- **US DOT Hazardous Materials Transportation Placards**
  Hazardous materials placards (DOT placards) are required when shipping hazardous materials in the United States, Canada and Mexico. These pages provide US DOT definitions for each hazmat placard.
- **Guide for Handling Household Chemicals**
  Things you can do to make your home safer.
- **Molarity, Molality and Normality**
  Introduces stoichiometry and explains the differences between molarity, molality and normality.
- **Molar Mass Calculations and Javascript Calculator**
  Molar mass calculations are explained and there is a JavaScript calculator to aid calculations.
- **Periodic Table of Elements**
  Provides comprehensive data for each element of the periodic table of elements including up to 40 properties, names in 10 languages and common chemical compounds. Information also provided for 3,600 nuclides and 4,400 nuclide decay modes.

Editor's note: Some chemicals in this database contain more information than others due to the original reason this information was collected and how the compilation was accomplished.

While working with material safety data sheets (MSDS), I found that manufacturers sometimes used obscure names

for constituent chemicals and I didn't always have a good idea of what I was dealing with. To resolve this problem, over the years, I compiled chemical names and identifiers into a personal database, cross referencing regulatory and health safety information when possible. Colleagues and friends eventually started suggesting that I make my data available on this website so that others could benefit from my efforts -- which I finally did in 2004. The more common, regulated and/or hazardous a chemical is, the more information I will have likely collected it.

Further notes are below.

Trademarks

If you are aware of any synonyms listed above that are registered trademarks, please contact us with relevant information so that trademarks can be appropriately noted.

Notes about mixtures

Some chemicals listed in this database or not pure chemical compounds, rather they are mixtures/solutions of chemicals. It is not uncommon for wide range of molar ratios of a mixture to be lumped together as "synonyms" of the same "chemical". In some instances chemicals that are very similar from a health & safety and/or regulatory standpoint also may have been lumped together.

Reference Sources

Data for this database was compiled from: hundreds of Material Safety Data Sheets (MSDS) of common industrial and household products; the Hazardous Materials Table from the United States "Code of Federal Regulations" title 49 section 172.101; the National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards; the US DOT 1996, 2000 & 2004 Emergency Response Guidebooks; U.S. National Library of Medicine and many other related resources.

Safety data for indeno[1,2,3-cd]pyrene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,10-(1,2-phenylene)pyrene, 1,10-(o-phenylene)pyrene, o-phenylenepyrene, 2,3-phenylenepyrene, 2,3,o-phenylenepyrene, IP
Use:
Molecular formula: $C_{22}H_{12}$
CAS No: 193-39-5
EINECS No: 205-893-2

Physical data

Appearance: solid
Melting point: 161 - 163 C
Boiling point: 536 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

Limited evidence that this material may be carcinogenic.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R40.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Non-hazardous for air, sea and road freight.

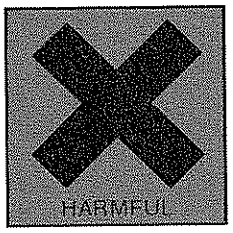
Personal protection

Treat as potentially hazardous - many multi-ring aromatic compounds are suspected carcinogens.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S36 S37 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for pyrene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: beta-pyrene, coal tar pitch volatiles
Molecular formula: $C_{16}H_{10}$
CAS No: 129-00-0
EC No: 204-927-3

Physical data

Appearance: yellow or white crystals and powder
Melting point: 149 - 151 C
Boiling point: 404 C
Vapour density:
Vapour pressure:
Specific gravity:
Flash point:
Explosion limits:
Autoignition temperature:

Stability

Stable. Incompatible with strong oxidizing agents. Flammable.

Toxicology

Harmful if swallowed. May be harmful by inhalation or through skin contact - readily absorbed through skin. Irritant. Toxicology not fully investigated.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)
ORL-RAT LD50 2700 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R10 R22 R36 R37 R38.

Personal protection

Safety glasses. Adequate ventilation.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for naphthalene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: albocarbon, mighty 150, mighty rd1, moth flakes, NCI-C52904, white tar, naphthalin, naphthene, camphor tar, tar camphor, moth balls
Molecular formula: $C_{10}H_8$

CAS No: 91-20-3
EC No: 202-049-5

Physical data

Appearance: white crystals
Melting point: 77 C
Boiling point: 218 C
Specific gravity: 1.14
Vapour pressure: 1 mm Hg at 20 C
Vapour density: 4.4 g/l
Flash point: 88 C
Explosion limits: 0.9 - 5.9%
Autoignition temperature:

Stability

Stable. Flammable - avoid sources of ignition. Incompatible with oxidizing agents. Heat-sensitive. Sublimes slowly at room temperature.

Toxicology

May cause irritation. Toxic by inhalation or ingestion. TLV 10 ppm. Sensitizer. Possible carcinogen.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)

ORL-CHD LDLO 100 mg kg^{-1}
UNR-HMN LDLO 29 mg kg^{-1}
ORL-MUS LD50 533 mg kg^{-1}
IVN-MUS LD50 100 mg kg^{-1}
ORL-RBT LD50 3000 mg kg^{-1}

Irritation data
EYE-RBT 100 mg/mld
SKN-RBT 495 mg open mld

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)

R20 R21 R22 R36 R37 R38 R43 R45.

Personal protection

Safety glasses. Use efficient ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S16 S26 S36 S37 S39 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for anthracene

Click here for data on anthracene in student-friendly format, from the HSci project

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: anthracin, paranaphthalene, green oil, tetra olive N2G
Molecular formula: $C_{14}H_{10}$

CAS No: 120-12-7
EINECS: 204-371-1

Physical data

Appearance: off-white to pale green crystals
Melting point: 215 - 219 C
Boiling point: 340 C
Specific gravity: 1.25
Vapour pressure:
Flash point: 121 C (closed cup)
Explosion limits: 0.6% (lower)
Autoignition temperature:

Stability

Stable. Substances to be avoided include strong oxidizing agents, hypochlorites, chromic acid, fluorine. Flammable.

Toxicology

Dust may irritate eyes, throat, nose or lungs. May act as a sensitizer. Possible tumor promotor. Typical PEL TWA 0.2 mg/m3.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-MUS Acute 1470-2440 mg kg^{-1}
IPR-MUS LD50 430 mg kg^{-1}

Irritation data
(The meaning of any abbreviations which appear in this section is given here.)
SKN-MUS 118 mg mld

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R36 R37 R38 R50 R53.

Environmental information

Harmful in the environment.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
UN No 3077. Hazard class 9. Packing group III.

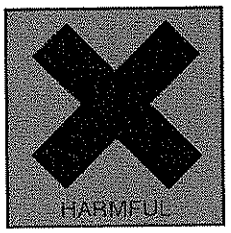
Personal protection

Safety glasses. Suitable ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S26 S36.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for acenaphthylene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: cycopenta(de)naphthalene
Use:
Molecular formula: $C_{12}H_8$
CAS No: 208-96-8
EINECS No: 205-917-1

Physical data

Appearance: yellow crystalline powder
Melting point: 90 - 92 C
Boiling point: 280 C
Vapour density:
Vapour pressure:
Density (g cm^{-3}):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:

Stability

Stable. Incompatible with oxidizing agents.

Toxicology

Harmful if swallowed. May be harmful if inhaled or absorbed through the skin. Skin, eye and respiratory irritant. Toxicology not fully investigated.

Toxicity data
(The meaning of any toxicological abbreviations which appear in this section is given here.)
IPR-RAT LD50 1700 mg kg^{-1}
ORL-MUS LD50 1760 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R22 R36 R37 R38.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)

Personal protection

Safety glasses, adequate ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S26 S36 S37 S39.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Chemical Database
2-Methylnaphthalene

Identifications

- **CAS Number:** 91-57-6
- **Synonyms/Related:**
  - .beta.-Methylnaphthalene
  - 2-Methylnaphthalene
  - 2-Naphthylmethyl radical
  - beta-methyl naphthalenes
  - beta-Methylnaphthalene
  - c0699
  - C14098
  - NAPHTALENE,2-METHYL MFC11 H10
  - Naphthalene, 2-methyl-
  - Naphthalene, beta-methyl-

Related Resources

- **USDOT Hazardous Materials Table 49 CFR 172.101**
  An online version of the USDOT's listing of hazardous materials from 49CFR 172.101. This table can be sorted by proper shipping name, UN/NA ID and/or by primary hazard class/division.
- **2004 ERG (Emergency Response Guidebook)**
  Have you ever wondered what those four digit numbers on the placards on the side of trucks and rail cars mean? Our online 2004ERG will give you your answer. This is an online version of the guidebook produced by the USDOT for first responders during the initial phase of a Dangerous goods/HazMat incident.
- **US DOT Hazardous Materials Transportation Placards**
  Hazardous materials placards (DOT placards) are required when shipping hazardous materials in the United States, Canada and Mexico. These pages provide US DOT definitions for each hazmat placard.
- **Guide for Handling Household Chemicals**
  Things you can do to make your home safer.
- **Molarity, Molality and Normality**
  Introduces stoichiometry and explains the differences between molarity, molality and normality.
- **Molar Mass Calculations and Javascript Calculator**
  Molar mass calculations are explained and there is a JavaScript calculator to aid calculations.
- **Periodic Table of Elements**
  Provides comprehensive data for each element of the periodic table of elements including up to 40 properties, names in 10 languages and common chemical compounds. Information also provided for 3,600 nuclides and 4,400 nuclide decay modes.

Editor's note: Some chemicals in this database contain more information than others due to the original reason this information was collected and how the compilation was accomplished.

While working with material safety data sheets (MSDS), I found that manufacturers sometimes used obscure names for constituent chemicals and I didn't always have a good idea of what I was dealing with. To resolve this problem, over the years, I compiled chemical names and identifiers into a personal database, cross referencing regulatory and health safety information when possible. Colleagues and friends eventually started suggesting that I make my data available on this website so that others could benefit from my efforts -- which I finally did in 2004. The more common, regulated and/or hazardous a chemical is, the more information I will have likely collected it.

Further notes are below.

Trademarks

If you are aware of any synonyms listed above that are registered trademarks, please contact us with relevant information so that trademarks can be appropriately noted.

Notes about mixtures

Some chemicals listed in this database or not pure chemical compounds, rather they are mixtures/solutions of chemicals. It is not uncommon for wide range of molar ratios of a mixture to be lumped together as "synonyms" of the same "chemical". In some instances chemicals that are very similar from a health & safety and/or regulatory standpoint also may have been lumped together.

Reference Sources

Data for this database was compiled from: hundreds of Material Safety Data Sheets (MSDS) of common industrial and household products; the Hazardous Materials Table from the United States "Code of Federal Regulations" title 49 section 172.101; the National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards; the US DOT 1996, 2000 & 2004 Emergency Response Guidebooks; U.S. National Library of Medicine and many other related resources.

Safety data for 2-butanone

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: methylacetone, ethyl methyl ketone, methyl ethyl ketone, MEK, butanone, MEETCO
Molecular formula: C_4H_8O

CAS No: 78-93-3
EINECS No: 201-159-0

Physical data

Appearance: colourless liquid
Melting point: -87 C
Boiling point: 80 C
Vapour density: 2.49 (air = 1)
Vapour pressure: 71 mm Hg at 20 C
Density (g cm^{-3}): 0.805
Flash point: -3 C
Explosion limits: 1.8% - 10.1%
Autoignition temperature: 515 C
Water solubility:

Stability

Stable. Highly flammable. Incompatible with oxidizing agents, bases, strong reducing agents. Protect from moisture.

Toxicology

Severe eye irritant. Can cause CNS depression. Skin irritant. May be harmful by ingestion, inhalation or through skin contact. May cause dermatitis.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 2737 mg kg^{-1}
IHL-RAT LC50 23500 mg/m3/8h
IPR-RAT LD50 607 mg kg^{-1}
ORL-MUS LD50 4050 mg kg^{-1}
IHL-MAM LC50 38 g m^{-3}
IHL-MUS LC50 32 g/m3/4h

Irritation data
(The meaning of any abbreviations which appear in this section is given here.)
EYE-HMN 350 ppm
SKN-RBT 500 mg/24 mod
SKN-RBT 402 mg/24h mld
SKN-RBT 14 mg/24h open mld

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R11 R36 R37.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Hazard class: 3.0. UN No 1193. Packing group: II.

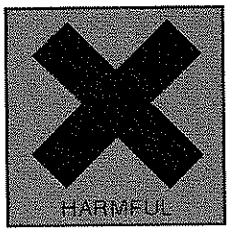
Personal protection

Safety glasses, adquate ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S9 S16 S25 S33.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for m-xylene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: m-dimethylbenzene, meta-xylene, 1,3-dimethylbenzene, 1,3-xylene

Molecular formula: C_8H_{10}

CAS No: 108-38-3
EC No: 203-576-3

Physical data

Appearance: colourless liquid
Melting point: -48 C
Boiling point: 138 - 139 C
Vapour density: 3.7
Vapour pressure: 16 mm Hg at 37.7 C
Specific gravity: 0.868
Flash point: 25 C
Explosion limits: 1.1 % - 7 %
Autoignition temperature: 527 C

Stability

Stable. Incompatible with oxidizing agents. Flammable.

Toxicology

Harmful by inhalation, ingestion or skin absorption. Narcotic effects. Readily absorbed through skin. May cause dermatitis. High concentrations can cause severe irritation. Reproductive hazard. Typical PEL 100 ppm.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 5000 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R10 R20 R21 R22 R36 R37 R38.

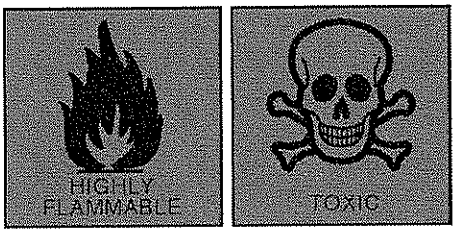
Personal protection

Safety glasses. Good ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S25.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for toluene



Click here for data on toluene in student-friendly format, from the HSci project

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: methylbenzene, phenylmethane, toluol, antisal 1A, CP 25, methacide, methylbenzol, NCI-C07272, RCRA waste number U220, tolu-sol
Uses: Solvent
Molecular formula: C_7H_8
CAS No: 108-88-3
EC No: 203-625-9
Annex I Index No: 601-021-00-3

Physical data

Appearance: Colourless liquid with a benzene-like odour (odour threshold 0.17 ppm)
Melting point: -93 C
Boiling point: 110.6 C
Specific gravity: 0.865
Vapour pressure: 22 mm Hg at 20 C (vapour density 3.2)
Flash point: 4 C
Explosion limits: 1% - 7%
Autoignition temperature: 536 C

Stability

Stable. Substances to be avoided: oxidizing agents, oxygen, moisture. Highly

flammable. Hygroscopic.

Toxicology

Toxic by inhalation, ingestion or by absorption through skin. Serious irritant. Experimental teratogen.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 636 mg kg^{-1}
IPR-RAT LD50 1332 mg kg^{-1}
ORL-HMN LDLO 50 mg kg^{-1}
IPR-MUS LD50 59 mg kg^{-1}
IHL-MAM LC50 30 g m^{-3}

Irritation data
(The meaning of any abbreviations which appear in this section is given here.)
EYE-HMN 300 ppm.
SKN-RBT 435 mg mild.

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R11 R23 R24 R25.

Transport information

(The meaning of any UN hazard codes which appear in this section is given here.)
Hazard class 3.0 Packing group II. UN No 1294. IMDG class 3.

Personal protection

Safety glasses. Good ventilation.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S16 S25 S29 S33.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for ethylbenzene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: phenylethane, EB, ethylbenzol, ethyl benzene
Molecular formula: C_8H_{10}
CAS No: 100-41-4
EC No: 202-849-4

Physical data

Appearance: colourless liquid
Melting point: -95 C
Boiling point: 136 C
Vapour density: 3.7
Vapour pressure: 10 mm Hg at 20 C
Specific gravity: 0.867
Flash point: 15 C
Explosion limits: 1 % - 6.7 %
Autoignition temperature: 432 C

Stability

Stable. Incompatible with oxidizing agents. Flammable.

