CHESTNUT COMMONS ATLANTIC AVE. SITE
BROOKLYN, KINGS COUNTY, NEW YORK

Remedial Investigation Report/Remedial Action Work Plan

NYSDEC BCP Number: C224276

110 Dinsmore Place, Brooklyn, New York

Prepared for:

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DECEMBER 2019

CERTIFICATIONS

I, Jessica L. Taylor, certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Report 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 that all activities were performed in full accordance with the DER-approved work plan and any DER-approved modifications.

Jessica L. Taylor	12/11/19	Jessica L. Taylor
Qualified Environmental Professional	Date	Signature

I, Brian P. Morrissey, certify that I am currently a NYS registered professional engineer and that this Remedial Action 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).

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

Brian P. Morrissey #062617	12/11/19	Brian P. Morrissey
NYS Professional Engineer #	Date	Signature

It is a violation of Article 145 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 145, New York State Education Law.

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LIST OF ACRONYMS

µg/kg .....Micrograms per Kilogram
µg/L.....Micrograms per Liter
µg/m^3.....Micrograms per Cubic Meter
mg/kg .....Milligrams per Kilogram
4,4'-DDE.....4,4'-Dichlorodiphenyldichloroethylene
4,4'-DDD 4,4-Dichlorodiphenyldichloroethane
4,4'-DDT.....4,4-Dichlorodiphenyltrichloroethane
AOCs.....Areas of Concern
ARARs.....Applicable or Relevant and Appropriate Requirements
ASP .....Analytical Services Protocol
AWQSGVs .....Ambient Water Quality Standards and Guidance Values
BCA .....Brownfield Cleanup Agreement
BCP .....Brownfield Cleanup Program
BEEI.....Bureau of Environmental Exposure Investigation
bls.....Below Land Surface
BOA .....Brownfield Opportunity Areas
CAMP .....Community Air Monitoring Plan
CEH.....Center for Environmental Health
CFR.....Code of Federal Regulations
COC .....Certificate of Completion
CP-51 .....Commissioner Policy-51
CPP .....Citizen Participation Plan
CQAP.....Construction Quality Assurance Plan
CSM .....Conceptual Site Model
cy.....Cubic Yards
DCE.....cis-1,2-dichloroethene
DEC.....Department of Environmental Conservation
DER-10 .....NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation
DMM.....Division of Materials Management
DO.....Dissolved Oxygen
DUSR.....Data Usability Summary Report
EC .....Engineering Control
ECL.....Environmental Conservation Law
EDD .....Electronic Data Deliverable
EJ.....Environmental Justice
ELAP.....Environmental Laboratory Approval Program
ESA.....Environmental Site Assessment
FER .....Final Engineering Report
Ft .....Feet/Foot
HASP .....Health and Safety Plan
HAZWOPER ....Hazardous Waste Operations and Emergency Response
IC.....Institutional Control
LNAPL.....Light Non-Aqueous Phase Liquid
MEK.....Methyl Ethyl Ketone; 2-butanone

MS/MSD.....Matrix Spike/Matrix Spike Duplicate
MW .....Monitoring Well
NYCDEP.....New York City Department of Environmental Protection
NYCDOT.....New York City Department of Traffic
NYCRR.....New York Codes, Rules, and Regulations
NYSDEC.....New York State Department of Environmental Conservation
NYSDOH.....New York State Department of Health
NYSDOT .....New York State Department of Transportation
O&M .....Operation and Maintenance
OSHA.....Occupational Safety and Health Administration
PAHs .....Polycyclic Aromatic Hydrocarbons
PCBs .....Polychlorinated Biphenyls
PCE .....Tetrachloroethene (Perchloroethene)
PEJA .....Potential Environmental Justice Area
PDF .....Portable Document Format
PID .....Photo Ionization Detector
PPE.....Personal Protective Equipment
PVC.....Polyvinyl Chloride
QAPP .....Quality Assurance Project Plan
QA/QC .....Quality Assurance/Quality Control
RAOs.....Remedial Action Objectives
RAWP .....Remedial Action Work Plan
RI.....Remedial Investigation
RIR.....Remedial Investigation Report
RIR/RAWP .....Remedial Investigation Report/Remedial Action Work Plan
SCG.....Standards, Criteria, and Guidance
SCOs .....Soil Cleanup Objectives
SEQRA .....State Environmental Quality Review Act
SGC.....Short-term Guidance Concentration
SMP.....Site Management Plan
SoMP.....Soil Management Plan
SOP .....Site Operations Plan
SSO .....Site Safety Officer
Stiles.....Stiles Properties, LLC
SVOCs .....Semivolatile Organic Compounds
SWPPP.....Stormwater Pollution Prevention Plan
TAGM.....Technical and Administrative Memorandum
TAL.....Target Analyte List
TBCs .....To Be Considered
TCE.....Trichloroethene
TCL.....Target Compound List
TOGS .....Technical and Operational Guidance Series
USEPA.....United States Environmental Protection Agency
USGS .....United States Geological Survey
VOCs.....Volatile Organic Compounds

EXECUTIVE SUMMARY

Site Description/Physical Setting/Site History

Chestnut Commons Apartments LLC entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) on September 14, 2018, to investigate and remediate a 0.66-acre property located at 110 Dinsmore Place in the East New York section of Brooklyn, Kings County, New York at Tax Block 4142 and Lot 34 (Site). The Brownfield Cleanup Program (BCP) Site is also known as the Chestnut Commons Atlantic Ave Site BCP Site No. 224276. Chestnut Commons Apartments LLC entered the BCP with a Volunteer status in relation to the BCP Site due to the presence of contaminated soil, groundwater, and soil vapor on the Site. The planned reuse for the property is a mixed-use building consisting of 100% affordable housing units, as well as community and open/recreational space, and a cellar.

Currently, the Site is a vacant, fenced, unpaved lot with overgrown vegetation. There is an undergoing development by New York City School Construction Authority (NYCSCA) to the west of the property. There is also a vacant property to the east of the Site across Chestnut Street that is also enrolled in the NYSDEC BCP (BCP Site #C224236). An aboveground subway line is one block to the north of the Site, and an underground Long Island Rail Road line is located to the south, running east to west beneath Atlantic Avenue.

Historical Site uses include: the Brooklyn Water House, which was an open-air coal shed and part of the facilities "oil house" between 1887 until 1902, and a water pumping station with a large building, storage sheds and large stacks between 1924 until 1975.

Summary of the Remedial Investigation

The purpose of the RI is to determine the nature and extent of contamination at the Site, characterize environmental media, qualitatively assess the potential exposure of receptors to Site contaminants, and develop any other additional data necessary to support the development of a RAWP. During 2018 and 2019, Roux performed a RI which included the collection of soil, groundwater, and soil vapor samples throughout the Site. In general, the data generated during the RI indicate the following Site-wide conditions:

- Soil lithology consists of a layer of historical fill ranging in thickness from 5 to 15 feet that overlies native soil consisting of glacial outwash sediments comprised of predominantly sand and gravel.
- The depth to groundwater in the monitoring wells was between approximately 26 to 32 feet bls. Groundwater flow is assumed to be toward the southwest. A groundwater flow map is shown in **Figure 3**.
- Soil contaminants were consistent with contaminated historical fill and former coal operations on the Site, and included:
    - Volatile organic compounds (VOCs), specifically acetone, benzene, and toluene, were detected above the Unrestricted Use SCOs and Protection of Groundwater SCOs; however, none of these exceeded Restricted Residential SCOs.
    - Semivolatile organic compounds, specifically polycyclic aromatic hydrocarbons (PAHs), were detected above Unrestricted Use SCOs in nine samples, above the Restricted Residential SCOs in seven samples, and above the Protection of Groundwater SCOs in six samples.
    - Metals, specifically arsenic, copper, lead, mercury, nickel, silver, and zinc, were detected above the Unrestricted Use SCOs, the Restricted Residential SCOs, and/or the Protection of Groundwater SCOs. Filtered groundwater data (discussed below) indicates that presence of metals in soil has not impacted groundwater quality at the Site.
    - PCBs were not detected during the RI.
    - Pesticides, specifically dieldrin, 4,4'-DDD, 4,4'-DDE, and 4,4'-DDT, were detected above Unrestricted Use SCOs, but below Restricted Residential and Protection of Groundwater SCOs. The presence of pesticides in shallow soil is likely indicative of the historical fill or application of pesticides to the Site while it was vacant land for many years.
- Groundwater does not appear to be significantly contaminated by the historical fill/coal residue present at the Site; however, there are impacts of chlorinated VOCs (CVOCs) indicative of contamination likely from an off-site source. Specific groundwater conditions include:
    - VOCs including chloroform, tetrachloroethene (PCE), and trichloroethene (TCE), were detected above Ambient Water Quality Standards and Guidance values (AWQSGVs). The CVOCs present in groundwater are highest in the southeast portion of the Site, and these CVOCs were not detected above Unrestricted Use SCOs in soil. Since groundwater flow direction is to the southwest, therefore, it is likely that the source of these CVOCs is originating off-site.
    - SVOCs were detected above AWQSGVs in one groundwater sample, specifically bis(2-ethylhexyl) phthalate.

  - Metals were detected above AWQSGVs in total (unfiltered) samples. Of these compounds, iron, magnesium, manganese, nickel, and sodium are naturally occurring metals which are commonly found in groundwater. Sodium and manganese were the only metals detected in both total and dissolved samples. Beryllium, chromium, copper, lead, and thallium, which are typical of historical fill and were also detected in soil, were only detected above AWQSGVs in the total metals analysis, and were not detected in soil above Protection of Groundwater SCOs. Since they were not detected in the dissolved samples it is likely the exceedance is due to sediment introduced into the sample during groundwater sampling.

  - PCBs were not detected in any of the groundwater samples collected during this RI.

  - Pesticides were detected above AWQSGVs in one sample, specifically chlordane.

- Soil vapor analysis indicates that the Site has been impacted by CVOCs, presumed to be emanating from an off-site source to the west of the Site. Carbon tetrachloride, cis-1,2-dichloroethene, 1,1-dichloroethene, TCE, PCE, 1,1,1-trichloroethane, methylene chloride, and vinyl chloride were all detected at elevated concentrations above the NYSDOH matrices.
- In addition to the RI sampling, in situ waste characterization was performed. The results of the soil waste characterization are consistent with findings from the RI:
  - SVOCs were present at concentrations exceeding Unrestricted Use SCOs and Restricted Residential SCOs. These SVOCs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno[1,2,3-cd]pyrene, chrysene, and dibenzo[a,h]anthracene.
  - Metals including arsenic, mercury, and cadmium were present at concentrations exceeding Unrestricted Use SCOs and Restricted Residential SCOs.
  - Pesticides including 4,4'-DDD, 4-4'-DDT, 4,4'-DDE, and dieldrin were present at concentrations exceeding Unrestricted Use SCOs. Restricted Residential SCOs were not exceeded for any pesticides.
  - RCRA Characteristic Waste for Toxicity was not exceeded for any metals.
  - None of the results for the waste disposal parameters (ignitability, corrosivity, and reactivity), exceeded thresholds for consideration as hazardous waste.

Qualitative Human Health Exposure Assessment

The following table summarizes the exposure assessment.