Toxicology

May be harmful by inhalation, ingestion or through skin contact. Causes severe eye irritation. Skin and respiratory system irritant. Experimental teratogen. Narcotic in high concentration.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-RAT LD50 3500 mg kg^{-1}
SKN-RBT LD50 17800 mg kg^{-1}

IHL-GPG LCLO 10000 ppm

Irritation data
(The meaning of any abbreviations which appear in this section is given here.)
SKN-RBT 15 mg/24h open mld.

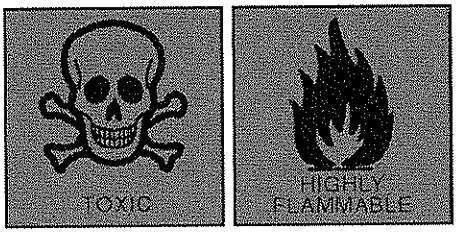
Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R10 R36 R37 R38.

Personal protection

Safety glasses. Good ventilation.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Safety data for benzene



Click here for data on benzene in student-friendly format, from the HSci project

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: (6)annulene, benzin, benzol, benzole, benzolene, phene, phenyl hydride, pyrobenzole, coal naphtha
Molecular formula: C_6H_6

CAS No: 71-43-2
EC No: 200-753-7
Annex I Index No: 601-020-00-8

Physical data

Appearance: colourless liquid
Melting point: 5.5 C
Boiling point: 80 C
Specific gravity: 0.87
Vapour pressure: 74.6 mm Hg at 20 C
Flash point: -11 C
Explosion limits: 1.3 % - 8 %
Autoignition temperature: 561 C

Stability

Stable. Substances to be avoided include strong oxidizing agents, sulfuric acid, nitric acid, halogens. Highly flammable.

Toxicology

This material is a known carcinogen. The risks of using it in the laboratory must be fully assessed before work begins. TLV 10 ppm. Short-term exposure may cause a variety of effects, including nausea, vomiting, dizziness, narcosis, reduction in blood pressure, CNS depression. Skin contact may lead to dermatitis. Long-term exposure may lead to irreversible effects. Severe eye irritant. Skin and respiratory irritant.

Toxicity data
(The meaning of any abbreviations which appear in this section is given here.)
ORL-MAN LDLO 50 mg kg^{-1}
IHL-HMN LCLO 2000 ppm/5h
ORL-RAT LD50 930 mg kg^{-1}
IHL-MUS LC50 9980 ppm
IPR-MUS LD50 340 mg kg^{-1}
ORL-MUS LD50 4700 mg kg^{-1}

Risk phrases
(The meaning of any risk phrases which appear in this section is given here.)
R11 R23 R24 R25 R36 R38 R45 R48 R65.

Personal protection

Safety glasses, gloves, good ventilation. Thought should be given to using an alternative, safer product.

Safety phrases
(The meaning of any safety phrases which appear in this section is given here.)
S45 S53.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

Heat Stress Guidelines

OSHA® QUICK CARD™

Protecting Workers from Heat Stress

Heat Illness

Exposure to heat can cause illness and death. The most serious heat illness is heat stroke. Other heat illnesses, such as heat exhaustion, heat cramps and heat rash, should also be avoided.

There are precautions your employer should take any time temperatures are high and the job involves physical work.

Risk Factors for Heat Illness

- High temperature and humidity, direct sun exposure, no breeze or wind
- Low liquid intake; previous heat illnesses
- Heavy physical labor
- Waterproof clothing
- No recent exposure to hot workplaces

Symptoms of Heat Exhaustion

- Headache, dizziness, or fainting
- Weakness and wet skin
- Irritability or confusion
- Thirst, nausea, or vomiting

Symptoms of Heat Stroke

- May be confused, unable to think clearly, pass out, collapse, or have seizures (fits)
- May stop sweating

To Prevent Heat Illness, Your Employer Should

- Provide training about the hazards leading to heat stress and how to prevent them.
- Provide a lot of cool water to workers close to the work area. At least one pint of water per hour is needed.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA

OSHA 3154-08-10R v2

OSHA® QUICK CARD™

- Schedule frequent rest periods with water breaks in shaded or air-conditioned areas.
- Routinely check workers who are at risk of heat stress due to protective clothing and high temperature.
- Consider protective clothing that provides cooling.

How You Can Protect Yourself and Others

- Know signs/symptoms of heat illnesses; monitor yourself; use a buddy system.
- Block out direct sun and other heat sources.
- Drink plenty of fluids. Drink often and BEFORE you are thirsty.
- Avoid beverages containing alcohol or caffeine.
- Wear lightweight, light colored, loose-fitting clothes.

- Be aware that poor physical condition, some health problems (such as high blood pressure or diabetes), pregnancy, colds and flu, and some medications can increase your personal risk. If you are under treatment, ask your healthcare provider.

What to Do When a Worker is Ill from the Heat

- Call a supervisor for help. If the supervisor is not available, call 911.
- Have someone stay with the worker until help arrives.
- Move the worker to a cooler/shaded area.
- Remove outer clothing.
- Fan and mist the worker with water; apply ice (ice bags or ice towels).
- Provide cool drinking water, if able to drink.

IF THE WORKER IS NOT ALERT or seems confused, this may be a heat stroke. CALL 911 IMMEDIATELY and apply ice as soon as possible.

If you have any questions or concerns, call OSHA at 1-800-321-OSHA.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA

Directive Number: TED 01-00-015
Effective Date: 1/20/1999

SECTION III: CHAPTER 4

HEAT STRESS

Contents:

For problems with accessibility in using figures and illustrations in this document, please contact the Office of Science and Technology Assessment at (202) 693-2095 .

I. INTRODUCTION.

Operations involving high air temperatures, radiant heat sources, high humidity, direct physical contact with hot objects, or strenuous physical activities have a high potential for inducing heat stress in employees engaged in such operations. Such places include: iron and steel foundries, nonferrous foundries, brick-firing and ceramic plants, glass products facilities, rubber products factories, electrical utilities (particularly boiler rooms), bakeries, confectioneries, commercial kitchens, laundries, food canneries, chemical plants, mining sites, smelters, and steam tunnels.

Outdoor operations conducted in hot weather, such as construction, refining, asbestos removal, and hazardous waste site activities, especially those that require workers to wear semipermeable or impermeable protective clothing, are also likely to cause heat stress among exposed workers.

A. CAUSAL FACTORS.

1. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. However, even the type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

2. It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

B. DEFINITIONS.

1. The American Conference of Governmental Industrial Hygienists (1992) states that workers should not be permitted to work when their deep body temperature exceeds 38°C (100.4°F).

2. **Heat** is a measure of energy in terms of quantity.

3. A **calorie** is the amount of heat required to raise 1 gram of water 1°C (based on a standard temperature of 16.5 to 17.5°C).

4. **Conduction** is the transfer of heat between materials that contact each other. Heat passes from the warmer material to the cooler material. For example, a worker's skin can transfer heat to a contacting surface if that surface is cooler, and vice versa.

5. **Convection** is the transfer of heat in a moving fluid. Air flowing past the body can cool the body if the air temperature is cool. On the other hand, air that exceeds 35°C (95°F) can increase the heat load on the body.

6. **Evaporative cooling** takes place when sweat evaporates from the skin. High humidity reduces the rate of evaporation and thus reduces the effectiveness of the body's primary cooling mechanism.

7. **Radiation** is the transfer of heat energy through space. A worker whose body temperature is greater than the temperature of the surrounding surfaces radiates heat to these surfaces. Hot surfaces and infrared light sources radiate heat that can increase the body's heat load.

8. **Globe temperature** is the temperature inside a blackened, hollow, thin copper globe.

9. **Metabolic heat** is a by-product of the body's activity.

10. **Natural wet bulb (NWB) temperature** is measured by exposing a wet sensor, such as a wet cotton wick fitted over the bulb of a thermometer, to the effects of evaporation and convection. The term natural refers to the movement of air around the sensor.

11. **Dry bulb (DB) temperature** is measured by a thermal sensor, such as an ordinary mercury-in-glass thermometer, that is shielded from direct radiant energy sources.

II. HEAT DISORDERS AND HEALTH EFFECTS.

A. **HEAT STROKE** occurs when the body's system of temperature regulation fails and body temperature rises to critical levels. This condition is caused by a combination of highly variable factors, and its occurrence is difficult to predict. Heat stroke is a medical emergency. The primary signs and symptoms of heat stroke are confusion; irrational behavior; loss of consciousness; convulsions; a lack of sweating (usually); hot, dry skin; and an abnormally high body temperature, e.g., a rectal temperature of 41°C (105.8°F). If body temperature is too high, it causes death. The elevated metabolic temperatures caused by a combination of work load and environmental heat load, both of which contribute to heat stroke, are also highly variable and difficult to predict.

If a worker shows signs of possible heat stroke, professional medical treatment should be obtained immediately. The worker should be placed in a shady area and the outer clothing should be removed. The worker's skin should be wetted and air movement around the worker should be increased to improve evaporative cooling until professional methods of cooling are initiated and the seriousness of the condition can be assessed. Fluids should be replaced as soon as possible. The medical outcome of an episode of heat stroke depends on the victim's physical fitness and the timing and effectiveness of first aid treatment.

Regardless of the worker's protests, no employee suspected of being ill from heat stroke should be sent home or left unattended unless a physician has specifically approved such an order.

B. **HEAT EXHAUSTION**. The signs and symptoms of heat exhaustion are headache, nausea, vertigo, weakness, thirst, and giddiness. Fortunately, this condition responds readily to prompt treatment. Heat exhaustion should not be dismissed lightly, however, for several reasons. One is that the fainting associated with heat exhaustion can be dangerous because the victim may be operating machinery or controlling an operation that should not be left unattended; moreover, the victim may be injured when he or she faints. Also, the signs and symptoms seen in heat exhaustion are similar to those of heat stroke, a medical emergency.

Workers suffering from heat exhaustion should be removed from the hot environment and given fluid replacement. They should also be encouraged to get adequate rest.

C. **HEAT CRAMPS** are usually caused by performing hard physical labor in a hot environment. These cramps have been attributed to an electrolyte imbalance caused by sweating. It is important to understand that cramps can be caused by both too much and too little salt. Cramps appear to be caused by the lack of water replenishment. Because sweat is a hypotonic solution (±0.3% NaCl), excess salt can build up in the body if the water lost through sweating is not replaced. Thirst cannot be relied on as a guide to the need for water; instead, water must be taken every 15 to 20 minutes in hot environments.

Under extreme conditions, such as working for 6 to 8 hours in heavy protective gear, a loss of sodium may occur. Recent studies have shown that drinking commercially available carbohydrate-electrolyte replacement liquids is effective in minimizing physiological disturbances during recovery.

D. **HEAT COLLAPSE** ("Fainting"). In heat collapse, the brain does not receive enough oxygen because blood pools in the extremities. As a result, the exposed individual may lose consciousness. This reaction is similar to that of heat exhaustion and does not affect the body's heat balance. However, the onset of heat collapse is rapid and unpredictable. To prevent heat collapse, the worker should gradually become acclimatized to the hot environment.

E. **HEAT RASHES** are the most common problem in hot work environments. Prickly heat is manifested as red papules and usually appears in areas where the clothing is restrictive. As sweating increases, these papules give rise to a prickling sensation. Prickly heat occurs in skin that is persistently wetted by unevaporated sweat, and heat rash papules may become infected if they are not treated. In most cases, heat rashes will disappear when the affected individual returns to a cool environment.

F. **HEAT FATIGUE.** A factor that predisposes an individual to heat fatigue is lack of acclimatization. The use of a program of acclimatization and training for work in hot environments is advisable. The signs and symptoms of heat fatigue include impaired performance of skilled sensorimotor, mental, or vigilance jobs. There is no treatment for heat fatigue except to remove the heat stress before a more serious heat-related condition develops.

III. INVESTIGATION GUIDELINES.

These guidelines for evaluating employee heat stress approximate those found in the 1992-1993 ACGIH publication, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.*

A. EMPLOYER AND EMPLOYEE INTERVIEWS.

1. The inspector will review the OSHA 200 Log and, if possible, the OSHA 101 forms for indications of prior heat stress problems.

2. Following are some questions for employer interviews: What type of action, if any, has the employer taken to prevent heat stress problems? What are the potential sources of heat? What employee complaints have been made?

3. Following are some questions for employee interviews: What heat stress problems have been experienced? What type of action has the employee taken to minimize heat stress? What is the employer's involvement, i.e., does employee training include information on heat stress? (Appendix III:4-1 lists factors to be evaluated when reviewing a heat stress situation, and Appendix III:4-2 contains a follow-up checklist.)

B. **WALKAROUND INSPECTION.** During the walkaround inspection, the investigator will: determine building and operation characteristics; determine whether engineering controls are functioning properly; verify information obtained from the employer and employee interviews; and perform temperature measurements and make other determinations to identify potential sources of heat stress. Investigators may wish to discuss any operations that have the potential to cause heat stress with engineers and other knowledgeable personnel. The walkaround inspection should cover all affected areas. Heat sources, such as furnaces, ovens, and boilers, and relative heat load per employee should be noted.

C. **WORK-LOAD ASSESSMENT.**

1. Under conditions of high temperature and heavy workload, the CSHO should determine the work-load category of each job (Table III:4-1 and Figure III:4-1). Work-load category is determined by averaging metabolic rates for the tasks and then ranking them:

    1. Light work: up to 200 kcal/hour
    2. Medium work: 200-350 kcal/hour
    3. Heavy work: 350-500 kcal/hour

2. *Cool Rest Area:* Where heat conditions in the rest area are different from those in the work area, the metabolic rate (M) should be calculated using a time-weighted average, as follows:

    Equation III: 4-1. Average Metabolic Rate

$$Average_M = \frac{(M_1)(t_1)+(M_2)(t_2)+\ldots+(M_n)(t_n)}{(t_1)+(t_2)+\ldots(t_n)}$$

    where: M = metabolic rate

    t = time in minutes

    In some cases, a videotape is helpful in evaluating work practices and metabolic load.

FIGURE III:4-1. ACTIVITY EXAMPLES

- Light hand work: writing, hand knitting
- Heavy hand work: typewriting
- Heavy work with one arm: hammering in nails (shoemaker, upholsterer)
- Light work with two arms: filing metal, planing wood, raking the garden
- Moderate work with the body: cleaning a floor, beating a carpet
- Heavy work with the body: railroad track laying, digging, barking trees

Sample Calculation: Assembly line work using a heavy hand tool

Walking along	2.0 kcal/min
Intermediate value between heavy work with two arms and light work with the body	3.0 kcal/min
Add for basal metabolism	1.0 kcal/min
Total:	6.0 kcal/min

Source: ACGIH 1992.

TABLE III:4-1. ASSESSMENT OF WORK

Body position and movement	***kcal/min****
Sitting	0.3
Standing	0.6
Walking	2.0-3.0
Walking uphill	add 0.8 for every meter (yard) rise

Type of work	***Average kcal/min***	***Range kcal/min***
Hand work		
Light	0.4	0.2-1.2
Heavy	0.9	
Work: One arm		
Light	1.0	0.7-2.5
Heavy	1.7	
Work: Both arms		
Light	1.5	1.0-3.5
Heavy	2.5	
Work: Whole body		
Light	3.5	2.5-15.0
Moderate	5.0	
Heavy	7.0	
Very heavy	9.0	

* For a "standard" worker of 70 kg body weight (154 lbs) and 1.8m^2 body surface (19.4 ft^2).

Source: ACGIH 1992.

IV. **SAMPLING METHODS.**

A. **BODY TEMPERATURE MEASUREMENTS.** Although instruments are available to estimate deep body temperature by measuring the temperature in the ear canal or on the skin, these instruments are not sufficiently reliable to use in compliance evaluations.

B. **ENVIRONMENTAL MEASUREMENTS.** Environmental heat measurements should be made at, or as close as possible to, the specific work area where the worker is exposed. When a worker is not continuously exposed in a single hot area but moves between two or more areas having different levels of environmental heat, or when the environmental heat varies substantially at a single hot area, environmental heat exposures should be measured for each area and for each level of environmental heat to which employees are exposed.

C. **WET BULB GLOBE TEMPERATURE INDEX.**

1. Wet Bulb Globe Temperature (WBGT) should be calculated using the appropriate formula in Appendix III:4-2. The

WBGT for continuous all-day or several hour exposures should be averaged over a 60-minute period. Intermittent exposures should be averaged over a 120-minute period. These averages should be calculated using the following formula:

Equation III:4-2. Average Web Bulb Globe Temperature (WBGT)

$$Average_{WBGT} = \frac{(WBGT_1)(t_1)+ (WBGT_2)(t_2)+...+(WBGT_n)(t_n)}{(t_1)+(t_2)+...(t_n)}$$

For indoor and outdoor conditions with no solar load, WBGT is calculated as:

$$WBGT = 0.7NWB + 0.3GT$$

For outdoors with a solar load, WBGT is calculated as

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Nature Wet-Bulb Temperature
DB = Dry-Bulb Temperature
GT = Globe Temperature

2. The exposure limits in Table III:4-2 are valid for employees wearing light clothing. They must be adjusted for the insulation from clothing that impedes sweat evaporation and other body cooling mechanisms. Use Table III:4-3 to correct Table III:4-2 for various kinds of clothing.

3. Use of Table III:4-2 requires knowledge of the WBGT and approximate workload. Workload can be estimated using the data in Table III:4-1, and sample calculations are presented in Figure III:4-1.

D. **MEASUREMENT**. Portable heat stress meters or monitors are used to measure heat conditions. These instruments can calculate both the indoor and outdoor WBGT index according to established ACGIH Threshold Limit Value equations. With this information and information on the type of work being performed, heat stress meters can determine how long a person can safely work or remain in a particular hot environment. See Appendix III:4-2 for an alternate method of calculation.

TABLE III:4-2. PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUE

	---------- Work Load* ----------		
Work/rest regimen	**Light**	**Moderate**	**Heavy**
Continuous work	30.0°C (86°F)	26.7°C (80°F)	25.0°C (77°F)
75% Work, 25% rest, each hour	30.6°C (87°F)	28.0°C (82°F)	25.9°C (78°F)
50% Work, 50% rest, each hour	31.4°C (89°F)	29.4°C (85°F)	27.9°C (82°F)
25% Work, 75% rest, each hour	32.2°C (90°F)	31.1°C (88°F)	30.0°C (86°F)

*Values are in °C and °F, WBGT.

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38°C (100.4° F). They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH *1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III:4-2 must be reduced by the corrections shown in Table III:4-3.

Source: ACGIH 1992.

E. **OTHER THERMAL STRESS INDICES.**

1. The Effective Temperature index (ET) combines the temperature, the humidity of the air, and air velocity. This index has been used extensively in the field of comfort ventilation and air-conditioning. ET remains a useful measurement technique in mines and other places where humidity is high and radiant heat is low.

2. The Heat-Stress Index (HSI) was developed by Belding and Hatch in 1965. Although the HSI considers all environmental factors and work rate, it is not completely satisfactory for determining an individual worker's heat stress and is also difficult to use.

TABLE III:4-3. WBGT CORRECTION FACTORS IN °C

Clothing type	Clo* value	WBGT correction
Summer lightweight working clothing	0.6	0
Cotton coveralls	1.0	-2
Winter work clothing	1.4	-4
Water barrier, permeable	1.2	-6

*Clo: Insulation value of clothing. One clo = 5.55 kcal/m^2/hr of heat exchange by radiation and convection for each degree °C difference in temperature between the skin and the adjusted dry bulb temperature.

Note: Deleted from the previous version are trade names and "fully encapsulating suit, gloves, boots and hood" including its clo value of 1.2 and WBGT correction of -10.

Source: ACGIH 1992.

V. **CONTROL.**

Ventilation, air cooling, fans, shielding, and insulation are the five major types of engineering controls used to reduce heat stress in hot work environments. Heat reduction can also be achieved by using power assists and tools that reduce the physical demands placed on a worker.

However, for this approach to be successful, the metabolic effort required for the worker to use or operate these devices must be less than the effort required without them. Another method is to reduce the effort necessary to operate power assists. The worker should be allowed to take frequent rest breaks in a cooler environment.

A. **ACCLIMATIZATION.**

1. The human body can adapt to heat exposure to some extent. This physiological adaptation is called acclimatization. After a period of acclimatization, the same activity will produce fewer cardiovascular demands. The worker will sweat more efficiently (causing better evaporative cooling), and thus will more easily be able to maintain normal body temperatures.

2. A properly designed and applied acclimatization program decreases the risk of heat-related illnesses. Such a program basically involves exposing employees to work in a hot environment for progressively longer periods. NIOSH (1986) says that, for workers who have had previous experience in jobs where heat levels are high enough to produce heat stress, the regimen should be 50% exposure on day one, 60% on day two, 80% on day three, and 100% on day four. For new workers who will be similarly exposed, the regimen should be 20% on day one, with a 20% increase in exposure each additional day.

B. **FLUID REPLACEMENT**. Cool (50°-60°F) water or any cool liquid (except alcoholic beverages) should be made available to workers to encourage them to drink small amounts frequently, e.g., one cup every 20 minutes. Ample supplies of liquids should be placed close to the work area. Although some commercial replacement drinks contain salt, this is not necessary for acclimatized individuals because most people add enough salt to their summer diets.

C. **ENGINEERING CONTROLS.**

1. **General ventilation** is used to dilute hot air with cooler air (generally cooler air that is brought in from the outside). This technique clearly works better in cooler climates than in hot ones. A permanently installed ventilation system usually handles large areas or entire buildings. Portable or local exhaust systems may be more effective or practical in smaller areas.

2. **Air treatment/air cooling** differs from ventilation because it reduces the temperature of the air by removing heat (and sometimes humidity) from the air.

3. **Air conditioning** is a method of air cooling, but it is expensive to install and operate. An alternative to air conditioning is the use of chillers to circulate cool water through heat exchangers over which air from the ventilation system is then passed; chillers are more efficient in cooler climates or in dry climates where

evaporative cooling can be used.

4. **Local air cooling** can be effective in reducing air temperature in specific areas. Two methods have been used successfully in industrial settings. One type, cool rooms, can be used to enclose a specific workplace or to offer a recovery area near hot jobs. The second type is a portable blower with built-in air chiller. The main advantage of a blower, aside from portability, is minimal set-up time.

5. Another way to reduce heat stress is to increase the air flow or **convection** using fans, etc. in the work area (as long as the air temperature is less than the worker's skin temperature). Changes in air speed can help workers stay cooler by increasing both the convective heat exchange (the exchange between the skin surface and the surrounding air) and the rate of evaporation. Because this method does not actually cool the air, any increases in air speed must impact the worker directly to be effective.

   If the dry bulb temperature is higher than 35°C (95°F), the hot air passing over the skin can actually make the worker hotter. When the temperature is more than 35°C and the air is dry, evaporative cooling may be improved by air movement, although this improvement will be offset by the convective heat. When the temperature exceeds 35°C and the relative humidity is 100%, air movement will make the worker hotter. Increases in air speed have no effect on the body temperature of workers wearing vapor-barrier clothing.

6. **Heat conduction** methods include insulating the hot surface that generates the heat and changing the surface itself.

7. Simple engineering controls, such as shields, can be used to reduce radiant **heat,** i.e. heat coming from hot surfaces within the worker's line of sight. Surfaces that exceed 35°C (95°F) are sources of infrared radiation that can add to the worker's heat load. Flat black surfaces absorb heat more than smooth, polished ones. Having cooler surfaces surrounding the worker assists in cooling because the worker's body radiates heat toward them.

   With some sources of radiation, such as heating pipes, it is possible to use both insulation and surface modifications to achieve a substantial reduction in radiant heat. Instead of reducing radiation from the source, shielding can be used to interrupt the path between the source and the worker. Polished surfaces make the best barriers, although special glass or metal mesh surfaces can be used if visibility is a problem.

   Shields should be located so that they do not interfere with air flow, unless they are also being used to reduce convective heating. The reflective surface of the shield should be kept clean to maintain its effectiveness.

D. **ADMINISTRATIVE CONTROLS AND WORK PRACTICES.**

1. Training is the key to good work practices. Unless all employees understand the reasons for using new, or changing old, work practices, the chances of such a program succeeding are greatly reduced.

2. NIOSH (1986) states that a good heat stress training program should include at least the following components:

   - Knowledge of the hazards of heat stress;
   - Recognition of predisposing factors, danger signs, and symptoms;
   - Awareness of first-aid procedures for, and the potential health effects of, heat stroke;
   - Employee responsibilities in avoiding heat stress;
   - Dangers of using drugs, including therapeutic ones, and alcohol in hot work environments;
   - Use of protective clothing and equipment; and
   - Purpose and coverage of environmental and medical surveillance programs and the advantages of worker participation in such programs.

3. Hot jobs should be scheduled for the cooler part of the day, and routine maintenance and repair work in hot areas should be scheduled for the cooler seasons of the year.

E. **WORKER MONITORING PROGRAMS.**

1. Every worker who works in extraordinary conditions that increase the risk of heat stress should be personally monitored. These conditions include wearing semipermeable or impermeable clothing when the temperature exceeds 21°C (69.8°F), working at extreme metabolic loads (greater than 500 kcal/hour), etc.

2. Personal monitoring can be done by checking the heart rate, recovery heart rate, oral temperature, or extent of body water loss.

3. To check the heart rate, count the radial pulse for 30 seconds at the beginning of the rest period. If the heart rate exceeds 110 beats per minute, shorten the next work period by one third and maintain the same rest period.

4. The recovery heart rate can be checked by comparing the pulse rate taken at 30 seconds (P_1) with the pulse rate taken at 2.5 minutes (P_3) after the rest break starts. The two pulse rates can be interpreted using Table III:4-4.

5. Oral temperature can be checked with a clinical thermometer after work but before the employee drinks water. If the oral temperature taken under the tongue exceeds 37.6°C, shorten the next work cycle by one third.

6. Body water loss can be measured by weighing the worker on a scale at the beginning and end of each work day.

The worker's weight loss should not exceed 1.5% of total body weight in a work day. If a weight loss exceeding this amount is observed, fluid intake should increase.

F. **OTHER ADMINISTRATIVE CONTROLS**. The following administrative controls can be used to reduce heat stress:

- Reduce the physical demands of work, e.g., excessive lifting or digging with heavy objects;
- Provide recovery areas, e.g., air-conditioned enclosures and rooms;
- Use shifts, e.g., early morning, cool part of the day, or night work;
- Use intermittent rest periods with water breaks;
- Use relief workers;
- Use worker pacing; and
- Assign extra workers and limit worker occupancy, or the number of workers present, especially in confined or enclosed spaces.

TABLE III:4-4. HEART RATE RECOVERY CRITERIA

Heart rate recovery pattern	P_3	Difference between P_1 and P_3
Satisfactory recovery	<90	--
High recovery (Conditions may require further study)	90	10
No recovery (May indicate too much stress)	90	<10

VI. **PERSONAL PROTECTIVE EQUIPMENT.**

A. **REFLECTIVE CLOTHING**, which can vary from aprons and jackets to suits that completely enclose the worker from neck to feet, can stop the skin from absorbing radiant heat. However, since most reflective clothing does not allow air exchange through the garment, the reduction of radiant heat must more than offset the corresponding loss in evaporative cooling. For this reason, reflective clothing should be worn as loosely as possible. In situations where radiant heat is high, auxiliary cooling systems can be used under the reflective clothing.

B. **AUXILIARY BODY COOLING.**

1. Commercially available **ice vests**, though heavy, may accommodate as many as 72 ice packets, which are usually filled with water. Carbon dioxide (dry ice) can also be used as a coolant. The cooling offered by ice packets lasts only 2 to 4 hours at moderate to heavy heat loads, and frequent replacement is necessary. However, ice vests do not encumber the worker and thus permit maximum mobility. Cooling with ice is also relatively inexpensive.

2. **Wetted clothing** is another simple and inexpensive personal cooling technique. It is effective when reflective or other impermeable protective clothing is worn. The clothing may be wetted terry cloth coveralls or wetted two-piece, whole-body cotton suits. This approach to auxiliary cooling can be quite effective under conditions of high temperature and low humidity, where evaporation from the wetted garment is not restricted.

3. **Water-cooled garments** range from a hood, which cools only the head, to vests and "long johns," which offer partial or complete body cooling. Use of this equipment requires a battery-driven circulating pump, liquid-ice coolant, and a container.

   Although this system has the advantage of allowing wearer mobility, the weight of the components limits the amount of ice that can be carried and thus reduces the effective use time. The heat transfer rate in liquid cooling systems may limit their use to low-activity jobs; even in such jobs, their service time is only about 20 minutes per pound of cooling ice. To keep outside heat from melting the ice, an outer insulating jacket should be an integral part of these systems.

4. **Circulating air** is the most highly effective, as well as the most complicated, personal cooling system. By directing compressed air around the body from a supplied air system, both evaporative and convective cooling are improved. The greatest advantage occurs when circulating air is used with impermeable garments or double cotton overalls.

   One type, used when respiratory protection is also necessary, forces exhaust air from a supplied-air hood ("bubble hood") around the neck and down inside an impermeable suit. The air then escapes through openings in the suit. Air can also be supplied directly to the suit without using a hood in three ways:

   - by a single inlet;
   - by a distribution tree; or
   - by a perforated vest.

   In addition, a vortex tube can be used to reduce the temperature of circulating air. The cooled air from this tube can be introduced either under the clothing or into a bubble hood. The use of a vortex tube separates the air stream into a hot and cold stream; these tubes also can be used to supply heat in cold climates. Circulating air, however, is noisy and requires a constant source of compressed air supplied through an attached air hose.

One problem with this system is the limited mobility of workers whose suits are attached to an air hose. Another is that of getting air to the work area itself. These systems should therefore be used in work areas where workers are not required to move around much or to climb. Another concern with these systems is that they can lead to dehydration. The cool, dry air feels comfortable and the worker may not realize that it is important to drink liquids frequently.

C. **RESPIRATOR USAGE.** The weight of a self-contained breathing apparatus (SCBA) increases stress on a worker, and this stress contributes to overall heat stress. Chemical protective clothing such as totally encapsulating chemical protection suits will also add to the heat stress problem.

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APPENDIX III:4-1. HEAT STRESS: GENERAL WORKPLACE REVIEW.

NOTE: Listed below are sample questions that the Compliance Officer may wish to consider when investigating heat stress in the workplace.

WORKPLACE DESCRIPTION.

A. Type of business
B. Heat-producing equipment or processes used
C. Previous history (if any) of heat-related problems
D. At "hot" spots:

- Is the heat steady or intermittent?
- Number of employees exposed?
- For how many hours per day?
- Is potable water available?
- Are supervisors trained to detect/evaluate heat stress symptoms?

ARE EXPOSURES TYPICAL FOR A WORKPLACE IN THIS INDUSTRY?

A. Weather at Time of Review
B. Temperature
C. Humidity
D. Air velocity
E. Is Day Typical of Recent Weather Conditions?
(Get information from the Weather Bureau)
F. Heat-Reducing Engineering Controls

G. Ventilation in place?
H. Ventilation operating?
I. Air conditioning in place?
J. Air conditioning operating?
K. Fans in place?
L. Fans operating?
M. Shields or insulation between sources and employees?
N. Are reflective faces of shields clean?

WORK PRACTICES TO DETECT, EVALUATE, AND PREVENT OR REDUCE HEAT STRESS.

A. Training program?
B. Content?
C. Where given?
D. For whom?
E. Liquid replacement program?
F. Acclimatization program?
G. Work/rest schedule?
H. Scheduling of work (during cooler parts of shift, cleaning and maintenance during shut-downs, etc.)
I. Cool rest areas (including shelter at outdoor work sites)?
J. Heat monitoring program?
K. Personal Protective Equipment
L. Reflective clothing in use?
M. Ice and/or water-cooled garments in use?
N. Wetted undergarments (used with reflective or impermeable clothing) in use?
O. Circulating air systems in use?
P. First Aid Program
Q. Trained personnel?
R. Provision for rapid cool-down?
S. Procedures for getting medical attention?
T. Transportation to medical facilities readily available for heat stroke victims?
U. Medical Screening and Surveillance Program
V. Content?
W. Who manages program?
X. Additional Comments

(Use additional pages as needed.)