Environmental Media and Exposure Route	Human Exposure Assessment
Direct contact with subsurface soils (and incidental ingestion)	• Remedial workers can come into contact with soil if they perform ground intrusive work at the Site. • During remediation, remedial workers, trespassers, passersby, and utility workers could come into contact with contaminated soil contained in dust through inhalation, incidental ingestion and dermal contact, however, these potential exposure scenarios will be controlled through implementation of the Health & Safety Plan (HASP), Soil Management Plan (SMP) and Community Air Monitoring Plan (CAMP) during the remediation to avoid these exposure scenarios. • Future exposure will be eliminated though addressing contaminated soil as described in the RAWP portion of this document.
Ingestion of groundwater	• Contaminated groundwater is not used for drinking water, as the Site is connected to the public water supply, therefore, there is no potential for human contact with groundwater.
Direct contract with groundwater (and incidental ingestion)	• Remedial workers could come into contact with contaminated groundwater through dermal contact and incidental ingestion during sampling activities, however, these potential exposure scenarios will be controlled through implementation of the HASP, SMP and CAMP during the remediation to avoid these exposure scenarios. • Future exposure will be reduced or eliminated by addressing contaminated soil that is acting as a source of contamination to groundwater, and addressing groundwater contamination as described in the RAWP portion of this document.

Environmental Media and Exposure Route	Human Exposure Assessment
Inhalation of air (exposures related to soil vapor intrusion)	• Remedial workers, trespassers, and utility workers may be exposed to contaminated soil vapor within open excavations, however, these potential exposure scenarios will be controlled through implementation of the HASP, SMP and CAMP during the remediation to avoid these exposure scenarios. • Future exposure will be reduced or eliminated through installation of a sub-slab vapor barrier and the operation of an active sub-slab depressurization system (SSDS) below the Site building, including a vapor barrier system (minimum thickness 20 mil) under the building foundation's slab and up the foundation walls to prevent any exposure from soil vapor from off-Site exposure pathways as a component of this system. The vapor barrier will be a sealing methodology used to seal the foundation slab as required in the DOH Guidance document and then the SSDS will be installed.

Summary of the Remedy

The following is a concise description of the selected remedy including all Engineering/Institutional Controls and the goals of each element of the Remedial Action listed in the order they will be implemented.

A Track 1 Unrestricted Use remedy is preferred for the Site. If a Track 1 remedy cannot be achieved, a Track 2 Restricted Residential Cleanup contingency will apply. The elements of the Track 1 Unrestricted Use remedy are listed below.

1. Screening for indications of contamination (by visual means, odor, and monitoring with PID) of all excavated soil during any intrusive Site work;
2. Excavation of soil/fill exceeding Unrestricted Use SCOs to achieve a Track 1 remedy listed in **Table 18** and shown on **Figure 8** as demonstrated by collection and analysis of end-point samples to evaluate the performance of the remedy with respect to attainment of Track 1 SCOs;
3. Installation of an active sub slab depressurization system (SSDS) under the building foundations slab to prevent the potential migration of vapors into the building as a short-term measure, including a vapor barrier system (minimum thickness 20 mil) under the building foundation's slab and up the foundation walls to prevent any exposure from soil vapor from off-Site exposure pathways as a component of this system The vapor barrier will be a sealing methodology used to seal the foundation slab as required in the DOH Guidance document and then the SSDS will be installed.;

4. Recording of a short-term Environmental Easement, including Institutional Controls and Engineering Controls, to prevent future exposure to any residual contamination remaining at the Site;
5. Publication of a Site Management Plan for short term management of residual contamination as required by the Environmental Easement, including plans for: (1) Institutional and Engineering Controls, (2) monitoring, (3) operation and maintenance and (4) reporting;
6. Appropriate off-Site disposal of all material removed from the Site in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal;
7. Import of materials to be used for backfill and cover in compliance with: (1) chemical limits and other specifications included in Table 19 (2) all Federal, State and local rules and regulations for handling and transport of backfill material;
8. All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable Federal, State and local rules and regulations.

Monitoring of on-Site groundwater conditions to confirm asymptotic conditions.

REMEDIAL INVESTIGATION/ REMEDIAL ACTION WORK PLAN

1.0 INTRODUCTION

Chestnut Commons Apartments LLC entered into a Brownfield Cleanup Agreement (BCA) with the New York State Department of Environmental Conservation (NYSDEC) on September 14, 2018, to investigate and remediate a 0.66-acre property located at 110 Dinsmore Place in the East New York section of Brooklyn, Kings County, New York at Tax Block 4142 and Lot 34 (Site). The Brownfield Cleanup Program (BCP) Site is also known as the Chestnut Commons Atlantic Ave Site BCP Site No. 224276. Chestnut Commons Apartments LLC entered the BCP with a Volunteer status due to the presence of contaminated soil, groundwater, and soil vapor on the Site. A mixed-used building consisting of 100% affordable housing units, as well as community and open/recreational space, and a cellar are the proposed redevelopment for the property.

This Remedial Investigation Report/Remedial Action Work Plan (RIR/RAWP) summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI) performed in April 2019 and proposes a remedial plan for the Site. The objectives of the RI were to determine the nature and extent of contamination at the Site, characterize environmental media at the Site, qualitatively assess the potential exposure of receptors to Site contaminants, and generate sufficient data necessary to support the development of a RIR/RAWP, including a proposed remedy for the Site based on the proposed residential Site use. This RIR/RAWP provides an evaluation of a Track 1 cleanup and other Remedial Action alternatives, their associated costs, and the recommended and preferred remedy. The remedy described in this document is consistent with the procedures defined in DER-10 and complies with all applicable standards, criteria and guidance. The remedy described in this document also complies with all applicable Federal, State and local laws, regulations and requirements. The NYSDEC and New York State Department of Health (NYSDOH) have determined this Site does not pose a significant threat to human health and the environment based on their review of this RIR/RAWP. The RI for this Site did not identify fish and wildlife resources.

A formal Remedial Design document is not anticipated to be required for this Site at this time.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located in the County of Kings, Brooklyn, New York and is identified as Block 4142, Lot 34, on the New York City Brooklyn Tax Map. A United States Geological Survey (USGS) topographical quadrangle map (**Figure 1**) shows the Site location. The Site is situated on an approximately 0.66-acre area bounded by Dinsmore Street to the north, South Conduit Avenue to the south, Chestnut Street to the east, and Logan Street to the west (see Site Plan presented in **Figure 2**). A boundary map reflective of the tax block and lot line is attached to the BCA. The 0.66-acre property is fully described on the survey map and in **Appendix A – Metes and Bounds**. A global positioning system coordinate for the starting point is included.

Currently, the Site is a vacant, fenced, unpaved lot with overgrown vegetation. There is an ongoing development by New York City School Construction Authority (NYCSCA) to the west of the property. There is also a vacant property to the east of the Site across Chestnut Street that is enrolled in the NYS BCP (Site #C224236). An aboveground subway line is one block to the north of the Site and an underground Long Island Rail Road line is located to the south, running east to west beneath Atlantic Avenue.

1.2 CONTEMPLATED REMEDIATION PLAN

The Remedial Action to be performed under the RIR/RAWP is intended to make the Site protective of human health and the environment consistent with the contemplated residential end use. The proposed redevelopment plan and end use is described here to provide the basis for this assessment. However, the Remedial Action contemplated under this RIR/RAWP may be implemented independent of the proposed redevelopment plan.

Chestnut Commons Apartment LLC is planning to redevelop the BCP Site into a mixed residential use development. The planned redevelopment of the Site entails the construction of a mixed-use building known as Chestnut Commons in a joint venture between MHANY Management, Inc., the Urban Builders Collaborative, and the Cypress Hills Local Development Corporation. The building will consist of 274 affordable housing units for extremely low-, very low-, and low-income households, and will also include community and one cellar level across the entire Site

footprint (the Project). Outdoor open/recreational space will be located in a courtyard above the first level of the building.

1.3 DESCRIPTION OF SURROUNDING PROPERTY

The area surrounding the Site consists of a mix of urban industrial and commercial properties. The table below provides details on surrounding property usage adjacent to the Site.

Surrounding Property Uses	
North	Dinsmore Place; commercial buildings
South	Atlantic Avenue; underground Long Island Rail Road line
East	Chestnut Street; vacant property that is also enrolled in the NYSDEC BCP (BCP Site #C224236).
West	New public school redevelopment project (under construction)

Development in the surrounding area is zoned for mixed-use (residential, commercial, school, and community-oriented uses) development. Additional detail regarding the zoning around the Site is provided in Exhibit I of the BCP Application.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Site was investigated in accordance with the requirements of NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation - May 2010 (DER-10). The investigation was conducted in February and July 2018 and April 2019, and the results of the RI are included in this RIR/RAWP.

2.1 SUMMARY OF REMEDIAL INVESTIGATIONS PERFORMED

This section presents a detailed description of the RI activities performed to characterize the soil, groundwater and soil vapor at the Site. Detailed discussion of the RI findings and results are provided in subsequent sections of this RI/RAWP.

2.1.1 Phase I ESA

Phase I Environmental Site Assessment (ESA), prepared by TRC Environmental Corporation (TRC) on behalf of the NYCSCA, September 2015.

In 2015, on behalf of the NYCSCA, TRC completed a Phase I ESA for the entirety of Block 4142, Lot 32 (including the Site), which included (in an appendix) a Phase I ESA performed by Holzmacher, McLendon and Murrell, P.C. (H2M) in 2009 (2009 Phase I ESA). The 2009 Phase I ESA referenced a 1994 Phase II ESA. The referenced 1994 Phase II ESA is reported to have determined soil at the Site was contaminated with polycyclic aromatic hydrocarbons (PAHs), chlorinated solvents, and lead; however, the 1994 Phase II ESA was not included in the supporting documentation.

2.1.2 Phase II ESA

<u>2018 Investigation</u>

On February 26 and 27, 2018, a total of fourteen soil borings (RX-1 to RX-14) were completed to a target depth of 5 feet below land surface (ft bls) using vacuum digging and hand tools at the locations shown on **Figure 2**. Roux retained the services of Trinity Environmental Corp. of Deer Park, New York to complete the 2018 field investigation. Due to the presence of concrete within the shallow subsurface, not all borings reached to the target depth. Soil from each location was visually inspected by a Roux scientist/geologist for evidence of impacts and screened for organic vapors in the field using a photoionization detector (PID). Soil lithology was recorded according to the Unified Soils Classification System (USCS). One soil sample from each boring was collected for laboratory analysis, from the two-foot interval exhibiting the greatest evidence of impact or fill conditions (e.g., elevated PID detections, odors, or staining).

The second phase of soil investigation, in July 2018, consisted of a total of eight soil borings (RX-1, RX-3, RX-5, RX-6, RX-9, RX-10, RX-12, and RX-14), which were installed using a Geoprobe direct push rig. Five borings were completed to 15 ft bls, the approximate depth of final excavation, and three borings were completed to the water table (approximately 25 to 30 ft bls) to assess deeper soil conditions and allow for installation of monitoring wells.

Prior to advancement with a drill rig, each boring location was cleared to a depth of 5 ft bls using hand tools to prevent damage to subsurface utilities. Soil from each of the borings was visually inspected for evidence of impacts and screened for organic vapors in the field using a PID. Soil lithology was recorded according to the USCS.

Up to two soil samples were collected from each boring to be submitted for laboratory analysis. One soil sample was collected from the first two-foot interval of soil, if it had not been collected during the shallow soil sampling investigation. A second sample was collected from the two-foot interval exhibiting the greatest evidence of impact (elevated PID detections, odors, or staining). If no evidence of impacts was observed during soil boring advancement, the soil sample was collected from the two-foot interval below the proposed maximum excavation depth.