APPENDIX III: 4-2. HEAT STRESS-RELATED ILLNESS OR ACCIDENT FOLLOW-UP.

A. Describe events leading up to the episode.
B. Evaluation/comments by other workers at the scene.
C. Work at time of episode (heavy, medium, light)?
D. How long was affected employee working at site prior to episode?
E. Medical history of affected worker, if known.
F. Appropriate engineering controls in place?
G. Appropriate engineering controls in operation?
H. Appropriate work practices used by affected employee(s)?
I. Appropriate personal protective equipment available?
J. Appropriate personal protective equipment in use?
K. Medical screening for heat stress and continued surveillance for signs of heat stress given other employees?
L. Additional comments regarding specific episode(s): (Use additional pages as needed.)

APPENDIX III: 4-3. MEASUREMENT OF WET BULB GLOBE TEMPERATURE.

Measurement is often required of those environmental factors that most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, the Wet Bulb Globe Temperature Index (WBGT) is the most used technique to measure these environmental factors. WBGT values are calculated by the following equations:

Equation III:4-4. Indoor or Outdoor Wet Bulb Globe Temperature Indexes (WBGI) Indoor or outdoors with no solar load

$$WBGT = 0.7NWB + 0.3GT$$

Outdoors with solar load

$$WBGT = 0.7NWB + 0.2GT + 0.1DB$$

where: WBGT = Wet Bulb Globe Temperature Index
NWB = Natural Wet-Bulb Temperature
DB = Dry-Bulb (air) Temperature
GT = Globe Thermometer Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer. The measurement of environmental factors shall be performed as follows:

1. The range of the dry and the natural wet-bulb thermometers should be -5°C to +50°C, with an accuracy of ±0.5°C. The dry bulb thermometer must be shielded from the sun and the other radiant surfaces of the environment without restricting the airflow around the bulb. The wick of the natural wet bulb thermometer should be kept wet with distilled water for at least one-half hour before the temperature reading is made. It is not enough to immerse the other end of the wick into a reservoir of distilled water and wait until the whole wick becomes wet by capillarity. The wick must be wetted by direct application of water from a syringe one-half hour before each reading. The wick must cover the bulb of the thermometer and an equal length of additional wick must cover the stem above the bulb. The wick should always be clean, and new wicks should be washed before using.

2. A globe thermometer, consisting of a 15 cm (6-inch) in diameter hollow copper sphere painted on the outside with a matte black finish, or equivalent, must be used. The bulb or sensor of a thermometer (range -5°C to +100°C with an accuracy of ±0.5°C) must be fixed in the center of the sphere. The globe thermometer should be exposed at least 25 minutes before it is read.

3. A stand should be used to suspend the three thermometers so that they do not restrict free air flow around the bulbs and the wet-bulb and globe thermometer are not shaded.

4. It is permissible to use any other type of temperature sensor that gives a reading similar to that of a mercury thermometer under the same conditions.

5. The thermometers must be placed so that the readings are representative of the employee's work or rest areas, as appropriate.

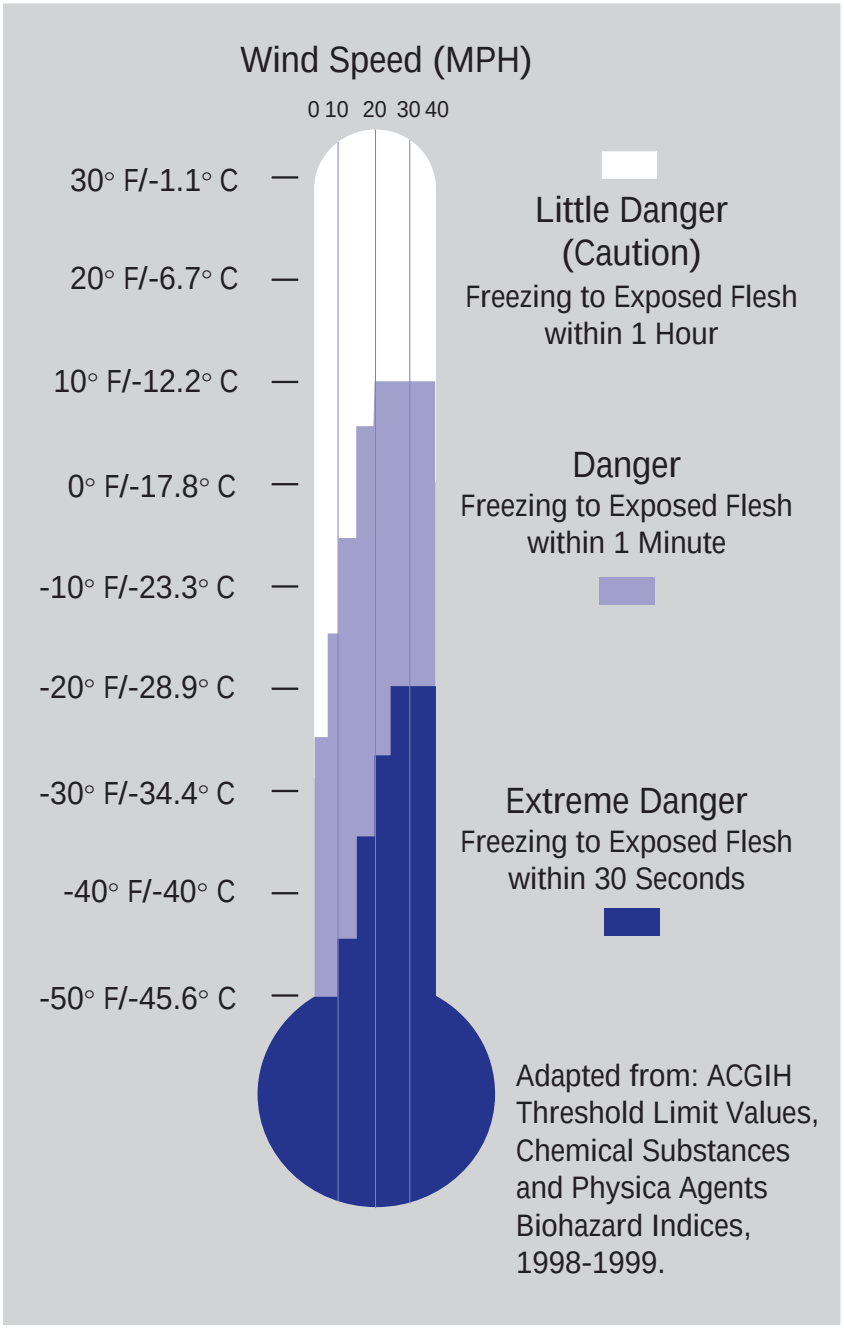
Once the WBGT has been estimated, employers can estimate workers' metabolic heat load (see Tables III:4-1 and III:4-2) and use the ACGIH method to determine the appropriate work/rest regimen, clothing, and equipment to use to control the heat exposures of workers in their facilities.

Cold Stress Guidelines

THE COLD STRESS EQUATION

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result. **Hypothermia** can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.



U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3156
1998

FROST BITE

What Happens to the Body:

FREEZING IN DEEP LAYERS OF SKIN AND TISSUE; PALE, WAXY-WHITE SKIN COLOR; SKIN BECOMES HARD and NUMB; USUALLY AFFECTS THE FINGERS, HANDS, TOES, FEET, EARS, and NOSE.

What Should Be Done: (land temperatures)

- Move the person to a warm dry area. Don't leave the person alone.
- Remove any wet or tight clothing that may cut off blood flow to the affected area.
- **DO NOT** rub the affected area, because rubbing causes damage to the skin and tissue.
- **Gently** place the affected area in a warm (105°F) water bath and monitor the water temperature to **slowly** warm the tissue. Don't pour warm water directly on the affected area because it will warm the tissue too fast causing tissue damage. Warming takes about 25-40 minutes.
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm. **NOTE:** If there is a chance the affected area may get cold again, do not warm the skin. If the skin is warmed and then becomes cold again, it will cause severe tissue damage.
- Seek medical attention as soon as possible.

HYPOTHERMIA - (Medical Emergency)

What Happens to the Body:

NORMAL BODY TEMPERATURE (98.6° F/37°C) DROPS TO OR BELOW 95°F (35^0 C); FATIGUE OR DROWSINESS; UNCONTROLLED SHIVERING; COOL BLUISH SKIN; SLURRED SPEECH; CLUMSY MOVEMENTS; IRRITABLE, IRRATIONAL OR CONFUSED BEHAVIOR.

What Should Be Done: (land temperatures)

- Call for emergency help (i.e., Ambulance or Call 911).
- Move the person to a warm, dry area. Don't leave the person alone. Remove any wet clothing and replace with warm, dry clothing or wrap the person in blankets.
- Have the person drink warm, sweet drinks (sugar water or sports-type drinks) if they are alert. **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) or alcohol.
- Have the person move their arms and legs to create muscle heat. If they are unable to do this, place warm bottles or hot packs in the arm pits, groin, neck, and head areas. **DO NOT** rub the person's body or place them in warm water bath. This may stop their heart.

What Should Be Done: (water temperatures)

- Call for emergency help (Ambulance or Call 911). Body heat is lost up to 25 times faster in water.
- **DO NOT** remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods because the layer of trapped water closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and put on a hat or hood.
- Get out of the water as quickly as possible or climb on anything floating. **DO NOT** attempt to swim unless a floating object or another person can be reached because swimming or other physical activity uses the body's heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water, huddle together with chests held closely.

How to Protect Workers

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Train the workforce about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene).
- Take frequent short breaks in warm dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system (work in pairs).
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) or alcohol.
- Eat warm, high-calorie foods like hot pasta dishes.

Workers Are at Increased Risk When…

- They have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension.
- They take certain medication (check with your doctor, nurse, or pharmacy and ask if any medicines you are taking affect you while working in cold environments).
- They are in poor physical condition, have a poor diet, or are older.

Excavation Check List and Procedures

Daily Excavation Safety Checklist

Company		**Date**	
Project Name		**Approx. Temp.**	
Project Location		**Approx. Wind Dir.**	
Job Number		**Safety Rep**	
Excavation Depth & Width		**Soil Classification**	
Protective System Used			
Activities In Excavation			
Competent Person			

Excavation > 4 feet deep? ___Yes ___No If *YES,* fill out a Confined Space Permit *PRIOR* to *ANY* person entering the excavation.

***NOTE:* Trenches over 4 feet in depth are considered excavations. Any items marked *NO* on this form *MUST* be remediated prior to any employees entering the excavation.**

YES	NO	N/A	DESCRIPTION
			GENERAL
			Employees protected from cave-ins & loose rock/soil that could roll into the excavation
			Spoils, materials & equipment set back at least 2 feet from the edge of the excavation.
			Engineering designs for sheeting &/or manufacturer's data on trench box capabilities on site
			Adequate signs posted and barricades provided
			Training (toolbox meeting) conducted w/ employees prior to entering excavation

YES	NO	N/A	DESCRIPTION
			UTILITIES
			Utility company contacted & given 24 hours notice &/or utilities already located & marked
			Overhead lines located, noted and reviewed with the operator
			Utility locations reviewed with the operator, & precautions taken to ensure contact does not occur
			Utilities crossing the excavation supported, and protected from falling materials
			Underground installations protected, supported or removed when excavation is open
			WET CONDITIONS
			Precautions taken to protect employees from water accumulation (continuous dewatering)
			Surface water or runoff diverted /controlled to prevent accumulation in the excavation
			Inspection made after every rainstorm or other hazard increasing occurrence
			HAZARDOUS ATMOSPHERES
			Air in the excavation tested for oxygen deficiency, combustibles, other contaminants
			Ventilation used in atmospheres that are oxygen rich/deficient &/or contains hazardous substances
			Ventilation provided to keep LEL below 10 %
			Emergency equipment available where hazardous atmospheres could or do exist
			Safety harness and lifeline used
			Supplied air necessary (if yes, contact safety department)

YES	NO	N/A	DESCRIPTION
			ENTRY & EXIT
			Exit (i.e. ladder, sloped wall) no further than 25 feet from ANY employee
			Ladders secured and extend 3 feet above the edge of the trench
			Wood ramps constructed of uniform material thickness, cleated together @ the bottom
			Employees protected from cave-ins when entering or exiting the excavation

Keep 1 copy of each daily excavation checklist on site for the project duration, and forward the original to the safety director

APPENDIX E

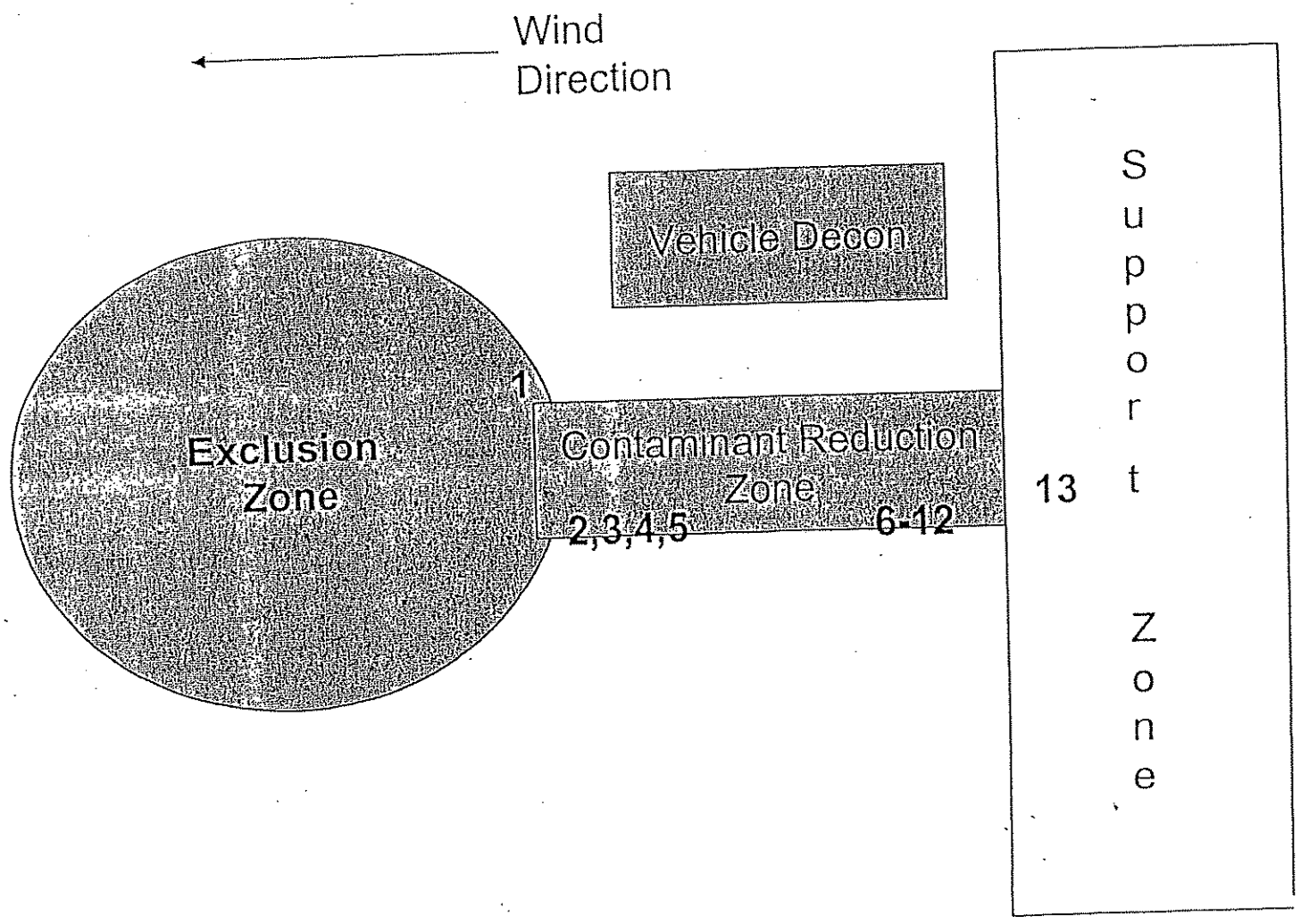
Example Decontamination Station Layout

TABLE I

PERSONNEL DECONTAMINATION PLAN

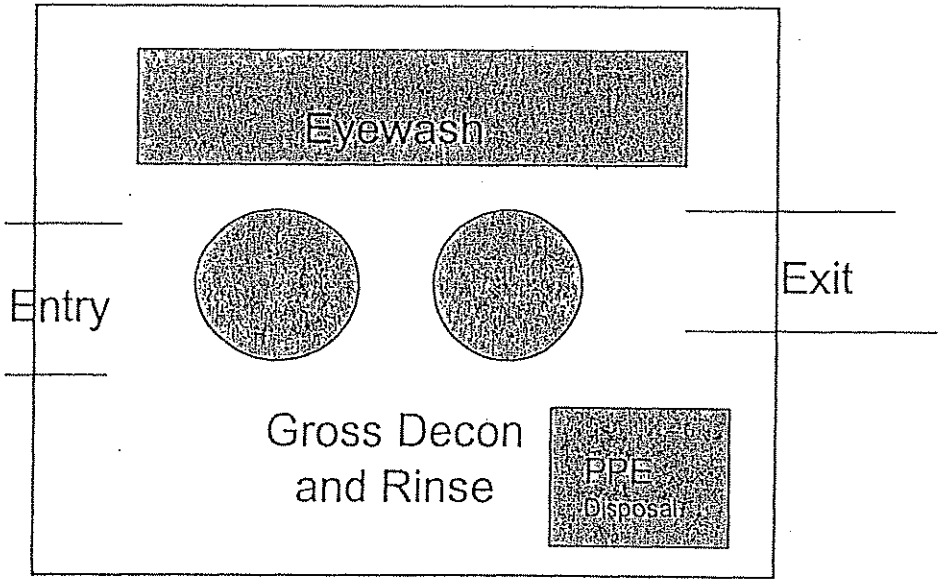
Step 1	Segregated Equipment Drop
Step 2	Cover Boot and Glove Wash
Step 3	Cover Boot and Glove Rinse
Step 4	Cover Boot Removal
Step 5	Cover Glove Removal
	---------- HOTLINE ----------
Step 6	Suit and Boot Wash – Disposable
Step 7	Suit and Boot Rinse – Disposable
Step 8	Suit Removal
Step 9	Boot Removal
Step 10	Respirator Removal
Step 11	Inner Glove Wash and Rinse
Step 12	Inner Clothing Removal
Step 13	Re-Dress