All TCL VOC soil samples were collected using EnCore samplers. All samples were submitted to TestAmerica of Edison, New Jersey, a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory for analysis.

Three of the soil borings at the Site were converted to temporary groundwater monitoring wells. The wells were advanced to 35 ft bls to bridge the water table, which was encountered at approximately 29.5 to 30.5 ft bls. The temporary monitoring wells were constructed of one-inch diameter polyvinyl chloride (PVC) riser and 10 feet of well screen. Immediately following installation, one groundwater sample was collected from each of the monitoring wells using low-flow sampling techniques.

Soil vapor sampling points were installed to a depth of approximately 13-14 ft bls, the assumed depth of the new building foundation, at the locations of three of the soil borings. At each location, a temporary, six-inch stainless-steel screen was installed by hand to a depth of approximately 14 ft bls with Teflon-lined sampling tubing extending to the surface. The annular space surrounding the screen was backfilled with clean sand to just below grade and sealed with bentonite to prevent ambient air intrusion. Following installation of each soil vapor point, the integrity of each sampling point seal was checked via a helium gas tracer test. This step was conducted as a quality assurance/quality control (QA/QC) measure to verify that the soil vapor sample was not compromised by inadvertent introduction of ambient air into the sample. Soil

vapor was purged from the point using an air pump calibrated to approximately 0.2 liters per minute while the sampling point was covered at the surface with a small enclosure that is partially filled with helium. The soil vapor discharging from the air pump and the air within the enclosure was continuously monitored for helium during purging. Helium was not detected from the sample tubing greater than 10% of the helium detected in the enriched area (i.e., within the bucket); therefore, the helium tracer test verified the integrity of the surface seal of the soil gas point.

Prior to sample collection, each soil vapor point was purged of approximately three volumes of soil vapor using the air pump. The samples were collected using batch certified vacuum canisters equipped with laboratory-supplied, eight-hour regulators.

2019 Investigation

On April 12, 2019, a geophysical survey was conducted across the entire Site by Ground Penetrating Radar Systems, Inc. (GPRS) of Edison, New Jersey to clear the proposed boring locations for subsurface utilities and to locate other potential buried structures. The geophysical survey included both electromagnetic (EM) and ground penetrating radar (GPR) methods. All locations were cleared and no large anomalies were identified.

In April 2019, a total of fifteen soil borings (RX-15, RX-16, MW-4 through MW-8, and WC-1 through WC-8) were advanced at the locations showed on **Figure 2**. Roux retained the services of Aquifer Drilling and Testing (ADT) of Mineola, New York to complete the installation of the soil borings, permanent monitoring wells, and soil vapor screens.

Soil borings were advanced using a Geoprobe® mobile drilling unit to a maximum depth of 32 feet below land surface slab (ft bls). The first five feet of each soil boring location was cleared for sub-surface utilities using hand tools and a Vactron clearance unit. No utilities were encountered as part of this investigation.

Soil from each location was visually inspected by a Roux scientist/geologist for evidence of impacts and screened for organic vapors in the field using a PID. Soil lithology was recorded according to the Unified Soils Classification System (USCS). Soil samples were collected continuously in five-foot increments from the land surface to a maximum depth of 32 ft bls. Soil boring logs are provided in **Appendix B.**

Five of the seven soil borings were converted to permanent monitoring wells for collection of water-level elevation measurements and groundwater samples. The monitoring wells were constructed of 2-inch diameter PVC with ten feet of 0.020-inch slotted well screen that intersected the water table and riser to land surface. Monitoring wells MW-4 and MW-5, were installed to a depth of approximately 37 ft bls and monitoring wells MW-6, MW-7, and MW-8 were installed to a depth of approximately 40 ft bls. Monitoring well screen zones were constructed to account for seasonal fluctuations in water table elevation. Monitoring well construction logs are provided in **Appendix B** and a summary of the monitoring well construction details is included in **Table 1**. All monitoring well locations are shown on **Figure 2.**

Following monitoring well installation activities, each well was developed to ensure proper hydraulic connection with the aquifer and to reduce/eliminate turbidity of the water. Each monitoring well was developed using a submersible pump and a surge block, which was surged periodically until well yield was consistent and had turbidity below 50 Nephelometric Turbidity Units (NTUs).

Following well installation and development, all five monitoring wells were sampled on April 30, 2019. To ensure groundwater samples collected were representative of the conditions in the surrounding aquifer, monitoring wells were purged prior to sample collection using low flow sampling procedures as outlined in the United States Environmental Protection Agency (USEPA) document entitled "Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells", dated July 30, 1996, revised September 19, 2017.

Water-level measurements were recorded for all monitoring wells to further define groundwater flow patterns beneath the Site. The wells were gauged using an electronic oil/water interface probe capable of detecting a light non-aqueous phase liquid (LNAPL) thickness of 0.01 feet (note that there was no LNAPL detected at the Site). All water-level depths were measured relative to a surveyed measuring point marked on each well casing. A summary of the gauging data is included in **Table 2.**

Eight soil vapor points (SV-4 through SV-11) were installed. The soil vapor point installation and sampling procedures were completed in in the same manner as the 2018 sampling, discussed above. The soil vapor sample locations are shown on **Figure 2.**

Soil vapor sampling logs are included as **Appendix D**.

2.1.3 Samples Collected, Laboratory Analyses, Quality Assurance/Quality Control Sampling and Data Usability Summary Report

During the February 2018 soil investigation, eight samples were analyzed for a full list of parameters, which includes:

- Target Compound List (TCL) Volatile Organic Compounds (VOCs)
- TCL Semi-Volatile Organic Compounds (SVOCs)
- Pesticides
- Polychlorinated Biphenyls (PCBs)
- Target Analyte List (TAL) Metals including mercury

Six samples were analyzed for a subset of parameters most likely present based on historical uses at the Site. The short list includes:

- TCL SVOCs
- TAL Metals including mercury
- Pesticides

During the July 2018 investigation, a total of 16 discrete soil samples (excluding QA/QC samples) were collected and submitted for laboratory analysis for the following parameters:

- TCL VOCs
- TCL SVOCs
- TCL Pesticides
- TCL Herbicides
- TCL PCBs
- TAL Metals and mercury

During the April 2019 investigation, a total of 23 discrete soil samples (excluding QA/QC samples) were collected and submitted for laboratory analysis for the following parameters:

- TCL VOCs +10
- TCL SVOCs +20
- TCL Pesticides
- TCL Herbicides
- TCL PCBs
- TAL Metals, mercury, and hexavalent chromium

A total of 9 groundwater samples (excluding QA/QC samples) were collected and submitted for laboratory analysis for the following parameters:

- TCL VOCs +10
- TCL SVOCs +20
- TCL Pesticides
- TCL Herbicides
- TCL PCBs
- TAL Metals (total and dissolved)

Five groundwater samples (excluding QA/QC samples) were collected and submitted for laboratory analysis for Emerging Contaminants from the permanent wells installed in 2019 (MW-4 through MW-8). ECs list includes 1,4-Dioxane and the 21 PFAS substances which include the 21 compounds listed in the NYSDEC July 2018 Groundwater Sampling for Emerging Contaminants Guidance (NYSDEC July 2018 Guidance) and the March 2019 Sampling for 1,4-Dioxane and PFAS Under NYSDEC's Part 375 Remedial Programs (NYSDEC March 2019 Guidance). PFAS in groundwater was analyzed by USEPA Method 537 Modified and 1,4-Dioxane in groundwater was analyzed by USEPA Method 8270D SIM and 1,4-Dioxane in soil was analyzed by USEPA Method 8270D SIM. Soil samples placed on hold at the laboratory were not analyzed for ECs. The 21 PFAS are:

- Perfluorobutanesulfonic acid
- Perfluorohexanesulfonic acid
- Perfluoroheptanesulfonic acid
- Perfluorooctancessulfonic acid
- Perfluorodecanesulfonic acid

- Perfluorobutanoic acid
- Perfluoropentanoic acid
- Perfluorohexanoic acid
- Perfluoroheptanoic acid
- Perfluorooctanoic acid
    - Perfluorononanoic acid
    - Perfluorodecanoic acid
    - Perfluoroundecanoic acid
    - Perfluorododecanoic acid
    - Perfluorotridecanoic acid
    - Perfluorotetradecanoic acid
    - 6:2 Fluorotelomer sulfonate
    - 8:2 Fluorotelomer sulfonate
    - Perfluroroctanesulfonamide
    - N-methyl perfluorooctanesulfonamidoacetic acid
    - N-ethyl perfluorooctanesulfonamidoacetic acid

A total of eleven soil vapor samples (excluding QA/QC samples) were collected and submitted for laboratory analysis for VOCs via USEPA Method TO-15.

All samples collected during the RI were transported under chain of custody procedures to either TestAmerica Laboratories of Edison, New Jersey, TestAmerica of Sacramento, California, and TestAmerica of Burlington, Vermont, NYSDOH ELAP certified laboratories (11452, 11666, and 10391, respectively)

QA/QC sampling during the RI included collection of one duplicate, one field blank and one matrix spike/matrix spike duplicate (MS/MSD) sample per 20 field samples and one trip blank per cooler containing groundwater sample containers.

The laboratory reported the results for RI data in Analytical Services Protocol (ASP) Category B deliverable packages. An electronic data deliverable (EDD) in the required NYSDEC format was provided by the laboratory. Analytical data packages are presented in **Appendix E.** A Data

Usability Summary Report (DUSR) was prepared by an independent data validator in accordance with Appendix 2B of DER-10 and is provided in **Appendix F.**

A summary of the sample designation, analytes, and matrices for all samples collected for laboratory analysis is included as **Table 3.**

2.1.4 Surveying Activities

Fehringer Surveying, P.C. of Seaford, New York, a NYS Licensed Surveyor, completed the survey of all monitoring well and soil boring locations on April 9, 2019. Location coordinates were provided in NY State Plan Coordinate System NAD 83 (LI Zone) and elevations were provided in North American Vertical Datum 1988 (NAVD 88).

2.1.5 Significant Threat

The NYSDEC and NYSDOH have determined this Site does not pose a significant threat to human health and the environment based on their review of this RIR/RAWP.

2.2 SITE HISTORY

Based on Roux's review of historical documentation including Certified Sanborn Maps and information available at the New York Public Library regarding Site history, the Site contained a portion of the Ridgewood Engine House, a coal-fired Water Pumping Station that was used by the Brooklyn Water Works as early as 1860. Water entered the pump house in the center of the building through below grade conduits following the path of present-day Conduit Boulevard and was pumped 0.8 miles northwest to the Ridgewood Reservoir in Queens. The location of these underground features does not appear to be included in the current Site footprint. The portion of the pumping station that is within the Site footprint is noted as a coal storage area.

The Site was in use by the Brooklyn Water Works through the 1920s and was generally vacant until its demolition by the city in the late 1960s. A playground was planned for the entirety of Block 4142; however, based on aerial photographs, it appears not to have been built. Later Certified Sanborn Maps indicate the Site was used for "Heavy Equipment Storage." The findings of the Final Environmental Impact Statement (FEIS) for the 2016 East New York Rezoning

indicated that past uses at the Site included auto repair/service/sales/towing, which was not corroborated by our review of available documentation.

A detailed summary of past site ownership is provided in Exhibit E of the BCP Application submitted to NYSDEC.