Decontamination Plan



Decontamination

Basic Personnel Decontamination Station



Accident/Incident Report OSHA 3000

OSHA
Forms for Recording
Work-Related Injuries and Illnesses

Dear Employer:

This booklet includes the forms needed for maintaining occupational injury and illness records for 2004. These new forms have changed in several important ways from the 2003 recordkeeping forms.

In the December 17, 2002 Federal Register (67 FR 77165-77170), OSHA announced its decision to add an occupational hearing loss column to OSHA's Form 300, Log of Work-Related Injuries and Illnesses. This forms package contains modified Forms 300 and 300A which incorporate the additional column M(5) Hearing Loss. Employers required to complete the injury and illness forms must begin to use these forms on January 1, 2004.

In response to public suggestions, OSHA also has made several changes to the forms package to make the recordkeeping materials clearer and easier to use:

- On Form 300, we've switched the positions of the day count columns. The days "away from work" column now comes before the days "on job transfer or restriction."
- We've clarified the formulas for calculating incidence rates.
- We've added new recording criteria for occupational hearing loss to the "Overview" section.
- On Form 300, we've made the column heading "Classify the Case" more prominent to make it clear that employers should mark only one selection among the four columns offered.

The Occupational Safety and Health Administration shares with you the goal of preventing injuries and illnesses in our nation's workplaces. Accurate injury and illness records will help us achieve that goal.

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What's Inside...

In this package, you'll find everything you need to complete OSHA's *Log* and the *Summary of Work-Related Injuries and Illnesses* for the next several years. On the following pages, you'll find:

- ***An Overview: Recording Work-Related Injuries and Illnesses —*** General instructions for filling out the forms in this package and definitions of terms you should use when you classify your cases as injuries or illnesses.

- ***How to Fill Out the Log —*** An example to guide you in filling out the *Log* properly.

- ***Log of Work-Related Injuries and Illnesses —*** Several pages of the *Log* (but you may make as many copies of the *Log* as you need.) Notice that the *Log* is separate from the *Summary*.

- ***Summary of Work-Related Injuries and Illnesses —*** Removable *Summary* pages for easy posting at the end of the year. Note that you post the *Summary* only, not the *Log*.

- ***Worksheet to Help You Fill Out the Summary —*** A worksheet for figuring the average number of employees who worked for your establishment and the total number of hours worked.

- ***OSHA's 301: Injury and Illness Incident Report —*** A copy of the OSHA 301 to provide details about the incident. You may make as many copies as you need or use an equivalent form.

Take a few minutes to review this package. If you have any questions, ***visit us online at www.osha. gov*** **or** ***call your local OSHA office.*** We'll be happy to help you.

An Overview: Recording Work-Related Injuries and Illnesses

The Occupational Safety and Health (OSH) Act of 1970 requires certain employers to prepare and maintain records of work-related injuries and illnesses. Use these definitions when you classify cases on the Log. OSHA's recordkeeping regulation (see 29 CFR Part 1904) provides more information about the definitions below.

The *Log of Work-Related Injuries and Illnesses* (Form 300) is used to classify work-related injuries and illnesses and to note the extent and severity of each case. When an incident occurs, use the *Log* to record specific details about what happened and how it happened. The *Summary* — a separate form (Form 300A) — shows the totals for the year in each category. At the end of the year, post the *Summary* in a visible location so that your employees are aware of the injuries and illnesses occurring in their workplace.

Employers must keep a *Log* for each establishment or site. If you have more than one establishment, you must keep a separate *Log* and *Summary* for each physical location that is expected to be in operation for one year or longer.

Note that your employees have the right to review your injury and illness records. For more information, see 29 Code of Federal Regulations Part 1904.35, *Employee Involvement*.

Cases listed on the *Log of Work-Related Injuries and Illnesses* are not necessarily eligible for workers' compensation or other insurance benefits. Listing a case on the *Log* does not mean that the employer or worker was at fault or that an OSHA standard was violated.

When is an injury or illness considered work-related?

An injury or illness is considered work-related if an event or exposure in the work environment caused or contributed to the condition or significantly aggravated a preexisting condition. Work-relatedness is presumed for injuries and illnesses resulting from events or exposures occurring in the workplace, unless an exception specifically applies. See 29 CFR Part 1904.5(b)(2) for the exceptions. The work environment includes the establishment and other locations where one or more employees are working or are present as a condition of their employment. See 29 CFR Part 1904.5(b)(1).

Which work-related injuries and illnesses should you record?

Record those work-related injuries and illnesses that result in:

- death,
- loss of consciousness,
- days away from work,
- restricted work activity or job transfer, or
- medical treatment beyond first aid.

You must also record work-related injuries and illnesses that are significant (as defined below) or meet any of the additional criteria listed below.

You must record any significant work-related injury or illness that is diagnosed by a physician or other licensed health care professional. You must record any work-related case involving cancer, chronic irreversible disease, a fractured or cracked bone, or a punctured eardrum. See 29 CFR 1904.7.

What are the additional criteria?

You must record the following conditions when they are work-related:

- any needlestick injury or cut from a sharp object that is contaminated with another person's blood or other potentially infectious material;
- any case requiring an employee to be medically removed under the requirements of an OSHA health standard;
- tuberculosis infection as evidenced by a positive skin test or diagnosis by a physician or other licensed health care professional after exposure to a known case of active tuberculosis.
- an employee's hearing test (audiogram) reveals 1) that the employee has experienced a Standard Threshold Shift (STS) in hearing in one or both ears (averaged at 2000, 3000, and 4000 Hz) and 2) the employee's total hearing level is 25 decibels (dB) or more above audiometric zero (also averaged at 2000, 3000, and 4000 Hz) in the same ear(s) as the STS.

What is medical treatment?

Medical treatment includes managing and caring for a patient for the purpose of combating disease or disorder. The following are not considered medical treatments and are NOT recordable:

- visits to a doctor or health care professional solely for observation or counseling;

What do you need to do?

1. Within 7 calendar days after you receive information about a case, decide if the case is recordable under the OSHA recordkeeping requirements.
2. Determine whether the incident is a new case or a recurrence of an existing one.
3. Establish whether the case was work-related.
4. If the case is recordable, decide which form you will fill out as the injury and illness incident report.

   You may use *OSHA's 301: Injury and Illness Incident Report* or an equivalent form. Some state workers compensation, insurance, or other reports may be acceptable substitutes, as long as they provide the same information as the OSHA 301.

How to work with the Log

1. Identify the employee involved unless it is a privacy concern case as described below.
2. Identify when and where the case occurred.
3. Describe the case, as specifically as you can.
4. Classify the seriousness of the case by recording the **most serious outcome** associated with the case, with column G (Death) being the most serious and column J (Other recordable cases) being the least serious.
5. Identify whether the case is an injury or illness. If the case is an injury, check the injury category. If the case is an illness, check the appropriate illness category.

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- diagnostic procedures, including administering prescription medications that are used solely for diagnostic purposes; and
- any procedure that can be labeled first aid. (*See below for more information about first aid.*)

What is first aid?

If the incident required only the following types of treatment, consider it first aid. Do NOT record the case if it involves only:

- using non-prescription medications at non-prescription strength;
- administering tetanus immunizations;
- cleaning, flushing, or soaking wounds on the skin surface;
- using wound coverings, such as bandages, BandAids™, gauze pads, etc., or using SteriStrips™ or butterfly bandages.
- using hot or cold therapy;
- using any totally non-rigid means of support, such as elastic bandages, wraps, non-rigid back belts, etc.;
- using temporary immobilization devices while transporting an accident victim (splints, slings, neck collars, or back boards).
- drilling a fingernail or toenail to relieve pressure, or draining fluids from blisters;
- using eye patches;
- using simple irrigation or a cotton swab to remove foreign bodies not embedded in or adhered to the eye;
- using irrigation, tweezers, cotton swab or other simple means to remove splinters or foreign material from areas other than the eye;
- using finger guards;
- using massages;
- drinking fluids to relieve heat stress

How do you decide if the case involved restricted work?

Restricted work activity occurs when, as the result of a work-related injury or illness, an employer or health care professional keeps, or recommends keeping, an employee from doing the routine functions of his or her job or from working the full workday that the employee would have been scheduled to work before the injury or illness occurred.

How do you count the number of days of restricted work activity or the number of days away from work?

Count the number of calendar days the employee was on restricted work activity or was away from work as a result of the recordable injury or illness. Do not count the day on which the injury or illness occurred in this number. Begin counting days from the day after the incident occurs. If a single injury or illness involved both days away from work and days of restricted work activity, enter the total number of days for each. You may stop counting days of restricted work activity or days away from work once the total of either or the combination of both reaches 180 days.

Under what circumstances should you NOT enter the employee's name on the OSHA Form 300?

You must consider the following types of injuries or illnesses to be privacy concern cases:

- an injury or illness to an intimate body part or to the reproductive system,
- an injury or illness resulting from a sexual assault,
- a mental illness,
- a case of HIV infection, hepatitis, or tuberculosis,
- a needlestick injury or cut from a sharp object that is contaminated with blood or other potentially infectious material (see 29 CFR Part 1904.8 for definition), and
- other illnesses, if the employee independently and voluntarily requests that his or her name not be entered on the log.

You must not enter the employee's name on the OSHA 300 *Log* for these cases. Instead, enter "privacy case" in the space normally used for the employee's name. You must keep a separate, confidential list of the case numbers and employee names for the establishment's privacy concern cases so that you can update the cases and provide information to the government if asked to do so.

If you have a reasonable basis to believe that information describing the privacy concern case may be personally identifiable even though the employee's name has been omitted, you may use discretion in describing the injury or illness on both the OSHA 300 and 301 forms. You must enter enough information to identify the cause of the incident and the general severity of the injury or illness, but you do not need to include details of an intimate or private nature.

What if the outcome changes after you record the case?

If the outcome or extent of an injury or illness changes after you have recorded the case, simply draw a line through the original entry or, if you wish, delete or white-out the original entry. Then write the new entry where it belongs. Remember, you need to record the most serious outcome for each case.

Classifying injuries

An injury is any wound or damage to the body resulting from an event in the work environment.

Examples: Cut, puncture, laceration, abrasion, fracture, bruise, contusion, chipped tooth, amputation, insect bite, electrocution, or a thermal, chemical, electrical, or radiation burn. Sprain and strain injuries to muscles, joints, and connective tissues are classified as injuries when they result from a slip, trip, fall or other similar accidents.

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Classifying illnesses

Skin diseases or disorders

Skin diseases or disorders are illnesses involving the worker's skin that are caused by work exposure to chemicals, plants, or other substances.

Examples: Contact dermatitis, eczema, or rash caused by primary irritants and sensitizers or poisonous plants; oil acne; friction blisters, chrome ulcers; inflammation of the skin.

Respiratory conditions

Respiratory conditions are illnesses associated with breathing hazardous biological agents, chemicals, dust, gases, vapors, or fumes at work.

Examples: Silicosis, asbestosis, pneumonitis, pharyngitis, rhinitis or acute congestion; farmer's lung, beryllium disease, tuberculosis, occupational asthma, reactive airways dysfunction syndrome (RADS), chronic obstructive pulmonary disease (COPD), hypersensitivity pneumonitis, toxic inhalation injury, such as metal fume fever, chronic obstructive bronchitis, and other pneumoconioses.

Poisoning

Poisoning includes disorders evidenced by abnormal concentrations of toxic substances in blood, other tissues, other bodily fluids, or the breath that are caused by the ingestion or absorption of toxic substances into the body.

Examples: Poisoning by lead, mercury, cadmium, arsenic, or other metals; poisoning by carbon monoxide, hydrogen sulfide, or other gases; poisoning by benzene, benzol, carbon tetrachloride, or other organic solvents; poisoning by insecticide sprays, such as parathion or lead arsenate; poisoning by other chemicals, such as formaldehyde.

Hearing Loss

Noise-induced hearing loss is defined for recordkeeping purposes as a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more in either ear at 2000, 3000 and 4000 hertz, and the employee's total hearing level is 25 decibels (dB) or more above audiometric zero (also averaged at 2000, 3000, and 4000 hertz) in the same ear(s).

All other illnesses

All other occupational illnesses.

Examples: Heatstroke, sunstroke, heat exhaustion, heat stress and other effects of environmental heat; freezing, frostbite, and other effects of exposure to low temperatures; decompression sickness; effects of ionizing radiation (isotopes, x-rays, radium); effects of nonionizing radiation (welding flash, ultra-violet rays, lasers); anthrax; bloodborne pathogenic diseases, such as AIDS, HIV, hepatitis B or hepatitis C; brucellosis; malignant or benign tumors; histoplasmosis; coccidioidomycosis.

When must you post the Summary?

You must post the *Summary* only — not the *Log* — by February 1 of the year following the year covered by the form and keep it posted until April 30 of that year.

How long must you keep the Log and Summary on file?

You must keep the *Log* and *Summary* for 5 years following the year to which they pertain.

Do you have to send these forms to OSHA at the end of the year?

No. You do not have to send the completed forms to OSHA unless specifically asked to do so.

How can we help you?

If you have a question about how to fill out the *Log*,

- ❑ ***visit us online at www.osha.gov*** or
- ❑ ***call your local OSHA office.***

Optional

Calculating Injury and Illness Incidence Rates

What is an incidence rate?

An incidence rate is the number of recordable injuries and illnesses occurring among a given number of full-time workers (usually 100 full-time workers) over a given period of time (usually one year). To evaluate your firm's injury and illness experience over time or to compare your firm's experience with that of your industry as a whole, you need to compute your incidence rate. Because a specific number of workers and a specific period of time are involved, these rates can help you identify problems in your workplace and/or progress you may have made in preventing work-related injuries and illnesses.

How do you calculate an incidence rate?

You can compute an occupational injury and illness incidence rate for all recordable cases or for cases that involved days away from work for your firm quickly and easily. The formula requires that you follow instructions in paragraph (a) below for the total recordable cases or those in paragraph (b) for cases that involved days away from work, *and* for both rates the instructions in paragraph (c).

(a) *To find out the total number of recordable injuries and illnesses that occurred during the year,* count the number of line entries on your OSHA Form 300, or refer to the OSHA Form 300A and sum the entries for columns (G), (H), (I), and (J).

(b) *To find out the number of injuries and illnesses that involved days away from work,* count the number of line entries on your OSHA Form 300 that received a check mark in column (H), or refer to the entry for column (H) on the OSHA Form 300A.

(c) *The number of hours all employees actually worked during the year*. Refer to OSHA Form 300A and optional worksheet to calculate this number.

You can compute the incidence rate for all recordable cases of injuries and illnesses using the following formula:

Total number of injuries and illnesses x *200,000* ÷ *Number of hours worked by all employees* = *Total recordable case rate*

(The 200,000 figure in the formula represents the number of hours 100 employees working 40 hours per week, 50 weeks per year would work, and provides the standard base for calculating incidence rates.)

You can compute the incidence rate for recordable cases involving days away from work, days of restricted work activity or job transfer (DART) using the following formula:

(Number of entries in column H + Number of entries in column I) x *200,000* ÷ *Number of hours worked by all employees* = *DART incidence rate*

You can use the same formula to calculate incidence rates for other variables such as cases involving restricted work activity (column (I) on Form 300A), cases involving skin disorders (column (M-2) on Form 300A), etc. Just substitute the appropriate total for these cases, from Form 300A, into the formula in place of the total number of injuries and illnesses.

What can I compare my incidence rate to?

The Bureau of Labor Statistics (BLS) conducts a survey of occupational injuries and illnesses each year and publishes incidence rate data by various classifications (e.g., by industry, by employer size, etc.). You can obtain these published data at www.bls.gov/iif or by calling a BLS Regional Office.

Worksheet

Total number of injuries and illnesses		200,000	÷	Number of hours worked by all employees	=	Total recordable case rate
	x					

Number of entries in Column H + Column I		200,000	÷	Number of hours worked by all employees	=	DART incidence rate
	x					

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How to Fill Out the Log

The *Log of Work-Related Injuries and Illnesses* is used to classify work-related injuries and illnesses and to note the extent and severity of each case. When an incident occurs, use the *Log* to record specific details about what happened and how it happened.

If your company has more than one establishment or site, you must keep separate records for each physical location that is expected to remain in operation for one year or longer.

We have given you several copies of the *Log* in this package. If you need more than we provided, you may photocopy and use as many as you need.

The *Summary* — a separate form — shows the work-related injury and illness totals for the year in each category. At the end of the year, count the number of incidents in each category and transfer the totals from the *Log* to the *Summary*. Then post the *Summary* in a visible location so that your employees are aware of injuries and illnesses occurring in their workplace.

You don't post the Log. You post only the Summary at the end of the year.

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OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name XYZ Company

City Anywhere State MA

Identify the person			Describe the case			Classify the case (CHECK ONLY ONE box for each case based on the most serious outcome for that case:)				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness:					
(A) Case no.	(B) Employee's name	(C) Job title (*e.g. Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g. Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g. Second degree burns on right forearm from acetylene torch*)	Death (G)	Days away from work (H)	Remained at Work: Job transfer or restriction (I)	Remained at Work: Other recordable cases (J)	Away from work (K)	On job transfer or restriction (L)	(M) Injury (1)	Skin disorders (2)	Respiratory conditions (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
1	Mark Bagin	Welder	5/25 month/day	basement	fracture, left arm and left leg, fell from ladder	☐	☑	☐	☐	12 days	15 days	☑	☐	☐	☐	☐	☐
2	Shana Alexander	Foundry man	7/2 month/day	pouring deck	poisoning from lead fumes	☐	☐	☑	☐	___ days	30 days	☐	☐	☐	☑	☐	☐
3	Sam Sander	Electrician	8/5 month/day	2nd floor storeroom	broken left foot, fell over box	☐	☑	☐	☐	7 days	30 days	☑	☐	☐	☐	☐	☐
4	Ralph Boccella	Laborer	9/17 month/day	packaging dept	Back strain lifting boxes	☐	☐	☐	☐	3 days	___ days	☑	☐	☐	☐	☐	☐
5	Jarrod Daniels	Machine opr.	10/23 month/day	production floor	dust in eye	☐	☐	☐	☑	___ days	___ days	☑	☐	☐	☐	☐	☐
___			/ month/day			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
___			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
___			/			☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐

Be as specific as possible. You can use two lines if you need more room.

Revise the log if the injury or illness progresses and the outcome is more serious than you originally recorded for the case. Cross out, erase, or white-out the original entry.

Choose ONLY ONE of these categories. Classify the case by recording the most serious outcome of the case, with column G (Death) being the most serious and column J (Other recordable cases) being the least serious.

Note whether the case involves an injury or an illness.

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ______________________

City ______________ State ________

Identify the person			Describe the case			Classify the case: CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "Injury" column or choose one type of illness:					
								Remained at Work				(M)					
(A) Case no.	(B) Employee's name	(C) Job title (e.g., Welder)	(D) Date of injury or onset of illness	(E) Where the event occurred (e.g., Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g., Second degree burns on right forearm from acetylene torch)	Death (G)	Days away from work (H)	Job transfer or restriction (I)	Other record-able cases (J)	Away from work (K)	On job transfer or restriction (L)	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
____	____	____	__/__ month/day	____	____	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐	☐
					Page totals➤	____	____	____	____	____	____	____	____	____	____	____	____
												Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	Hearing loss (5)	All other illnesses (6)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistical Analysis, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
_____	_____	_____	_____
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
_____	_____
(K)	(L)

Injury and Illness Types

Total number of . . .

	(M)		
(1) Injuries	_____	(4) Poisonings	_____
		(5) Hearing loss	_____
(2) Skin disorders	_____	(6) All other illnesses	_____
(3) Respiratory conditions	_____		

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Establishment information

Your establishment name _____

Street _____

City _____ State _____ ZIP _____

Industry description (*e.g., Manufacture of motor truck trailers*)

_____

Standard Industrial Classification (SIC), if known (*e.g., 3715*)

___ ___ ___ ___

OR

North American Industrial Classification (NAICS), if known (e.g., 336212)

___ ___ ___ ___ ___ ___

Employment information *(If you don't have these figures, see the Worksheet on the back of this page to estimate.)*

Annual average number of employees _____

Total hours worked by all employees last year _____

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

_____ _____
Company executive Title

( ) - / /
Phone Date

Optional

Worksheet to Help You Fill Out the Summary

At the end of the year, OSHA requires you to enter the average number of employees and the total hours worked by your employees on the summary. If you don't have these figures, you can use the information on this page to estimate the numbers you will need to enter on the Summary page at the end of the year.

How to figure the average number of employees who worked for your establishment during the year:

❶ ***Add*** the total number of employees your establishment paid in all pay periods during the year. Include all employees: full-time, part-time, temporary, seasonal, salaried, and hourly.

The number of employees paid in all pay periods = ❶ _____

❷ ***Count*** the number of pay periods your establishment had during the year. Be sure to include any pay periods when you had no employees.

The number of pay periods during the year = ❷ _____

❸ ***Divide*** the number of employees by the number of pay periods.

❶ / ❷ _____ = ❸ _____

❹ ***Round the answer*** to the next highest whole number. Write the rounded number in the blank marked *Annual average number of employees*.

The number rounded = ❹ _____

For example, Acme Construction figured its average employment this way:

For pay period...	**Acme paid this number of employees...**
1	10
2	0
3	15
4	30
5	40
▼	▼
24	20
25	15
26	+10
	830

Number of employees paid = 830 ❶

Number of pay periods = 26 ❷

830 / 26 = 31.92 ❸

31.92 rounds to 32 ❹

32 is the annual average number of employees

How to figure the total hours worked by all employees:

Include hours worked by salaried, hourly, part-time and seasonal workers, as well as hours worked by other workers subject to day to day supervision by your establishment (e.g., temporary help services workers).

Do not include vacation, sick leave, holidays, or any other non-work time, even if employees were paid for it. If your establishment keeps records of only the hours paid or if you have employees who are not paid by the hour, please estimate the hours that the employees actually worked.

If this number isn't available, you can use this optional worksheet to estimate it.

Optional Worksheet

_____ ***Find*** the number of full-time employees in your establishment for the year.

X _____ ***Multiply*** by the number of work hours for a full-time employee in a year.

_____ This is the number of full-time hours worked.

\+ _____ ***Add*** the number of any overtime hours as well as the hours worked by other employees (part-time, temporary, seasonal)

_____ ***Round*** the answer to the next highest whole number. Write the rounded number in the blank marked *Total hours worked by all employees last year.*

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA's Form 301
Injury and Illness Incident Report

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

This *Injury and Illness Incident Report* is one of the first forms you must fill out when a recordable work-related injury or illness has occurred. Together with the *Log of Work-Related Injuries and Illnesses* and the accompanying *Summary,* these forms help the employer and OSHA develop a picture of the extent and severity of work-related incidents.

Within 7 calendar days after you receive information that a recordable work-related injury or illness has occurred, you must fill out this form or an equivalent. Some state workers' compensation, insurance, or other reports may be acceptable substitutes. To be considered an equivalent form, any substitute must contain all the information asked for on this form.

According to Public Law 91-596 and 29 CFR 1904, OSHA's recordkeeping rule, you must keep this form on file for 5 years following the year to which it pertains.

If you need additional copies of this form, you may photocopy and use as many as you need.

Completed by _____

Title _____

Phone (_____)_____--_____ **Date** ____/ ____/ ____

Information about the employee

1) **Full name** _____

2) **Street** _____

City _____ **State** _____ **ZIP** _____

3) **Date of birth** _____ / ____ / _____

4) **Date hired** _____ / ____ / _____

5) ❒ **Male**
❒ **Female**

Information about the physician or other health care professional

6) **Name of physician or other health care professional** _____

_____

7) **If treatment was given away from the worksite, where was it given?**

Facility _____

Street _____

City _____ **State** _____ **ZIP** _____

8) **Was employee treated in an emergency room?**
❒ **Yes**
❒ **No**

9) **Was employee hospitalized overnight as an in-patient?**
❒ **Yes**
❒ **No**

Information about the case

10) **Case number from the *Log*** _____ *(Transfer the case number from the Log after you record the case.)*

11) **Date of injury or illness** _____ / ____ / _____

12) **Time employee began work** _____ **AM / PM**

13) **Time of event** _____ **AM / PM** ☐ **Check if time cannot be determined**

14) ***What was the employee doing just before the incident occurred?*** **Describe the activity, as well as the tools, equipment, or material the employee was using. Be specific.** *Examples:* **"climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."**

15) ***What happened?*** **Tell us how the injury occurred.** *Examples:* **"When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."**

16) ***What was the injury or illness?*** **Tell us the part of the body that was affected and how it was affected; be more specific than "hurt," "pain," or sore."** *Examples:* **"strained back"; "chemical burn, hand"; "carpal tunnel syndrome."**

17) ***What object or substance directly harmed the employee?*** *Examples:* **"concrete floor"; "chlorine"; "radial arm saw."** *If this question does not apply to the incident, leave it blank.*

18) ***If the employee died, when did death occur?*** **Date of death** _____ / ____ / _____

If You Need Help...

If you need help deciding whether a case is recordable, or if you have questions about the information in this package, feel free to contact us. We'll gladly answer any questions you have.

▼ Visit us online at www.osha.gov

▼ Call your OSHA Regional office and ask for the recordkeeping coordinator

or

▼ Call your State Plan office

Federal Jurisdiction

Region 1 - 617 / 565-9860
Connecticut; Massachusetts; Maine; New Hampshire; Rhode Island

Region 2 - 212 / 337-2378
New York; New Jersey

Region 3 - 215 / 861-4900
DC; Delaware; Pennsylvania; West Virginia

Region 4 - 404 / 562-2300
Alabama; Florida; Georgia; Mississippi

Region 5 - 312 / 353-2220
Illinois; Ohio; Wisconsin

Region 6 - 214 / 767-4731
Arkansas; Louisiana; Oklahoma; Texas

Region 7 - 816 / 426-5861
Kansas; Missouri; Nebraska

Region 8 - 303 / 844-1600
Colorado; Montana; North Dakota; South Dakota

Region 9 - 415 / 975-4310

Region 10 - 206 / 553-5930
Idaho

State Plan States

Alaska - 907 / 269-4957

Arizona - 602 / 542-5795

California - 415 / 703-5100

*Connecticut - 860 / 566-4380

Hawaii - 808 / 586-9100

Indiana - 317 / 232-2688

Iowa - 515 / 281-3661

Kentucky - 502 / 564-3070

Maryland - 410 / 767-2371

Michigan - 517 / 322-1848

Minnesota - 651 / 284-5050

Nevada - 702 / 486-9020

*New Jersey - 609 / 984-1389

New Mexico - 505 / 827-4230

*New York - 518 / 457-2574

North Carolina - 919 / 807-2875

Oregon - 503 / 378-3272

Puerto Rico - 787 / 754-2172

South Carolina - 803 / 734-9669

Tennessee - 615 / 741-2793

Utah - 801 / 530-6901

Vermont - 802 / 828-2765

Virginia - 804 / 786-6613

Virgin Islands - 340 / 772-1315

Washington - 360 / 902-5601

Wyoming - 307 / 777-7786

*Public Sector only

U.S. Department of Labor
Occupational Safety and Health Administration

U.S. Department of Labor
Occupational Safety and Health Administration

Have questions?

If you need help in filling out the *Log* or *Summary,* or if you have questions about whether a case is recordable, contact us. We'll be happy to help you. You can:

- Visit us online at: **www.osha.gov**
- Call your regional or state plan office. You'll find the phone number listed inside this cover.

Medical Surveillance Program

MEDICAL DATA SHEET

This form must be completed by all on-site personnel prior to the commencement of activities, and shall be kept by the Site Health and Safety Officer during site activities. This form must be delivered to any attending physician when medical assistance is needed.

(This form should be typed or printed legibly.)

Site: _____

Name: _____ Home Telephone: _____
(Area Code/Telephone Number)

Address: _____

Date of Birth: _____ Height: _____ Weight: _____

Emergency Contact: _____ Telephone: _____
(Area Code/Telephone Number)

Drug Allergies or Other Allergies: _____

_____

Previous Illnesses or Exposures to Hazardous Substances: _____

_____

_____

Current Medication (Prescription and Non-Prescription): _____

_____

_____

Medical Restrictions: _____

_____

Name, Address and Telephone Number of Person Physician: _____

_____

Daily Safety Logs

DATE: _____

TAILGATE SAFETY MEETING

Project Manager: _____ Project Name: _____

Site Supervisor: _____ Project Number: _____

Safety Officer _____ Project Location: _____

Type of Work to be Done: _____

SITE SAFETY INFORMATION:

Weather: _____

Chemical Hazards: _____

Physical Hazards: _____

otective Clothing/Equipment _____

Exclusion Zone PPE Level(s) _____

Location of Fire Extinguishers _____

Location of First Aid Kit(s) _____

Evacuation Rally Assembly Area: _____

Hospital _____ Phone: _____

Hospital Address _____

*** Dial 9-1-1 & Notify supervisor, safety officer & project manager for emergency medical accidents/incidents**

ATTENDEES

Name Printed	Signature

Meeting Conducted By: _____ _____

Name Printed Signature

APPENDIX I

Air Monitoring Log

APPENDIX I

AIR MONITORING LOG

PROJECT NAME: _____ **PROJECT NUMBER:** _____

PROJECT LOCATION: _____ **DATE:** _____

TYPE OF EQUIPMENT: (A) _____ **S / N:** _____ **CALIBRATION:** _____ **INITIALS:** _____
TYPE OF EQUIPMENT: (B) _____ **S / N:** _____ **CALIBRATION:** _____ **INITIALS:** _____
TYPE OF EQUIPMENT: (C) _____ **S / N:** _____ **CALIBRATION:** _____ **INITIALS:** _____
TYPE OF EQUIPMENT: (D) _____ **S / N:** _____ **CALIBRATION:** _____ **INITIALS:** _____

Location/Work Area	Time	Equip (A)	Equip (B)	Equip (C)	Equip (D)	PPE Level	Comments

_____
Signature

Accident Investigation Report

☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**
(Check applicable company name)

ACCIDENT REPORT

Joe Gentile, Corporate Health and Safety Manager
Cell: (610) 844-6911; Office: (856) 423-8800; Office FAX: (856) 423-3220; Home: (484) 373-0953

PART 1: ADMINISTRATIVE INFORMATION

Project #: _____
Project Name: _____
Project Location (street address/city/state)**:**
_____
_____
Client Corporate Name / Contact / Address / Phone #:
_____
_____
_____
_____
_____

Immediate Verbal Notifications Given To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No
Client Contact	☐Yes	☐No

REPORT STATUS (time due):
☐ Initial (24 hr) ☐ Final (5-10 days)
Date: _____ Date: _____

Accident Report Delivered To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No

REPORT TYPE: ☐ Loss ☐ Near Loss Estimated Costs: $ _____

OSHA CASE # Assigned by Corporate Health & Safety if Applicable: _____

Corporate Health & Safety Confirmed Final Accident Report
☐Yes ☐No

DATE OF INCIDENT: _____

TIME INCIDENT OCCURRED: _____ ☐AM ☐PM

INCIDENT LOCATION – City, State, and Country (If outside U.S.A.)