2.3 GEOLOGICAL CONDITIONS

During the completion of the 2018 Roux Phase II ESA and 2019 Roux Remedial Investigation, bedrock was not encountered on the Site. Brooklyn is located within the Atlantic Coastal lowland's physiographic province of New York State. The subsurface bedrock geology of Kings County (Brooklyn) is characterized by bedrock consisting of gneiss and schist of Precambrian age. Present day surface features and topography in New York City are primarily attributable to the most recent glaciation event and anthropogenic activities. The area is underlain by deposits of glacial outwash sediments, which were observed to be comprised of sand, silt, and gravel. Soil and bedrock stratigraphy throughout Brooklyn typically consist of a layer of historical fill that overlies glacial outwash sediments, decomposed unconsolidated bedrock, and bedrock. As referenced in the 2015 Phase I ESA, according to the 1994 bedrock and engineering geology maps set by Charles A. Baskerville, the depth to bedrock in the area is estimated to be approximately 450 feet below ground surface (ft bls).

The depth to groundwater in the monitoring wells was between approximately 26 to 32 feet bls. Groundwater flow is assumed to be toward the southwest. A groundwater flow map is shown in **Figure 3**.

2.4 CONTAMINATION CONDITIONS

2.4.1 Conceptual Model of Site Contamination

This section describes the Conceptual Site Model (CSM) developed for this Site. The CSM is a tool used to evaluate and identify potential sources of contamination, target analytes, potential entry and mechanisms for transport in the subsurface environment and potentially into the Site

structures, potential exposure routes, and the environmental media and locations most likely to have been impacted by the target analytes.

Potential Sources, Compounds of Concern, Transport Pathways, and Receptors

By 1968 the former Brooklyn Water Works building was demolished. Historical Site use includes an open-air coal shed and part of the Brooklyn Water Works "oil house" within the Site.

Based on the historical investigation and the recent RI results, select SVOCs (limited to PAHs), and select metals were identified in soil at concentrations greater than Unrestricted Use SCOs, the Protection of Groundwater SCOs, and Restricted Residential SCOs, and are considered to be the compounds of concern (COCs) for the Site. Additionally, there were elevated concentrations of chlorinated VOCs (CVOCs) in groundwater and soil vapor identified at the Site. The CVOC impacts were not identified in the soil at the Site and are attributable to an offsite source to the east of the Site.

Potential off-Site sources of environmental impacts may still be present or were present in the surrounding area. Specifically, the immediately adjacent property to the east (the former Columbia Machine Works & Malleable Plant located at 275 Chestnut Street) was a historical generator of hazardous wastes and is currently enrolled in the BCP (Site No. C224236). According to the NYSDEC Environmental Site Remediation Database, former uses at 275 Chestnut Street that may have led to contamination include: blacksmithing and stamping, a brass foundry, wood working, a blacksmith, a machine shop, tank and engine rooms, an iron works, wire braiding, and cable manufacturing from 1908 to 2012. During subsurface investigations performed at this property, mercury and arsenic were identified at concentrations exceeding Restricted Residential SCOs. Trichloroethene (TCE) was also identified in soil at concentrations exceeding the Protection of Groundwater Soil Cleanup Objective (Protection of Groundwater SCO). Chloroform, TCE, tetrachloroethene (PCE), manganese and nickel were identified at concentrations exceeding Ambient Water Quality Standards and Guidance Values (AWQSGVs). VOCs present in the adjacent property's groundwater can travel into soil vapor, which could cause soil vapor intrusion into surrounding properties. The RI data generated suggests that the Site is being impacted from this offsite BCP Site, which is acting as a source for migrating groundwater contamination.

As described in the following sections, the RI activities conducted by Roux were intended to provide a more comprehensive investigation of the entire Site. Therefore, most environmental media samples were analyzed for a full suite of parameters, including VOCs, SVOCs, metals, pesticides, and PCBs.

Based on the COCs present and the media in which these contaminants were identified, the following potential transport mechanisms were identified for the Site:

- COCs may potentially remain sorbed to soil (soil impacts);
- Groundwater may contaminate soil vapor (soil vapor impacts); and
- Leaching of COCs from soil to groundwater (groundwater impacts).

The following current potential exposure routes for COCs have been identified for the Site:

- Dermal contact and incidental ingestion of soil. Minimal risk since the entire site is currently secured.
- Inhalation of soil vapors. Soil gases have the potential to infiltrate into surrounding properties' building foundations.
- Dermal contact with groundwater. Considered minimal risk as groundwater is approximately 30 to 35 ft bls and is not used for drinking water or irrigation purposes.

2.4.2 Description of Areas of Concern

As summarized above, reviews of historical documentation and previous investigations performed at the Site have documented the existence of the several areas of concern (AOCs). This RIR/RAWP describes in detail the environmental investigation of soil, groundwater and soil vapor that was performed to evaluate the AOCs, delineate contamination, and the associated remedial design to address Site impacts. The Site AOCs are presented below:

1. **Former Usage and Structures Present at the Site:** Historic information indicates that the Site was used as coal storage and an oil house while the Ridgewood Engine House Water Pumping Station was present at the Site beginning in the 1860s.
2. **Historical Fill:** Fill is present due to the demolition of all buildings on the Site in the 1960s-1970s.
3. **Potential Unauthorized Dumping:** Aerial photographs and Site reconnaissance indicate the potential that dumping, evidenced by areas of piled debris and soil, has occurred while the Site has been vacant and unoccupied.
4. **Potential On-Site Migration of COCs from Surrounding Properties:** Several off-site properties located in proximity to the Site have the potential to have impacted the Site. As previously noted, the property to the east of the Site is also enrolled in the NYSDEC BCP

(Site No. C224236) and is an AOC due to its upgradient location and the presence of solvents and metals in groundwater and soil vapor found during previous investigations.

The 2018 Phase II ESA performed at the Site has documented the following contaminated media:

1. **Soil:** The primary contaminants of concern in soil were identified as SVOCs (specifically PAHs) and metals. These impacts are attributed to the former usage and/or historical fill AOC.
2. **Groundwater:** The 2018 investigation, discussed in greater detail below, identified PCE and TCE in exceedance of the AWQSGVs. These impacts are attributed to the potential on-Site migration from surrounding properties AOC.
3. **Soil Vapor:** The 2018 investigation, discussed in greater detail below, identified elevated concentrations of petroleum related VOCs and chlorinated VOCs (CVOCs). These impacts are attributed to the potential on-Site migration from the adjacent BCP site AOC.

2.4.3 Identification of Standards, Criteria and Guidance

SCGs are promulgated requirements ("standards" and "criteria") and non-promulgated guidance ("guidance") that govern activities that may affect the environment and are used by the NYSDEC at various stages in the investigation and remediation of a site. SCGs incorporate both the concept of "applicable or relevant and appropriate requirements" (ARARs) and the "to be considered" (TBCs) category of non-enforceable criteria or guidance, consistent with USEPA remediation programs. The following table provides a list of SCGs potentially applicable to the Site. Key SCGs are discussed in greater detail below.

Citation	Title	Regulatory Agency
General		
6 NYCRR Part 375	Environmental Remediation Programs	NYSDEC
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response	US Department of Labor, OSHA
29 CFR 1926	Safety and Health Regulations for Construction	US Department of Labor, OSHA
TAGM HWR-4031	Fugitive Dust Suppression and Particulate Monitoring Program at Inactive Hazardous Waste Sites	NYSDEC
No Cite	Analytical Services Protocol	NYSDEC

Citation	Title	Regulatory Agency
DER-10	Technical Guidance for Site Investigation and Remediation	NYSDEC
No Cite	Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs	NYSDEC
Soil		
6 NYCRR Part 375	Environmental Remediation Programs	NYSDEC
CP-51	Soil Cleanup Guidance	NYSDEC
Groundwater		
6 NYCRR Part 700-705	Surface Water and Ground Water Classification Standards	NYSDEC
TOGS 1.1.1	Ambient Water Quality Standards and Guidance Values (AWQSGVs)	NYSDEC
TOGS 2.1.3	Primary and Principal Aquifer	NYSDEC
Air		
Air Guide No. 1	Guidelines for the control of toxic ambient air contaminants	NYSDEC
No Cite	Final - Guidance for Evaluating Soil Vapor Intrusion in the State of New York	NYSDOH
Solid Waste		
6 NYCRR 360	Solid Waste Management Facilities	NYSDEC
6 NYCRR 364	Waste Transporters	NYSDEC
Hazardous Waste		
6 NYCRR Part 371	Identification and Listing of Hazardous Wastes	NYSDEC
6 NYCRR 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities	NYSDEC
6 NYCRR 376	Land Disposal Restrictions	NYSDEC
Site Management		
No Citation	Groundwater Monitoring Well Decommissioning Procedures	NYSDEC

Legend:

SCG:	Standards, Criteria and Guidelines
NYCRR:	New York Code of Rules and Regulations
NYSDEC:	New York State Department of Environmental Conservation
NYSDOH:	New York State Department of Health
OSHA:	Occupational Safety and Health Administration
TOGS:	Technical Operational Guidance Series
TAGM HWR:	Technical and Administrative Guidance Memorandum - Hazardous Waste Remediation

SCGs for Soil

SCGs for soil at BCP Sites are the numerical soil cleanup objectives presented in 6 NYCRR Section 375-6.8(a-b). The soil cleanup objectives are categorized into Track 1 unrestricted use criteria and Track 2 restricted use (residential, restricted-residential, commercial, or industrial) criteria, as well as criteria for protection of groundwater and ecological resources. The applicability of each category of soil cleanup objectives is determined based upon the current and reasonably anticipated future use of the Site, as well as cleanup tracks being evaluated.

The unrestricted criteria in 6 NYCRR Section 375-6.8(a) are applicable if the goal is to implement a Track 1 cleanup. Based on the Site's intended use for multi-family residential development, the restricted residential criteria 6 NYCRR Section 375-6.8(b) are applicable if the goal is a Track 2 cleanup.

SCGs for Groundwater

The NYSDEC AWQSGVs are applicable for groundwater at the Site.

SCGs for Soil Vapor

The NYSDOH Soil Vapor Intrusion Guidance document includes matrices of values over which the NYSDOH recommends soil vapor mitigation.

2.4.4 Soil/Fill Contamination

The following subsections summarize the soil quality based on laboratory analytical data that was generated during the Phase II ESA and RI. Data from the soil samples collected for *in situ* waste characterization is presented in Section 2.4.7.

The soil laboratory analytical results were compared to NYSDEC Part 375 Unrestricted Use SCOs, the Protection of Groundwater SCOs, and the Restricted Residential SCOs. Laboratory analytical data for soil are summarized on **Tables 4 through 8**; sample locations with exceedances of the abovementioned SCOs are shown on **Figure 4**.

2.4.4.1 Volatile Organic Compounds in Soil

Table 4 presents a summary of the VOC analytical data for soil samples collected during the RI. As part of the RI, 45 discrete soil samples were collected for VOC analysis, in addition to QA/QC samples. As shown, there were three VOCs detected above the Unrestricted Use SCOs and Protection of Groundwater SCOs; however, none of these exceeded Restricted Residential SCOs. Laboratory analytical data for the soil exceedances for VOCs are summarized below:

- Acetone was detected at a concentration exceeding its Unrestricted Use SCO and Protection of Groundwater SCO (both 0.05 milligrams per kilogram [mg/kg]) in one soil sample at one location, MW-7(0-2) at 0.074 mg/kg. Acetone is commonly used in laboratories and thus may have been introduced into the sample from laboratory cross-contamination and is not indicative of Site contamination.
- Benzene was detected at a concentration exceeding its Unrestricted Use SCO and Protection of Groundwater SCO (both 0.06 mg/kg) in one soil sample at one location. The maximum concentration detected was 4.2 mg/kg at RX-9(3-5).
- Toluene was detected at a concentration exceeding its Unrestricted Use SCO and Protection of Groundwater SCO (both 0.07 mg/kg) in one soil sample at one location. The maximum concentration detected was 2.7 mg/kg at RX-9(3-5).

Benzene and toluene, both petroleum related VOCs, may be present as a contaminant from fill or from storage of automobiles at the site. These compounds were not identified in the shallow (0-2 ft bls) or deeper (13-15 ft bls) samples collected from RX-9, or in groundwater anywhere at the Site.

2.4.4.2 Semivolatile Organic Compounds in Soil

Table 5 presents a summary of the SVOC analytical data for soil samples collected during the RI. A total of 51 discrete soil samples were collected for SVOC analysis (excluding QA/QC samples). As shown, there were nine SVOCs detected above Unrestricted Use SCOs and seven SVOCs detected above the Restricted Residential SCOs and six SVOCs detected above the

Protection of Groundwater SCOs. Laboratory analytical data for the soil exceedances for SVOCs are summarized below:

- 4-Methylphenol was detected at a concentration exceeding its Unrestricted Use SCO and Protection of Groundwater SCO (both 0.33 mg/kg) in one sample at one location. The maximum concentration detected was 0.48 mg/kg in sample MW-4(0-2).
- Benzo[a]anthracene was detected at a concentration exceeding its Unrestricted Use, Protection of Groundwater, and Restricted Residential SCOs (all 1 mg/kg) in eight samples at six locations at depths ranging from 0-4 ft bls. The maximum concentration detected was 2.8 mg/kg in RX-9(0-2).
- Benzo[a]pyrene was detected at a concentration exceeding its Unrestricted Use and Restricted Residential SCO (both 1 mg/kg) in eight samples at six locations at depths ranging from 0-2 ft bls. The maximum concentration detected was 2.1 mg/kg in MW-6(0-2).
- Benzo[b]fluoranthene was detected at a concentration exceeding its Unrestricted Use, Restricted Residential SCO (both 1 mg/kg) in thirteen samples at eleven locations, and exceeding the Protection of Groundwater SCO (1.7 mg/kg) in seven samples at five locations at depths ranging from 0-15 ft bls. The maximum concentration detected was 3.5 mg/kg, which was found in sample MW-6(0-2).
- Benzo[k]fluoranthene was detected at a concentration exceeding its Unrestricted Use SCO (0.8 mg/kg) in three samples at three locations. The maximum concentration detected was 1 mg/kg in samples MW-6(0-2) and RX-4(2-4).
- Chrysene was detected at a concentration exceeding its Unrestricted Use SCO and Protection of Groundwater SCO (both 1 mg/kg) in eight samples at six locations at depths ranging from 0-15 ft bls. The maximum concentration detected was 3.4 mg/kg, which was found in sample RX-9(0-2).
- Cresols, M&P (3- and 4-Methylphenol) was detected at a concentration exceeding its Unrestricted Use SCO and Protection of Groundwater SCO (both 0.33 mg/kg) in one sample at one location. The maximum concentration detected was 0.48 mg/kg in sample MW-4(0-2).
- Dibenzo(a,h)anthracene was detected at a concentration exceeding its Unrestricted Use SCO and Restricted Residential SCO (both 0.33 mg/kg) in two samples at two locations. The maximum concentration detected was 0.35 mg/kg in sample RX-9(0-2).
- Indeno(1,2,3-cd)pyrene was detected at a concentration exceeding its Unrestricted Use and Restricted Residential SCO (both 0.5 mg/kg) in eleven samples at eight locations at depths ranging from 0-32 ft bls. The maximum concentration detected was 1.5 mg/kg in sample MW-6(0-2).

The presence of SVOCs, specifically PAHs, in shallow soil is likely indicative of the historical fill and coal storage operations that were present at the Site. One PAH, indeno(1,2,3-cd)pyrene, was detected in a deep sample at RX-16(30-32) at a concentration (1.1 mg/kg)

exceeding the Unrestricted Use and Restricted Residential SCO (both 0.5 mg/kg). The presence of this compound is likely due to drill slough and not representative of the native soil at depth. This will be confirmed during a pre-design investigation discussed in Section 4.3.1. None of these compounds were detected in groundwater above AWQSGVs.

2.4.4.3 Metals in Soil

Table 6 presents a summary of the metals analytical data for soil samples collected during the RI. A total of 51 discrete soil samples were collected for metals analysis (excluding QA/QC samples). As shown, there were seven metals detected above the Unrestricted Use SCOs, the Restricted Residential SCOs, and/or the Protection of Groundwater SCOs. These compounds are common constituents of fill material. Laboratory analytical data for the soil exceedances for metals are summarized below:

- Arsenic was detected at a concentration exceeding its Unrestricted Use SCO (13 mg/kg), Protection of Groundwater SCO and Restricted Residential SCOs (both 16 mg/kg) in four samples at four locations. The maximum detection of arsenic was 39.2 mg/kg, found in sample MW-4(0-2)
- Copper was detected at a concentration exceeding its Unrestricted Use SCO (50 mg/kg) in fourteen samples at twelve locations. The maximum detection of copper was 97.6 mg/kg in sample RX-10(2-4).
- Lead was detected at a concentration exceeding its Unrestricted Use SCO (63 mg/kg) in twenty-three samples at eighteen locations, Restricted Residential SCO (400 mg/kg) at three locations, and Protection of Groundwater (450 mg/kg) in two locations. The maximum detection of lead was 487 mg/kg, found in sample RX-6(13-15).
- Mercury was detected at a concentration exceeding its Unrestricted Use SCO (0.18 mg/kg) in fifteen samples at thirteen locations, at depths ranging from 0 to 5 ft bls. The highest concentration of mercury detected was 0.51 mg/kg in sample RX-8(2-4).
- Nickel was detected at a concentration exceeding its Unrestricted Use SCO (30 mg/kg) in one sample at one location. The highest concentration of nickel detected was 75.2 mg/kg at RX-12(1.5-3.5).
- Silver was detected at a concentration exceeding its Unrestricted Use SCO (2 mg/kg) in one sample. The highest concentration of silver detected was 7.1 mg/kg at RX-12(1.5-3.5).
- Zinc was detected at a concentration exceeding its Unrestricted Use SCO (109 mg/kg) in twenty-one samples at seventeen locations. The highest concentration of zinc detected was 613 mg/kg in sample RX-13(1-3).

Of the compounds that exceed the Protection of Groundwater SCOs (arsenic and lead), only lead was detected in groundwater above AWQSGVs in the total (unfiltered) sample and was not detected in the dissolved (filtered) sample. The presence of metals in soil has not impacted groundwater quality at the Site.

2.4.4.4 Polychlorinated Biphenyls in Soil

Table 7 presents a summary of the PCB soil analytical data. A total of 45 discrete soil samples were collected for PCB analysis (excluding QA/QC samples). No detections of PCBs were present in the RI.

2.4.4.5 Pesticides in Soil

Table 8 presents a summary of the pesticide soil analytical data in the RI. A total of 51 discrete soil samples were collected for pesticide analysis (excluding QA/QC samples). As shown, there were four pesticides detected above the Unrestricted Use SCOs. Laboratory analytical data for the soil exceedances for metals are summarized below:

- Dieldrin was detected at a concentration exceeding its Unrestricted Use SCO (0.005 mg/kg) in one sample. The highest concentration of dieldrin was 0.031 mg/kg in sample RX-3(3-5).
- 4,4'-DDD detected at a concentration exceeding its Unrestricted Use SCO (0.0033 mg/kg) in two samples at two locations. The highest concentration of 4,4'-DDD was 0.0072 mg/kg in sample RX-14(0-2).
- 4,4'-DDE was detected at a concentration exceeding its Unrestricted Use SCO (0.0033 mg/kg) in three samples three locations. The highest concentration of 4,4'DDE detected was 0.0078 mg/kg in sample RX-6(2-3.5).
- 4,4'-DDT was detected at a concentration exceeding its Unrestricted Use SCO (0.0033 mg/kg) in twenty-four samples at sixteen locations. The highest concentration of 4,4'-DDT detected was 0.08 mg/kg in sample RX-6(2-3.5).

The presence of pesticides in shallow soil is likely indicative of the historical fill or application of pesticides to the Site while it was vacant land for many years. One pesticide, 4,4'-DDT, was detected in two deep samples at RX-16(30-32) and MW-6(30-32) at estimated concentrations (0.0037 and 0.005 mg/kg) exceeding the Unrestricted Use SCO (0.0033 mg/kg). The presence of this compound is likely due to drill slough and not representative of the native soil

at depth, which will be confirmed during a pre-design investigation discussed in Section 4.3.1. This compound was not detected in groundwater above AWQSGVs.

2.4.5 Groundwater Contamination

The following subsections summarize the groundwater quality based on laboratory analytical data that was generated during this RI. A total of eight groundwater samples (excluding QA/QC samples) were collected from three temporary wells and five permanent monitoring wells during this RI. Groundwater samples were collected on July 25th, 2018 and April 30th, 2019. Laboratory analytical data for groundwater samples are summarized in **Tables 9 through 14** and are compared to NYSDEC AWQSGVs for Class GA groundwater. Exceedances of the AWQSGVs are shown on **Figure 5**.

2.4.5.1 Volatile Organic Compounds in Groundwater

A summary of laboratory analytical data for VOCs in groundwater is presented in **Table 9**. Groundwater VOC exceedances were identified in five groundwater samples, from temporary wells MW-2 and MW-3 and permanent monitoring wells (MW-4, MW-7 and MW-8). Three VOCs, chloroform, PCE, and TCE, were detected above AWQSGVs. Concentrations of groundwater exceedances for VOCs are summarized below:

- Chloroform was detected in three groundwater samples at concentrations in exceedance of the AWQSGV of 7 µg/L, with a maximum concentration of 23 µg/L in permanent well MW-8.
- PCE was detected in three groundwater samples at concentrations in exceedance of the AWQSGV of 5 µg/L, with a maximum concentration of 22 µg/L in temporary well MW-2.
- TCE was detected in one groundwater sample, temporary well MW-2, at a concentration of 5.4 µg/L and slightly exceeded the AWQSGV of 5 µg/L.

The chlorinated VOCs (CVOCs) present in groundwater are highest in the southeast portion of the Site. These CVOCs were not detected above Unrestricted Use SCOs in soil and groundwater flow direction is to the southwest; therefore, it is likely that the source of CVOCs is originating off-site.

2.4.5.2 Semivolatile Organic Compounds in Groundwater

A summary of laboratory analytical data for SVOCs in groundwater is presented in **Table 10**. One SVOC, bis(2-ethylhexyl) phthalate (maximum concentration of 18 µg/L) was detected at a concentration exceeding its AWQSGV in one permanent monitoring well (MW-6). The AWQSGV for bis(2-ethylhexyl) phthalate is 5 µg/L.