INCIDENT TYPES: (Select most appropriate if Loss occurred.)
From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

☐**INJURY** ☐**ILLNESS**

----------Severity Level----------

☐Fatality ☐First Aid ☐Medical Treatment
☐Restricted Work ☐Lost Time

OTHER INCIDENT TYPES

☐Spill / Release
Material involved:_____
Quantity (U.S. Gallons): _____

☐Misdirected Waste ☐Consent Order ☐NOV
☐Property Damage ☐Exceedance
☐Motor Vehicle ☐Fine / Penalty

ACTIVITY TYPE (Check most appropriate one.)

☐Decommissioning	☐Geoprobe	☐Sampling
☐Demolition	☐Motor Vehicle	☐System Start-up
☐Dewatering	☐Operations/ Maintenance	☐Trenching
☐Drilling		☐AST/UST Removal
☐Excavation	☐Pump/Pilot Test	☐Other_____
☐Gauging	☐Rigging/Lifting	

INJURY TYPE (Check all applicable.)

☐Abrasion	☐Occupational Illness
☐Amputation	☐Puncture
☐Burn	☐Rash
☐Cold/Heat Stress	☐Repetitive Motion
☐Inflammation	☐Sprain/Strain
☐Laceration	☐Other_____

BODY PART AFFECTED (Check all applicable.)

☐Respiratory	☐Shoulder	☐Face
☐Neck	☐Arm	☐Leg
☐Chest	☐Wrist	☐Knee
☐Abdomen	☐Hand/Fingers	☐Ankle
☐Groin	☐Eye	☐Foot/Toes
☐Back	☐Head	☐Other_____

I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Directly/Indirectly Involved in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:
1)				
2)				

II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Injured in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:	Description of Injury:
1)					
2)					

III. PROPERTY DAMAGED IN INCIDENT (Attach additional information as necessary/applicable.)

Property Damaged:	Property Location:	Owner Name, Address & Phone #:	Description of Damage:	Estimated Cost:
1)				$

2)				$

IV. WITNESSES TO INCIDENT (Attach additional information as necessary/applicable.)

Witness Name:	Address:	Phone #:
1)		
2)		

PART 2: WHAT HAPPENED AND INCIDENT DETAILS

PROVIDE FACTUAL DESCRIPTION OF INCIDENT (e.g., describe loss/near loss, injury, response / treatment).

I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED (Attach additional information as necessary/applicable.)

Authority/Agency Notified:	Name/Phone #/Fax # of Person Notified:	Address of Person Notified:	Date & Time of Notification:	Exact Information Reported/Provided:

II. PUBLIC RESPONSES TO INCIDENT (if applicable)

Response/Inquiry By: (check one)	Entity Name:	Name/Phone # of Respondent/ Inquirer:	Address of Entity/Person:	Date & Time of Response/Inquiry:
☐Newspaper ☐Television ☐Community Group ☐Neighbors ☐Other _____				

Describe Response/Inquiry:

Roux/Remedial Response:

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)
ATTACHED INFORMATION: ☐Photo ☐Sketches ☐Vehicle Acord Form ☐Police Report ☐Other

Name(s) of person(s) who prepared Initial and Final Report:	**Title(s):**	**Phone number(s):**

PART 3: INVESTIGATION TEAM ANALYSIS

CONCLUSION: WHY IT HAPPENED (LIST CAUSAL FACTORS AND CORRESPONDING ROOT CAUSES)

(Root Causes: Lack of knowledge or skill, Doing the task according to procedures or acceptable practices takes more time or effort, Short-cuts or not following acceptable practices is reinforced or tolerated, Not following procedures or acceptable practices did not result in an accident, Lack of or inadequate procedures, Inadequate communications of expectations regarding procedures or acceptable practices, Inadequate tools or equipment, External Factors)

ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING

CAUSAL FACTOR	ROOT CAUSE		SOLUTION(S) [Must Match Root Cause(s)]		PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE
			#	Solution(s)			
			1				
			2				
			3				

INVESTIGATION TEAM:

PRINT NAME	JOB POSITION	DATE	SIGNATURE

No One Gets Hurt!

Job Safety Analysis (JSAs)

JOB SAFETY ANALYSIS	Ctrl. No. GEN-001	DATE: 12/5/12	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**Construction - Excavation**	**Excavation / Trenching**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Ian Holst	Staff Engineer	Curtis Taylor	Health and Safety Officer
		Michael Ritorto	Project Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Leather or cut resistant
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☒ LONG SLEEVED SHIRT	☒ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility long sleeved clothing	
☐ LIFELINE / BODY HARNESS	☒ SAFETY SHOES: Steel-toe boots		
☒ SAFETY GLASSES			

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Jackhammer, Excavator, Hand Tools, Photoionization Detector, barrels, cones, caution tape, ladders, shovels, digging bars , power tools (cut off saw)

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE: Maintain 10' or greater exclusion zone around excavator while it is in motion.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Pre-Clearance Protocol.	1a. **CONTACT:** Damage to underground utility.	1a. Confirm that (if applicable) "Call Before You Dig" and local utility companies were contacted prior to trenching in order to confirm utility mark outs. Must have a case # before digging.
	1b. **ENERGY SOURCE/CONTACT:** Property damage; Pressurized water mains. Pressurized gas mains. Sewer lines. Underground electric.	1b. Pre-clearing of the trenching location must be conducted to a minimum of 4 vertical feet below the ground surface (8 feet minimum for Critical Zone) using hand tools (shovel and non-metallic dig bar) prior to trenching. Supervisor should be contacted to discuss appropriate pre-clearing depth. Complete subsurface clearance checklist.
	1c. **FALL:** Slip ,Trip or Fall.	1c. Be aware of the conditions when walking, or loading equipment and working. Walk within established pathway avoiding uneven surfaces. Remove potential slip/trip/fall hazards.
2. Set up work zone.	2a. **CONTACT/CAUGHT:** Injury from equipment.	2a. Isolate work area from hazards with cones, barricades, and caution tape. Utilize a flag person when necessary (i.e., third party traffic in area). Install traffic signs in roadways and for detours. Spotters will maintain and enforce exclusion zone.
	2b. **FALL:** Slip ,Trip or Fall.	2b. See 1c.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into five types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards, energy source; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Trenching Activity.	3a. **CONTACT:** Injury due to contact with machine. 3b. **FALL:** Slip ,Trip or Fall. 3c. **EXPOSURE:** Noise, Dust, Concrete- Asphalt, petroleum hydrocarbon vapors.	3a. Spotter(s) required for all heavy equipment operation. No worker shall be allowed inside the exclusion zone or along the trench/excavation area while any equipment is digging. A minimum exclusion zone greater than the length of the equipment boom must be established. Workers only allowed in exclusion zone if the operator is in "Hands Off "mode. Operator will not operate equipment until worker is out of exclusion zone. 3b. Any trench/excavation deeper than 4' must have a ladder within 25' of any worker in the excavation. At least 3' (rungs) shall be above the top of the excavation. All spoil piles shall be maintained 2' minimum from edge of excavation. 3c. Air monitoring using a calibrated photoionization detector (PID) will be used to monitor the breathing zone of the work area. If a reading of >5ppm is recorded, the oversight personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings.
4. Setting Trench protections if necessary.	4a. **CAUGHT:** Injury due to contact with failed trench. 4b. **CONTACT/CAUGHT:** Injury due rigging activities and entering exclusion zone during lifting and/or transport of shoring box/material. 4c. **FALL:** Possible injury due to fall into excavation.	4a. To prevent cave-ins and avoid caught by/between, excavations over 5' in depth shall have engineer approved shoring, sheeting or digging box. Top of protection shall be at least 2' above top of excavation. 4b. Use only inspected rigging with 2, 3 or 4 lift points; wear cut-resistant gloves. Rigging to be hooked up to factory installed hook up points on equipment. Control load with non-conductive tag lines with workers out of exclusion zone. Don't stand underneath suspended load; wear steel toed boots and hard hat. 4c. Shoring to be set and sides will be backfilled to avoid fall hazards before workers allowed to enter area. Operator will be in "HANDS OFF" mode before workers enter work area to unhook rigging. An inspected ladder set 3' above top of shoring will be used to enter and exit shoring. Workers will use three points of contact when using ladder.
5. Secure/Leave Site. **If backfilling, see excavation backfilling and compaction JSA for potential hazards and critical actions.**	5a. **FALL:** Potential Slip ,Trip or Fall hazards.	5a. See 1c. All open excavations must be backfilled or secured prior to departure with steel plates, orange construction fence or temporary chain link fencing.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-003	DATE: 12/6/2012	☒ NEW ☐ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Construction – Concrete and Asphalt**	**Concrete Form Assembly and Concrete Pouring**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Jimmy Kuruvilla	Project Construction Manager	Curtis Taylor	Health and Safety Officer
		Michael Ritorto	Project Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Leather and Nitrile/Latex
☒ HARD HAT	☒ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☒ OTHER: Chaps
☐ LIFELINE / BODY HARNESS	☒ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest, long sleeve shirt	
☐ PERSONAL FALL ARREST SYSTEM	☒ SAFETY SHOES: Steel /composite toe boots		
☒ SAFETY GLASSES			

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE (EZ): Maintain a minimum 10' exclusion zone around equipment and loads while it is in motion.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Set-up work zone.	**1a. CONTACT:** Moving equipment, third party traffic.	1a. Secure work area using barricades and caution tape. Use flagmen to control third party traffic. **Maintain minimum exclusion zone (EZ) of 10'** around equipment and live loads. 1a. When machines are operating, all workers will remain outside of EZ unless operator is in "HANDS OFF" mode.
2. Assembly of concrete form (i.e., plywood, lumber, rebar, etc.).	**2a. CONTACT:** Contacting materials being lowered into work area. Potential for cuts and abrasions and to be contacted by nails while assembling. **2b. EXERTION:** Muscle strain. **2c. EXPOSURE:** Noise, dust, fumes. **2d. CAUGHT:** Pinch points, Caught between, Crushed	2a. Workers will keep fingers and limbs out of the line of fire of tools, equipment and live loads. Workers will use inspected rigging and only attach rigging to manufacturer installed lifting points. Loads will be controlled with non-conductive tag lines from outside the EZ. Wear hard hat. See JSA for applicable cutting tool. 2b. When transporting and working with forms, workers will keep backs straight, knees bent, and keep loads close to their body. Any load more than 50 lbs., will be lifted by two or more workers or a mechanical lifting device. 2c. Workers will wear hearing protection, face shields and chaps when using all power tools. Fuel powered tools will be fueled away from the work zone in a well-ventilated area. Refueling will be done after a minimum cool down period of 2 minutesSee JSA for applicable cutting tool. 2d. Keep hands away from rigging while hooking/unhooking materials; wear leather gloves.
3. Set up concrete trucks and chute.	3a. **CONTACT/CAUGHT:** Potential for truck to contact personnel, fingers to be pinched while setting up hoses. 3b. **OVEREXERTION:** Strain, pulled muscles.	3a. Spotters will guide concrete trucks into position; wheel chocks will be set before work begins when trucks are parked. Workers will stay out of exclusion zone until truck is parked and secured. 3b. All workers will keep back straight and bend their knees when lifting. Two workers will be used when load exceeds 50 lbs.
4. Pour concrete into forms.	4b. **CONTACT:** Wet concrete.	4b. Possible splashing from concrete, portable eye wash stations shall be set up in close proximity for easy access; wear safety glasses. Nitrile or latex gloves shall be worn to eliminate skin contact with concrete.
5. Vibrate to settle and remove air from poured cement.	5a. **ENERGY SOURCE:** Potential for personnel to be exposed to live electricity. 5b. **OVEREXERTION:** Potential muscle strain while vibrating cement, stepping over forms/rebar reinforcements.	5a. Electrical tools shall be inspected for defects prior to being used. Any extension cords shall be heavy duty rated and be free from defects (no exposed wires). All electrical connections shall be connected to GFCI outlets. 5b. Constantly check/observe where you are walking; wear steel toed boots. Keep back straight and knees bent while settling concrete with vibrator.

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[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
6. Cleanup of work area and tools.	6a. **CONTACT/FALL:** Potential slip, trip, and fall on materials and tools left in the work area.	6a. Place additional materials and tools in designated storage areas. Remove any garbage from the work area.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-006	DATE 8/22/2013	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**Surveying**	**Elevation Surveying**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Bjorn Wespestad	Project Engineer	Curtis Taylor	Health and Safety Officer
		Michael Ritorto	Project Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant or leather
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel-toe boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Surveying equipment (i.e., leveling rod/measuring ruler, tripod and scope).