2.4.5.3 Metals in Groundwater

A summary of laboratory analytical data for metals in groundwater is presented in **Table 11**. Both total (unfiltered) and dissolved (lab filtered) groundwater samples were collected and submitted for metals analysis. Ten metals were detected above the AWQSGVs. Concentrations of groundwater exceedances for metals are summarized below:

- Beryllium was detected above the AWQSGV in one total metals sample collected from temporary well MW-3 at a concentration of 4.6 µg/L, but was not detected in the dissolved sample.
- Chromium was detected above the AWQSGV in one total metals sample collected from temporary well MW-3 at a concentration of 402 µg/L, but was not detected in the dissolved sample.
- Copper was detected above the AWQSGV in one total metals sample collected at temporary well MW-3 with a maximum concentration of 254 µg/L , but was not detected in the dissolved sample.
- Iron was detected above the AWQSGV in six total metals samples with a maximum detection of 216,000 µg/L at temporary well MW-3, but was not detected above AWQSGVs in the corresponding dissolved samples.
- Lead was detected above the AWQSGVs in two total metals samples with a maximum detection of 100 µg/L at temporary well MW-3, but was not detected above AWQSGVs in the corresponding dissolved samples.
- Magnesium was detected above the AWQSGVs in one total metals sample, with a maximum detection of 52,200 µg/L at temporary well MW-3.
- Manganese was detected above the AWQSGVs in five total metals and five dissolved metals samples, with a maximum detection of 10,100 µg/L at temporary well MW-3.
- Nickel was detected above the AWQSGVs in one total metals sample, with a maximum detection of 503 µg/L at temporary well MW-3.

- Sodium (maximum detection of 107,000 µg/L found in MW-5); and thallium (maximum detection of 1.3 µg/L found in MW-3).
- Thallium was detected above the AWQSGVs in one total metals sample, with a maximum detection of 1.3 µg/L at temporary well MW-3.

Of these compounds, iron, magnesium, manganese, nickel, and sodium are naturally occurring metals which are commonly found in groundwater. Sodium and manganese were the only metals detected in both total and dissolved samples. Beryllium, chromium, copper, lead, and thallium, which are typical of historical fill and were also detected in soil, were only detected above AWQSGVs in the total metals analysis, and were not detected in soil above Protection of Groundwater SCOs. Since they were not detected in the dissolved samples it is likely the exceedance is due to sediment introduced into the sample during groundwater sampling.

2.4.5.4 Polychlorinated Biphenyls in Groundwater

A summary of laboratory analytical data for PCBs in groundwater is presented in **Table 12**. PCBs were not detected in any of the groundwater samples collected during this RI.

2.4.5.5 Pesticides in Groundwater

A summary of laboratory analytical data for pesticides in groundwater is presented in **Table 13**. One pesticide, chlordane, was detected above the AWQSGV (0.05 µg/L) at a concentration of 1.4 µg/L in temporary well MW-2.

2.4.5.6 PFAS in Groundwater

A summary of the PFAS detections in groundwater is presented in **Table 14**. Groundwater was analyzed for PFAS in all permanent monitoring wells (MW-4 through MW-8). There are no finalized NYSDEC AWQSGVs for PFAS, and therefore, PFAS detections are not presented in **Figure 5**.

2.4.6 Soil Vapor Contamination

Eleven soil vapor samples were collected at the locations shown on **Figure 2** and submitted for analysis for VOCs. Results of the soil vapor samples are summarized on **Table 15** and VOC

detections are shown on **Figure 6**. In total, 43 compounds were detected in the eleven soil vapor samples collected.

There are currently no standards for soil vapor established by either NYSDEC or the NYSDOH. The NYSDOH has established guidance for evaluating soil vapor intrusion in which the results of soil vapor samples are compared to corresponding indoor air quality results for eight VOCs. The guidance is presented in Matrix A, Matrix B, and Matrix C from the NYSDOH Center for Environmental Health (CEH) Bureau of Environmental Exposure Investigation (BEEI) Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006 (matrices were updated in May 2017). The matrices provide guidance relative to carbon tetrachloride, cis-1,2-dichloroethene, 1,1-dichloroethene, trichloroethene (TCE), tetrachloroethene (PCE), 1,1,1-trichloroethane, methylene chloride, and vinyl chloride.

Matrix A Compounds: carbon tetrachloride, cis-1,2-dichloroethene, 1,1-dichloroethene, TCE

- Carbon tetrachloride was detected in six soil vapor samples (SV-4, SV-6, SV-7, SV-8, SV-9, and SV-10) at concentrations ranging from 0.20 µg/m^3 to 0.54 µg/m^3, with a maximum detection in SV-8.
- Cis-1,2-dichloroethene was detected in four soil vapor samples (SV-3, SV-6, SV-7, and SV-8) at concentrations ranging from 1.4 µg/m^3 to 550 µg/m^3, with a maximum detection in SV-7.
- 1,1-dichloroethene was detected in one soil vapor sample (SV-7) at a concentration of 0.55 µg/m^3.
- TCE was detected in all eleven soil vapor samples at concentrations ranging from 1.6 µg/m^3 to 4,600 µg/m^3, with a maximum detection in SV-3.

Matrix B Compounds: PCE, 1,1,1-trichloroethane, methylene chloride

- PCE was detected in all soil vapor samples ranging in concentration from 3.0 µg/m^3 to 13,000 µg/m^3, with a maximum detection in soil vapor sample SV-3.
- 1,1,1-trichloroethane was detected in six soil vapor samples (SV-1, SV-2, SV-4 SV-6, SV-7 and SV-10) ranging in concentration from 0.57 µg/m^3 to 3.3 µg/m^3, with a maximum detection in the duplicate soil vapor sample collected at SV-1.
- Methylene chloride was detected in five soil vapor samples (SV-1, SV-4, SV-5, SV-7 and SV-9) ranging in concentration from 0.85J µg/m^3 to 83 µg/m^3, with a maximum detection in soil vapor sample SV-4.

Matrix C Compound: vinyl chloride

- Vinyl chloride was detected in one soil vapor sample (SV-7) at a concentration of 0.88 µg/m^3.

Concentrations of CVOCs in soil vapor are highest in the southeast portion of the Site, corresponding to the elevated concentrations in groundwater. The source of these CVOCs is presumed to be emanating from the groundwater contamination at the adjacent BCP Site to the east of the Site at 275 Chestnut Street.

2.4.7 Waste Characterization Sampling Program

In anticipation and preparation for the proposed redevelopment of the Site, Roux completed an extensive *in situ* soil waste characterization sampling program. This data was generated to properly characterize soil for off-site disposal in advance of excavation. A detailed report documenting the sampling program implemented, analytical data tables, figures, laboratory reports, etc. is provided in **Appendix H** of this RIR/RAWP, and a summary of this work is provided in this section.

Roux mobilized to the Site on April 17, 2019 to begin the waste characterization sampling concurrent with the RI field investigation. Roux installed a total of eight soil borings for waste characterization purposes, WC-1 through WC-8, as shown on **Figure 2**. At each boring, three six-foot composite soil samples were collected for waste characterization (i.e., 0-6 ft bls, 6-12 ft bls, and 12-18 ft bls). One pre-design investigation sample was collected from the two-foot interval located at 18-20 ft bls immediately below the bottom depth of the waste characterization samples. These samples were collected to evaluate the potential remedial excavation depths to achieve the different remedial tracks. The results of the pre-design investigation sampling were included in Section 2.4.4. The locations and depths of these borings, their corresponding sample intervals, and the waste characterization grid cell designations are shown on Plate 1 and Table 1 of the waste characterization report (**Appendix H**). Waste characterization soil samples were analyzed for the following list of parameters:

- TCL VOCs +10 TICs
- TCL Base neutral acids (BNA)/SVOCs + 20 TICs;
- TCL Pesticides;

- TCL Herbicides;
- TCL PCBs;
- Target Analyte List (TAL) Metals (including hexavalent chromium);
- Total Cyanide;
- Extractable Petroleum Hydrocarbons (EPH);
- Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity);
- Paint Filter; and
- Toxicity Characteristic Leaching Procedure (TCLP) Metals.

The results of the soil waste characterization samples, summarized below, are consistent with findings from the Remedial Investigation:

- SVOCs were present at concentrations exceeding Unrestricted Use SCOs and Restricted Residential SCOs. These SVOCs were benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, indeno[1,2,3-cd]pyrene, chrysene, and dibenzo[a,h]anthracene.
- Metals including arsenic, mercury, and cadmium were present at concentrations exceeding Unrestricted Use SCOs and Restricted Residential SCOs.
- Pesticides including 4,4'-DDD, 4-4'-DDT, 4,4'-DDE, and dieldrin were present at concentrations exceeding Unrestricted Use SCOs. Restricted Residential SCOs were not exceeded for any pesticides.
- RCRA Characteristic Waste for Toxicity was not exceeded for any metals.
- None of the results for the waste disposal parameters (ignitability, corrosivity, and reactivity), exceeded thresholds for consideration as hazardous waste.

2.5 ENVIRONMENTAL AND PUBLIC HEALTH ASSESSMENTS

2.5.1 Qualitative Human Health Exposure Assessment

As described in Appendix 3B of DER-10, "The overall purpose of the Qualitative Human Health Exposure Assessment (or the exposure assessment) is to evaluate and document how people might be exposed to site related contaminants, and to identify and characterize the potentially

exposed population(s) now and under the reasonably anticipated future use of the site." The following section details the exposure assessment based on data collected during the RI.

2.5.1.1 Soil Exposure

As described above in Section 2.4.4, soil samples collected during the RI indicated the presence of VOCs, SVOCs, metals, and pesticides at concentrations above the Unrestricted Use SCOs, and in some instances above the Restricted Residential and Protection of Groundwater SCOs. An individual could be exposed to these contaminants through direct contact with Site soil during ground intrusive work at the Site. Direct contact without the use of proper personal protective equipment (PPE) and personal hygiene measures could lead to dermal contact and incidental ingestion of these compounds. Since the Site is currently completely fenced and locked, potential contact with Site soil is restricted to remedial and construction contract workers at the Site performing ground intrusive activities. The general public is not currently exposed to direct contact with Site soil. The general public is not currently exposed to direct contact with Site soil. A community air monitoring program (CAMP) will be implemented during intrusive activities to protect the surrounding community by minimizing the potential for off-Site exposures from soil/dust leaving the Site. Site workers will be required to comply with the Health & Safety Plan (HASP) to protect themselves from exposure.

The planned future use of the Site is a mixed residential and recreational use building. The proposed remedy for the Site is conditional Track 1, which includes removal of all soil in exceedance of Unrestricted Use SCOs, as described in the RAWP portion of this document and protection of future occupants from vapor intrusion based on planned vapor intrusion mitigation measures.

2.5.1.2 Groundwater Exposure

As described above in Section 2.4.5, groundwater samples collected during the RI indicated the presence of VOCs, one SVOC, one pesticide, and metals that exceed the AWQSGVs. Individuals who perform groundwater sampling or remedial activities may come into contact with contaminated groundwater if proper PPE and personal hygiene measures are not used, which could lead to dermal contact and the potential for incidental ingestion of these compounds. Due to the

depth of groundwater, groundwater is not expected to be encountered during Site excavation and will not pose a direct contact risk during remedial excavation work. The new building, which will cover the entire footprint of the Site, will be serviced by the public water supply and groundwater will not be used for drinking or irrigation, therefore, there is no direct contact with or ingestion of groundwater by the general public.

2.5.1.3 Soil Vapor Exposure

As described above in Section 2.4.6, soil vapor samples collected during the RI indicated the presence of VOCs in soil vapor at the Site, specifically CVOCs with highest concentrations in the southeast portion of the Site. The future Site use will be a mixed residential recreational use building.

The existence of the proposed building over the entire Site footprint, where contaminants were detected in soil vapor samples, results in the potential for soil vapor intrusion. However, the installation of a sub-slab vapor barrier and an active sub-slab depressurization system (SSDS) at the Site (see Section 7.3), coupled with additional remedial actions for soil (see Section 5.1) will mitigate this potential exposure impact.

2.5.1.4 Exposure Assessment Summary

The following table summarizes the exposure assessment.

Environmental Media and Exposure Route	Human Exposure Assessment
Direct contact with subsurface soils (and incidental ingestion)	• Remedial workers can come into contact with soil if they perform ground intrusive work at the Site. • During remediation, remedial workers, trespassers, passersby, and utility workers could come into contact with contaminated soil contained in dust through inhalation, incidental ingestion and dermal contact, however, these potential exposure scenarios will be controlled through implementation of the Health & Safety Plan (HASP), Soil Management Plan (SMP) and Community Air Monitoring Plan (CAMP) during the remediation to avoid these exposure scenarios. • Future exposure will be eliminated though addressing contaminated soil as described in the RAWP portion of this document.
Ingestion of groundwater	• Contaminated groundwater is not used for drinking water, as the Site is connected to the public water supply, therefore, there is no potential for human contact with groundwater.
Direct contract with groundwater (and incidental ingestion)	• Remedial workers could come into contact with contaminated groundwater through dermal contact and incidental ingestion during sampling activities, however, these potential exposure scenarios will be controlled through implementation of the HASP, SMP and CAMP during the remediation to avoid these exposure scenarios. • Future exposure will be reduced or eliminated by addressing contaminated soil that is acting as a source of contamination to groundwater, and addressing groundwater contamination as described in the RAWP portion of this document.
Inhalation of air (exposures related to soil vapor intrusion)	• Remedial workers, trespassers, and utility workers may be exposed to contaminated soil vapor within open excavations, however, these potential exposure scenarios will be controlled through implementation of the HASP, SMP and CAMP during the remediation to avoid these exposure scenarios. • Future exposure will be reduced or eliminated through installation of a sub-slab vapor barrier and the operation of an active sub-slab depressurization system (SSDS).

2.6 INTERIM REMEDIAL ACTION

There have been no interim remedial measures (IRMs) performed at the Site.

2.7 REMEDIAL ACTION OBJECTIVES

Based on the results of the RI, the following Remedial Action Objectives (RAOs) have been identified for this Site.

2.7.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater.

RAOs for Environmental Protection

2.7.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

RAOs for Environmental Protection

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

2.7.3 Soil Vapor

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

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

The following is a detailed description of the alternatives analysis and remedy selection process to address impacted media on the Site.

This section of the RIR/RAWP was prepared in accordance with Subpart 375 – 3.8(f), Subpart 375 – 1.8(f), and Section 4.3 of DER-10. As required, a minimum of two remedial alternatives (one being an unrestricted use scenario) are evaluated, as follows:

- One alternative (Remedial Alternative 1) that will achieve unrestricted use relative to on-Site soil (Track 1) with the short-term use of Institutional Controls (ICs) or Engineering Controls (ECs) for soil vapor, which is collectively a Conditional Track 1 Remedy; and
- One alternative (Remedial Alternative 2) assuming achievement of the Track 2 restricted use (restricted residential) cleanup objectives for on-Site soil coupled with the use of ICs and ECs for soil vapor (Track 2).

The following is a detailed description of the alternatives analysis and remedy selection process to address impacted media at the Site.

Remedial Alternative 1: Track 1 Unrestricted Use Cleanup (Figure 7):

- Excavation and off-Site disposal of approximately 21,285 cubic yards (cy) of soil (i.e., all soil exceeding Unrestricted Use SCOs in the area of building foundation) over the entire Site. The assumed remedial excavation depth is approximately 15 to 20 ft bls (actual volume is subject to change based on field conditions and results of end point sampling).
- Excavation and off-Site disposal of approximately 250 cubic yards (cy) of soil (i.e., all soil exceeding Unrestricted Use SCOs) in two deeper 30-32 feet hot spots, pending results of a confirmatory sampling. The assumed remedial excavation depth is approximately 32 ft bls (actual volume is subject to change based on field conditions and results of end point sampling, which may not reveal the need to excavate this deep).
- Backfill and compaction of off-Site soil meeting the Unrestricted Use SCOs, as necessary.
- Collection of 21 total post-excavation bottom endpoint samples to document that the SCOs were met.
- .
- Mitigation of the potential for soil vapor intrusion through installation and short-term operation of an active SSDS below the Site building, including a vapor barrier system (minimum thickness 20 mil) under the building foundation's slab and up the foundation walls to prevent any exposure from soil vapor from off-Site exposure pathways as a component of this system. The vapor barrier will be a sealing methodology used to seal the foundation slab as required in the DOH Guidance document and then the SSDS will be installed.
- Backfill and compaction of off-Site soil meeting Unrestricted Use SCOs as necessary.

Remedial Alternative 2: Track 2 Restricted Residential Cleanup (Figure 8):

- Excavation and off-Site disposal of approximately 21,285 cubic yards of soil over the entire Site. The assumed remedial excavation depth ranges from approximately 15 to 20 ft bls.

All soils exceeding the Restricted Residential Use SCOs in the upper 15 feet will be excavated and disposed.

- Backfill and compaction of off-Site soil meeting the lower of Protection of Groundwater or Restricted Residential Use SCOs in the Track 2 Remedial Area, as necessary.
- Collection of 21 total post-excavation bottom endpoint samples to document the contamination to remain below the building foundation slab.
- Mitigation of the potential for soil vapor intrusion through installation and operation of an active SSDS below the Site building, including a vapor barrier system (minimum thickness 20 mil) under the building foundation's slab and up the foundation walls to prevent any exposure from soil vapor from off-Site exposure pathways as a component of this system. The vapor barrier will be a sealing methodology used to seal the foundation slab as required in the DOH Guidance document and then the SSDS will be installed.

3.1 EVALUATION OF REMEDIAL ALTERNATIVES

The goal of the remedy selection process under the BCP is to select a remedy that is protective of human health and the environment taking into consideration the current, intended, and reasonably anticipated future use of the property. Each remedial alternative is evaluated based on the factors listed below:

- Protection of human health and the environment;
- Compliance with standards, criteria, and guidelines (SCGs);
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community Acceptance; and
- Land use.

SCGs applicable to the Site are discussed in Section 2.4.3 of this RI/RAWP and are described briefly below.

- 6 NYCRR Part 375-6 Soil Cleanup Objectives – The unrestricted use, protection of groundwater and restricted residential use SCOs listed in the guidance were used to evaluate soils, delineate areas with impacts and specify cleanup objectives;

- New York State Groundwater Quality Standards – 6 NYCRR Part 703 – The standards listed in the guidance were used to evaluate groundwater quality, delineate areas with impacts, and specify cleanup objectives;
- NYSDEC Ambient Water Quality Standards and Guidance Values – TOGS 1.1.1 – The standards listed in the guidance were used to evaluate groundwater quality, delineate areas with impacts, specify cleanup objectives;
- NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation – May 2010 – The proposed remedial alternatives were developed in accordance with the abovementioned document;
- NYSDEC CP-51 Soil Cleanup Guidance – The standards listed in the guidance were used to evaluate groundwater quality, delineate areas with impacts, and specify cleanup objectives;
- New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan – Community air monitoring will be required for all ground intrusive activities, and the abovementioned document was used to prepare the CAMP;
- NYS Waste Transporter Permits – 6 NYCRR Part 364 – As the remedial alternatives include excavation and disposal of soil, the abovementioned guidance document applies;
- NYS Solid Waste Management Requirements – 6 NYCRR Part 360 and Part 364 – As the remedial alternatives include excavation and disposal of soil, the abovementioned guidance document applies; and
- NYSDOH Soil Vapor Intrusion Guidance Document October 2006 (as amended).

3.1.1 Overall Protection of Human Health and the Environment

This criterion is an evaluation of the ability of each alternative or the remedy to protect public health and the environment.

Remedial Alternative 1 (Conditional **Track 1 Remedy)** - will achieve compliance with the Track 1 SCOs through the removal of soil exceeding the Unrestricted Use SCOs, backfilling the area with material meeting the Unrestricted Use SCOs, and by employing short-term ICs and ECs including an active SSDS with a vapor barrier to address the potential for vapor intrusion. Implementing ICs including a Site Management Plan (SMP) will ensure that the SSDS remains in operation and provide for an evaluation of the active SSDS performance to determine if continued mitigation is necessary. Excavating soil above the Protection of Groundwater SCOs will minimize leaching of contamination into groundwater.

Remedial Alternative 1 will be protective of human health and the environment by protecting the Site from migration of offsite contaminants by removing the source of soil at the Site that exceeds the Unrestricted Use SCOs and backfilling the area with material meeting the Unrestricted Use SCOs as necessary, thus eliminating the potential exposure to human health, the environment to contaminated soil/fill once construction is complete, and eliminating the risk of contamination leaching from the soil/fill into underlying groundwater to the extent possible. Though there is minimal potential for contact with contaminated groundwater, as it is not used for potable purposes, the concentration of any contaminants in groundwater will be mitigated by the removal of the impacted soil and dewatering (if necessary). An active SSDS will be installed under the building foundation's slab and a vapor barrier will be installed beneath the slab and up the foundation walls to mitigate any exposure from soil vapor from off-Site exposure pathways.

Remedial Alternative 2 (Track 2 Remedy) - will achieve compliance with the Track 2 SCOs by removing on-Site soils above the Track 2 Restricted Residential in the upper 15 feet, resulting in no exposed impacted soil after remedial construction. Implementing ICs including an SMP and Environmental Easement will ensure that the ECs remain intact and protective and that use of groundwater is restricted. Though there is minimal potential for contact with contaminated groundwater, as it is not used for potable purposes, the concentration of any contaminants in groundwater will be mitigated by the removal of the impacted soil. A SSDS including a vapor barrier system (minimum thickness 20 mil) will be installed under the building foundation's slab to prevent any exposure from soil vapor from off-Site exposure pathways. During Site remediation and other construction activities, workers may be exposed to impacted soil. Potential worker exposure to contaminated media during remediation activities will be prevented or minimized through the implementation of the Site-Specific Health and Safety Plan (HASP), which includes the CAMP, and required worker training. Potential environmental exposures will be prevented or minimized by ECs implemented during remedial construction (i.e., dust suppression, odor control, temporary soil covers, and traffic control).

3.1.2 Standards, Criteria, and Guidance

The remedy must conform to officially promulgated standards and criteria that are directly applicable or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance as appropriate.

Remedial Alternative 1 will achieve compliance with the Track 1 Unrestricted Use SCOs by removing all contaminated soils and will therefore result in a permanent remedy. The proposed active SSDS and vapor barrier system would be a short-term EC for mitigation of soil vapor from offsite sources.

Remedial Alternative 2 will achieve compliance with the Track 2 Restricted Residential SCOs by removing on-Site soils above the Track 2 Restricted Residential SCOs for the COCs. Soil vapor contamination will be mitigated with the use of an active SSDS and vapor barrier system.

3.1.3 Long-Term Effectiveness and Permanence

This criterion is an evaluation of the long-term effectiveness and permanence of an alternative or remedy after implementation.