COMMITMENT TO LPS - All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Locate surveying position for instrument and rod and set-up work area	1a. **FALL:** Slip/trip hazards. 1b. **CONTACT:** Traffic (surveying locations could potentially be located in parking areas and sidewalks). 1c. **OVEREXERTION:** Hazard due to carrying, lifting, and bending while transporting equipment. 1d. **CAUGHT/CONTACT:** Pinch Points / sharp edges associated with setting up the tripod.	1a. Inspect area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to setting up at the survey location. 1b. Be aware of oncoming traffic. Utilize a flagman / spotter for locations in streets or high-traffic areas. 1b. Place 42 inch cones around the work area, and delineate work zone with caution tape, if necessary. 1b. Wear appropriate PPE including high visibility clothing or reflective safety vest. 1b. Face traffic, maintain eye contact with oncoming vehicles, and establish a safe exit route. 1c. Use proper body positioning and lifting techniques; keep back straight, lift with legs, keep load close to body, and never reach with a load. 1c. Avoid carrying too much equipment at one time and team-lift equipment that is more than 50lb. 1d. Wear cut resistant gloves when handling the tripod. Don't carry tripod by the pointed ends.
2. Open / close manhole cover to well that is being surveyed (if necessary).	2a. **OVEREXERTION:** Muscle strain 2b. **CAUGHT:** Pinch points associated with removing / replacing manholes and working with hand tools. 2c. **EXPOSURE:** To potentially hazardous vapors. 2d. **CONTACT:** With traffic.	2a. See 1c. Bend knees when reaching to open well. Use manhole lifting hook or pry bar to avoid bending. 2b. Wear leather gloves or cut resistant gloves when working with well cover and hand tools. 2b. Use proper tools (ratchet and crowbar or pry bar for well cover) and inspect before use. 2b. Do not put fingers under well cover. 2c. No open flames/heat sources. 2c. To minimize exposure to vapors allow well to vent after opening it and before survey activities begin. 2c. Work on the upwind side of well. 2d. See 1b.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Perform survey.	3a. **FALL:** Slip/trip hazards 3b. **CONTACT:** Traffic (surveying locations could be potentially located in parking areas and sidewalks)	3a. See 1a. 3b. See 1b. 3b. Personnel using the scope will be devoting most of their attention to the surveying activity. Personnel holding the measuring stick should be extra vigilant of survey personnel and communicate any potential hazards to the instrument person via handheld radio or similar means. Ensure reflective safety vest is worn.
4. Break down work area.	4a. **CONTACT:** Traffic (surveying locations can potentially be located in parking areas and sidewalks). 4b. **EXERTION:** Hazard due to carrying, lifting, and bending while transporting equipment	4a. See 1b. 4b. See 1c.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-007	DATE: 12/10/2012	☐ NEW ☒ REVISED	PAGE 1 of 1

JSA TYPE CATEGORY **GENERIC**	WORK TYPE	WORK ACTIVITY (Description) **Movement of 55-gallon Drums/Drum Handling**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Curtis Taylor	Health and Safety Officer	Michael Ritorto	Project Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant gloves
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER:
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel toed boots		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Drum Cart and/or forklift, safety cones, and caution tape

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE: A 10' exclusion zone will be maintained around forklift.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure Work Area, Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts. **See JSA Forklift for potential hazards and critical actions.** **Inspect forklift before operating to ensure it is in good condition and functioning correctly.**	1a. **FALL:** Tripping/falling due to uneven surface terrain. 1b. **EXPOSURE:** Drums could potentially be damaged and contain hazardous material. 1c. **OVEREXERTION:** Potential muscle strain while loosening or tightening bolts.	1a. Inspect walking path for uneven terrain, weather-related hazards (i.e., tree debris, puddles, etc.), and obstructions prior to accessing work area. 1a. Use established pathways and walk on stable, secure ground. 1a. Secure work area and coordinate and communicate the planned work activities with other personnel working in the area. 1a. 1b. When inspecting drums, don nitrile gloves under cut resistant glove. If drum is not properly labeled, do not open and cease all drum transport related activities. Immediately contact project manager and inform him/her of drum situation. 1b. Do not continue drum transport activities until further actions are determined by the project manager. 1b. If the drum is properly labeled, but leaking, improperly sealed, or in poor condition, place drum in an over-pack drum. 1c. Keep back straight and secure grip on drum ratchet.
2. When using a forklift, position drum clamp in between drum ribs. When using a drum dolly, secure fastening hook on top of drum. .	2a. **CAUGHT/CONTACT:** Hazards between drum/forklift clamp or dolly fastener/drum. 2b. **OVEREXERTION/CONTACT:** Hazards associated with balancing drum on drum cart (leaning back and pulling drum with your back).	2a. Position drum clamp between the ribs on the drum to prevent possible slipping. Do not place hands between drum clamp and drum; wear cut resistant gloves. 2b. Do not jerk body. Wear cut-resistant gloves and steel toed boots. 2b. Ensure that drums are not over-filled.
3. Transport drums to designated location and disengage drum clamp.	3a. **EXPOSURE/ CONTACT:** Hazards associated with drum transport; skin contact and vapors. 3b. **CAUGHT:** Pinching hazards associated with maneuvering drums. 3c. **FALL:** Tripping/ falling due to obstructions and uneven terrain.	3a. **Maintain a 10' EZ around forklift.** Ensure drum clamp is secure on drum before beginning to move. 3a. Ensure that drum is sealed and lid is tight before beginning to move. 3b. Do not place fingers between drum clamp and drum; wear cut resistant gloves. 3c. See 2b. 3c. If path is too rough for drum cart, utilize forklift. 3c. Utilize a spotter while operating the forklift.

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JOB SAFETY ANALYSIS	Cntrl. No. GEN-010	DATE: 12/31/2012	☐NEW ☒REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)	
GENERIC	**Site Recon**	**Mobilization/Demobilization**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Jared Lefkowitz	Staff Assistant Scientist	Curtis Taylor	SHSM
		Mike Ritorto	Project Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES	☐ GOGGLES ☐ FACE SHIELD ☒ HEARING PROTECTION (as needed) ☒ SAFETY SHOES: Steel Toe or composite toe	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest of high-visibility clothing; long sleeve shirt; long pants	☐ GLOVES: Leather, nitrile, and cut resistant (as needed) ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment:

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE: A minimumexclusion zone of 10' will be maintained around moving equipment (if necessary)

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilize/demobilize and establish work area	**1a. FALL:** Slip/trips/falls from obstructions, uneven terrain, weather conditions, heavy loads, and/or poor housekeeping.	1a. Use 3 points-of-contact/ensure secure footing when entering and exiting vehicle. 1a. Inspect walking path for uneven terrain, steep hills, obstructions, and/or weather-related hazards (i.e., ice, snow, and puddles) prior to mobilizing equipment. Use established pathways.Walk on stable/secure ground. 1a. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1a. Wear boots with adequate treads. 1a. Delineate unsafe areas with 42" cones, caution tape and/or flagging.
	1b. CONTACT: Personal injury and/or property damage caused by being struck by Site traffic or equipment used in Site activities.	1b. Observe and maintain the posted speed limits. 1b. When first arriving onsite, park vehicles in designated parking space and/or out of the way locations. Use parking brake on all vehicles and tire chocks on work trucks and trailers. 1b. Check in with Site Manager/Supervisor to ensure coordination with other Site activities. 1b. Identify potential traffic sources. 1b. Wear PPE including high visibility clothing or reflective vest. 1b. Use a spotter while moving work vehicles; plan ahead to avoid backing when unnecessary. 1b. Maintain a minimum 10' exclusion zone when vehicles are in motion. When backing up truck rig with an attached trailer use a second spotter if there is tight clearance simultaneously on multiple sides of the equipment or if turning angles limit driver visibility. 1b. Delineate work area with 42" cones, flags, caution tape, and/or other barriers. 1b. Position "Work Area" signs at Site entrances, if possible, or at either side of work area. 1b. Position largest vehicle to protect against oncoming traffic. 1b. Face traffic, maintain eye contact with oncoming vehicles, use a spotter, and establish a safe exit route.
	1c. CAUGHT: Personal injury from pinch points and being in line-of-fire of vehicle and/or equipment.	1c. Make sure driver has engaged parking brake and placed wheel chocks in a position to prevent movement. Be sure that vehicle is parked in front/down gradient of work area. 1c. Wear leather gloves when handling any tools or equipment. Avoid wearing loose clothing. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools. 1c. Keep body parts away from line-of-fire of equipment. 1c. Always carry tools by the handles and/or designated carrier. Ensure sharp-edged tools are sheathed/secure. 1c. Remove any loose jewelry. Ensure loose clothing is secure.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
	1d. OVEREXERTION: Muscle strains while lifting/carrying equipment.	1d. Use body positioning and lifting techniques that avoid muscle strain; keep back straight, lift with legs, keep load close to body, and never reach with a load. 1d. Ensure that loads are balanced. Use assistance (mechanical or additional person) to carry equipment that is either awkward to carry or over 50 lbs.
	1e. EXPOSURE: Personal injury from exposure to biological and environmental hazards.	1e. Inspect area to avoid contact with biological hazards (i.e. poisonous plants, stinging insects, ticks, etc.). 1e. Wear long sleeved clothes, apply insect repellant containing DEET, and inspect clothes and skin for ticks during and after work. 1e. Apply sunscreen (SPF 15+) if exposure to sun for 30 minutes or more is expected.
	1f. EXPOSURE: Heat and cold related injuries.	1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). Take breaks as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks as needed. 1f. Wear clothing appropriate for weather and temperature conditions (e.g., rain jackets, snow pants, multiple layers). 1f. If lightning is observed, wait 30 minutes in a sheltered location (car is acceptable) before resuming work.
	1g. EXPOSURE: Personal injury from noise hazards.	1g. Wear hearing protection if sound levels exceed 85 dBA.

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JOB SAFETY ANALYSIS B-13	Ctrl No. GP 014	DATE: 3/27/2013	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Site Specific **Site: Greenpoint**	**Construction - Excavation**	**Excavation /Trenching With Heavy Machinery**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Thomas Mastrocinque	H&S Officer	Charles Giudice	Supervisor
Rosario Puglisi	Timberman	Curtis Taylor	SHSM
Luis Natal	Laborer		

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT WITH LIGHT ☒ PPE CLOTHING: fluorescent long sleeve shirt or long sleeve shirt and reflective safety vest. ☐ LIFELINE / BODY HARNESS	☐ GOGGLES ☐ FACE SHIELD ☐ HEARING PROTECTION ☒ SAFETY BOOTS steel or composite toe	☒ AIR PURIFYING RESPIRATOR as needed ☐ SUPPLIED RESPIRATOR ☒ CLEAR SAFETY GLASSES	☒ GLOVES: Leather or cut resistant ☐ OTHER

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Excavator, VAC Truck, Photoionization Detector, ladders, shovels, digging bars, APR if VOC's >5 ppm

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE: 10' exclusion zone (EZ) around excavator. 4' EZ for the primary machine spotter in order to look out for unmarked utilities.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Pre-Clearance protocol **REFER TO VAC TRUCK JSA AND SUBSURFACE CLEARANCE PROCEDURE CHECKLIST**	1a. **CONTACT:** Property Damage: Underground utilities, pressure water mains, pressure gas mains, sewer lines, underground electric	1a. Confirm that "Call Before You Dig" and local utility companies were contacted prior to trenching in order to confirm utility mark outs. All mark-outs shall be re-marked with fresh paint on a daily basis. Prior to initiating any new excavation, the Subsurface Clearance Procedure Checklist will be reviewed by field supervisor and/or foreman. There shall be a pre-excavation meeting of all field personnel involved with any excavation activities to discuss where utilities are located and what precautions shall be taken to identify and protect them. All utilities within excavation area shall be exposed 5' feet in all directions using hand tools (shovel and bar) and/or soft excavation (Vac Truck) prior to excavating with machine. Fiberglass digging bars shall be used when digging within 5' of known electrical lines.
	1b. **FALL:** Slip ,Trip or Fall	1b. Be aware of the conditions when walking in or around work area. Walk within established pathways and avoid uneven surfaces.
2. Setup work zone	2a. **CONTACT/CAUGHT:** Injury from equipment	2a. Isolate work area from hazards with cones, barrels or barricades and caution tape. A flag person shall be used to control third party vehicular and/or pedestrian traffic. Spotters shall maintain and enforce **10ft exclusion zone (EZ).**
	2b. **FALL:** Slip ,Trip or Fall	2b. See 1b.
	2c. **OVEREXERTION:** Potential for back and muscle strain while soft digging	2c. Keep back straight, knees bent, heels flat on ground when lifting. Stay hydrated, take adequate breaks.
3. Trenching activity	3a. **CONTACT:** With machine, with falling debris or material Personnel injury to personnel in trench	3a. Workers shall enter exclusion zone only when the operator is in "Hands Off "mode. **Operator shall not operate equipment until workers are out of the exclusion zone.** The **EZ is 10 feet** for this task (4 ft for the primary spotter). All spoil piles and materials shall be maintained 2' minimum from edge of excavation. Any time there is a worker(s) present in trench there shall be a competent person out of the trench (on top) to watch for hazards.

[1] Each Job or Operation consists of a set of tasks / steps. Be sure to list all the steps needed to perform job.

[2] A hazard is a potential danger. Break hazards into six types: Contact - victim is struck by or strikes an object; Caught - victim is caught on, caught in or caught between objects; Fall - victim falls to ground or lower level (includes slips and trips); Exertion - excessive strain or stress / ergonomics / lifting techniques; Exposure - inhalation/skin hazards; Energy Source – electricity, pressure, compression/tension.

[3] Using the first two columns as a guide, decide what actions or procedures are necessary to eliminate or minimize the risk. List the recommended safe operating procedures. Say exactly what needs to be done - such as "use two persons to lift". Avoid general statements such as, "be careful".

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
	3b. **FALL:** Slip ,Trip or Fall	3b. Any trench/excavation deeper than 4' shall have an inspected ladder within 25' of any worker in the excavation. At least 3' (rungs) shall be above the top of the excavation. Ladders shall be secured and tied off. Workers shall maintain three points of contact on ladder at all times. Tools and equipment shall not be carried while on ladder – use taglines or machines to move tools/equipment/material in and out of the excavation. 3b. Any excavation 6ft or deeper requires a guardrail/fence system – or – anyone within 6ft of an unprotected edge shall don a personal fall arrest system (harness & lanyard anchored to a 5000 pound anchorage point).
	3c. **EXPOSURE:** To fumes and vapors: toxic, flammable, explosive, corrosive and/or asphyxiating	3c. Air monitor shall be calibrated, bump tested and monitored daily (readings documented at regular intervals) during excavation activities. Excavation shall be evacuated when/if air monitor sounds (VOC's >5 ppm). APR shall be donned before reentering. Inspected 20lb Fire extinguisher shall be at hand. Don't stand downwind of excavation.
4. Shoring **Refer to JSA for Wood Sheeting Installation, Steel Trench Box Assembly, or Installation of Steel Z Sheeting**	4a. **Refer to JSA for Wood Sheeting Installation, Steel Trench Box Assembly, or Installation of Steel Z Sheeting for potential hazards**	4a. **Refer to JSA for Wood Sheeting Installation, Steel Trench Box Assembly, or Installation of Steel Z Sheeting for critical actions.**
5. Secure/Leave Site **Refer to Backfilling Excavation JSA if applicable**	5a. **FALL:** Slip ,Trip or Fall	5a. See 1b. All open excavations must be backfilled or secured prior to departure with steel plates, orange construction fence or temporary chain link fencing.

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OSHA Poster

You Have a Right to a Safe and Healthful Workplace.

IT'S THE LAW!

- ❑ You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- ❑ You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- ❑ You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act.*
- ❑ You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- ❑ Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- ❑ You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- ❑ Your employer must post this notice in your workplace.

The *Occupational Safety and Health Act of 1970 (OSH Act),* P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act.* The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, visit our website at www.osha.gov or call 1-800-321-OSHA or your nearest OSHA office:

Atlanta (404) 562-2300	Boston (617) 565-9860	Chicago (312) 353-2220	Dallas (214) 767-4731
Denver (303) 844-1600	Kansas City (816) 426-5861	New York (212) 337-2378	Philadelphia (215) 861-4900
San Francisco (415) 975-4310	Seattle (206) 553-5930	Teletypewriter (TTY) 1-877-889-5627	

If you work in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

1-800-321-OSHA

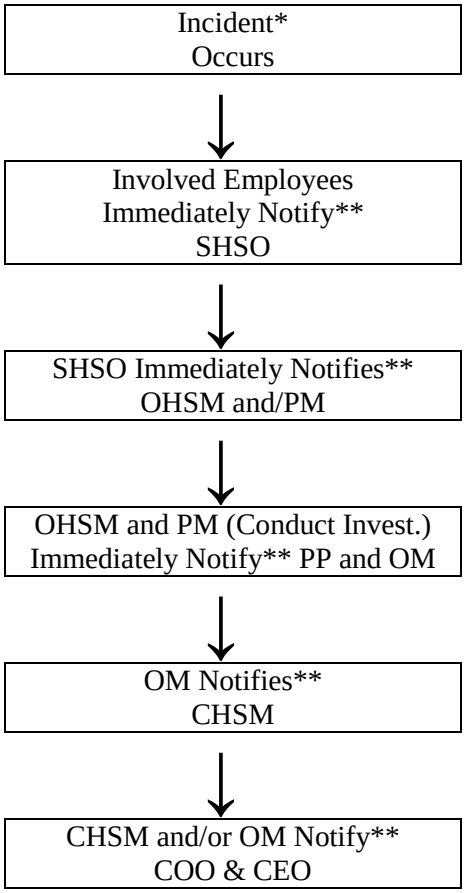
OSHA Occupational Safety and Health Administration

www.osha.gov U.S. Department of Labor

OSHA 3165-09R

Health & Safety Near/Loss - Loss (Incident) Notification Flow Chart

Health & Safety Near/Loss – Loss (Incident)*
Notification Flow Chart



* Incident – any work or site-related occurrence that resulted in, or could potentially have resulted in, the need for medical care or in property damage (i.e., all injuries or illnesses, exposure to toxic materials or any other significant occurrence resulting in property damage or in a "near loss")

** Verbal Notification

Initial Incident Report (written) to SHSO, OHSM, OM and CHSM within 24 hours
Follow-up Report within one week.

(Reference: Corporate H&S Standard Operating Procedure, Incident Investigation and Reporting, SOP #1.8, dated March 2000)