Remedial Alternative 1 would achieve long-term effectiveness by providing a permanent cleanup of on-Site contamination through removal of all impacted soil/ fill material in excess of the Track 1 SCOs. The vapor barrier foundation system will be a permanent barrier against off-Site migration of contaminants in soil vapor and the operation of an active SSDS will eliminate potential soil vapor intrusion. The use of a short-term SMP and Environmental Easement will ensure effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and restrictions continue to be in place and are functioning as intended. The SMP and Environmental Easement will be evaluated within five years to determine if long-term operation of the SSDS is necessary. If the SSDS cannot be removed as an EC, a Track 2 contingency would be used. Therefore, incremental risk will be eliminated and the remedy will continue to meet RAOs in the future, thus providing a permanent long-term remedy for the Site.

Remedial Alternative 2 would achieve long-term effectiveness by providing a permanent cleanup of on-Site contamination through removal of all impacted soil/ fill material in excess of the Restricted Residential Use SCOs. The vapor barrier foundation system will be a permanent barrier against migration of off-Site contaminants in soil vapor and the operation of an active SSDS will eliminate potential soil vapor intrusion. Therefore, incremental risk will be eliminated and the remedy will continue to meet RAOs in the future, thus providing a permanent long-term remedy for the Site. The SSDS will be a long-term remedy to protect human health and the environment by preventing exposures to off-Site soil vapor exposure pathways through implementation of a SMP. The SMP and Environmental Easement will ensure long-term effectiveness of the SSDS by requiring periodic inspection and certification that these controls and restrictions continue to be in place and are functioning as intended.

3.1.4 Reduction in Toxicity, Mobility, or Volume of Contamination Through Treatment

This criterion is an evaluation of the ability of an alternative or remedy to reduce the toxicity, mobility, and volume of Site contamination. Preference should be given to remedies that permanently or significantly reduce the toxicity, mobility, or volume of the contamination at the Site. The ways to achieve this includes:

- removal and/or treatment;
- containment;
- elimination of exposure; and
- treatment of source at the point of exposure.

Remedial alternatives that use treatment or removal to eliminate contaminants at a site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media are preferable.

Remedial Alternative 1 permanently eliminates the toxicity, mobility, and volume of contaminants within soil at the Site by removing all soil with concentrations that exceeded the Unrestricted Use SCOs. Soil vapor and groundwater contaminants from an offsite source will be mitigated using short-term ICs and ECs (i.e., Environmental Easement and active SSDS and vapor barrier system).

Remedial Alternative 2 will permanently eliminate the toxicity, mobility, and volume of contaminants within the site that exceed the Restricted Residential Use SCOs through implementation of the SMP and Environmental Easement requiring long-term maintenance of the Cover System, the vapor barrier, and the SSDS.

3.1.5 Short-Term Impacts and Effectiveness

This criterion is an evaluation of the potential short-term adverse environmental impacts and human exposures during the construction and/or implementation of an alternative or remedy.

Although **Remedial Alternative 1** and **Remedial Alternative 2** both require excavation of impacted materials, the length of construction for Remedial Alternative 1 would be greater than Remedial Alternative 2. Thus, Remedial Alternative 1 has higher potential exposure risks to the community and construction workers. These potential risks are addressed in the Site-specific HASP and CAMP and the Soil/Materials Management Plan (SoMP), which detail monitoring during the construction and describe ECs to be implemented as necessary (e.g., dust suppression and traffic control).

Both **Remedial Alternative 1** and **Remedial Alternative 2** would employ appropriate measures to prevent short term impacts, including a CAMP and a Soil Management Plan (SoMP), during all on-Site soil disturbance activities and would effectively prevent the release of significant contaminants into the environment. Both alternatives provide short term effectiveness in protecting the surrounding community by decreasing the risk of contact with on-Site contaminants with ECs (i.e., dust suppression and traffic control).

Potential worker exposure to soil and groundwater during remediation activities will be mitigated through the required Occupational Safety and Health Administration (OSHA) HazWoper training and appropriate HASPs. Construction workers operating under appropriate management procedures and a HASP will be protected from on-Site contaminants (personal protective equipment would be worn consistent with the documented risks within the respective work zones). Other potential risks include material handling, electrical shock, general trip hazards, and noise. These potential impacts are addressed in the Site-specific HASP and CAMP and the

SoMP, which detail monitoring during the construction and describe ECs to be implemented as necessary (e.g., dust suppression and traffic control).

3.1.6 Implementability

This criterion is an evaluation of the technical and administrative feasibility of implementing an alternative or remedy. Both Remedial Alternatives are technically feasible, however, Remedial Alternative 2 may be more readily implementable than Remedial Alternative 1.

The techniques, materials, and equipment to implement **Remedial Alternative 1** and **Remedial Alternative 2** are readily available and have been proven effective in remediating the contaminants associated with the Site. Standard materials, services, and well-established technologies will be implemented. There are no specific difficulties associated with any of the activities proposed, which utilize standard construction methods except for the hot spot areas which may require additional support of excavation activities and groundwater pumping that do not justify the attempt to achieve a Site-wide Track 1 remedy.

3.1.7 Cost Effectiveness

This criterion is an evaluation of the overall cost effectiveness of an alternative or remedy. Cost estimates for each alternative are shown in **Tables 16 and 17**.

The total cost for **Remedial Alternative 1** is estimated at approximately $8,408,400. The total cost for **Remedial Alternative 2** is estimated at approximately $8,262,600.

The costs associated with Remedial Alternative 1 are higher than Remedial Alternative 2 due to the additional excavation, backfill materials, and off-Site transportation and disposal that will be required to achieve Track 1 Unrestricted Use SCOs. Deeper excavation to achieve Track 1 would be required, which will be more expensive and may require dewatering.

3.1.8 Community Acceptance

This criterion is evaluated after the public review of the remedy selection process as part of the final DEC selection/approval of a remedy for a site.

1. Any public comment relative to these criteria will be considered by DEC after the close of the public comment period.
2. Documentation of the public comments received is to be consistent with the Citizen Participation Plan (CPP) identified for a remedial program in accordance with applicable DEC policy.

While a full evaluation of this criterion cannot be made until after the public comment period is complete, the community is likely to accept both Remedial alternatives since Remedial Alternative 1 achieves an unrestricted remedy and Remedial Alternative 2 achieves a restricted remedy.

3.1.9 Land Use

This criterion is an evaluation of the current, intended, and reasonably anticipated future use of the Site and its surroundings, as it relates to an alternative or remedy, when unrestricted levels would not be achieved.

This evaluation has considered reasonably-anticipated future uses of the Site and takes into account:

- current use and historical and/or recent development patterns;
- applicable zoning laws and maps;
- NYS Department of State's Brownfield Opportunity Areas (BOA) pursuant to section 970-r of the general municipal law;
- applicable land use plans;
- proximity to real property currently used for residential use, and to commercial, industrial, agricultural, and/or recreational areas;
- environmental justice impacts, Federal or State land use designations;
- population growth patterns and projections;
- accessibility to existing infrastructure;
- proximity of the Site to important cultural resources and natural resources, potential vulnerability of groundwater to contamination that might emanate from the Site, proximity to flood plains, geography and geology; and
- current ICs applicable to the Site.

Remedial Alternative 1 would render the Site available for unrestricted use following remedial construction. Therefore, this remedy allows for any land use.

Remedial Alternative 2 is compatible with the planned future use of the new Site buildings as mixed-use commercial/residential/community/recreational use based on implementation of long-term engineering and institutional controls for vapor mitigation that will be recorded and will run with the land so that future owners are aware that land use options are restricted as described in the Environmental Easement.

Improvements in the current condition of the Site achieved by both cleanup alternatives are also consistent with the city's goals for cleanup of contaminated land, bringing such properties to productive reuse, and making such properties protective of natural and cultural resources.

3.2 SELECTION OF THE PREFERRED REMEDY

The Preferred Remedy for the Site, Remedial Alternative 1, was selected for implementation since it adequately meets each of the evaluation criteria. In summary, the Preferred Remedy for the Site:

- Is protective of public health and the environment;
- Complies with the appropriate Track 1 UUSCOs;
- Provides long term effectiveness and permanence through source removal of all soil exceeding the Track 1 UUSCOs;
- Reduces the toxicity, mobility, or volume of impacted material through source removal;
- Provides short-term effectiveness, including minimal impacts to workers or the surrounding neighborhood through the implementation of ECs during construction;
- Is readily implementable;
- Is compatible with land use; and
- Should be acceptable to the community.

The Preferred Remedy for the Site is consistent with the approach for Track 1 Unrestricted Use scenario described in the Part 375 Regulations. If a Track 1 remedy for the Site cannot be achieved due to the presence of soil above Track 1 Unrestricted Use SCOs or long-term ECs, the Site will defer to a Track 2 contingency.

3.2.1 Zoning

As discussed in the BCP application, the Site is currently zoned M1-4/R8A, a residential and light manufacturing district. See Exhibit I in the BCP application. There are commercial

buildings northerly adjacent to the Site on Dinsmore Street. Several nearby properties include car and truck storage. A subway line is one block to the east of the Site. The nearest residential area is one block away on Euclid Avenue and Fountain Avenue.

3.2.2 Applicable Comprehensive Community Master Plans Or Land Use Plans

The future redevelopment of Site is consistent with the surrounding community redevelopment plans. The redevelopment would provide affordable residential housing, commercial business opportunities, and much needed community facilities. The property adjacent to the west of the Site is currently undergoing construction by the NYCSCA as a new public school.

3.2.3 Surrounding Property Uses

As described in the BCP application, the Site is located in the Borough of Brooklyn, City of New York in a highly developed urban area of Brooklyn consisting primarily of industrial and commercial structures. Most of the adjacent parcels are vacant and there is a baseball park on the corner of Atlantic Avenue and Fountain Avenue to the south of the Site. To the north of the Site are commercial buildings on Dinsmore Street and several properties nearby include car and truck storage, including the property bordering the Site to the west. The nearest residential areas are one block away to the south on Fountain Avenue and Euclid Avenue. There is a vacant property to the east of the Site across Chestnut Street that is also enrolled in the NYSDEC BCP (BCP Site #C224236). An aboveground subway line is one block to the north of the Site and an underground Long Island Rail Road line is located to the south and runs east-west below Atlantic Avenue. There are no agricultural areas in the vicinity of the Site. Surrounding land use is depicted on Exhibit I of the BCP application.

3.2.4 Citizen Participation

Citizen participation will be pursued throughout the remedial process in accordance with the BCP guide and the Citizen Participation Plan (CPP) for the Site.

3.2.5 Environmental Justice Concerns

As presented in the BCP application, and as established in DEC Commissioner Policy 29 on Environmental Justice (EJ) and Permitting (CP-29), potential EJ areas are 2013 U.S. Census block groups of 250 to 500 households each that, in the 2013 Census had populations that met or exceeded at least one of the following statistical thresholds:

- At least 51.1% of the population in an urban area reported themselves to be members of minority groups; or

- At least 33.8% of the population in a rural area reported themselves to be members of minority groups; or
- At least 23.59% of the population in an urban or rural area had household incomes below the federal poverty level.

The Site is located in a potential environmental justice area (PEJA) according to maps issued by NYSDEC.

3.2.6 Land Use Designations

There are no federal or state land use designations related to the Site.

3.2.7 Population Growth Patterns

The population in NYC is projected to grow. Therefore, more affordable and market rate housing is required to accommodate this growth.

3.2.8 Accessibility to Existing Infrastructure

The Site's location in Brooklyn is accessible to existing infrastructure, however, new infrastructure will be constructed during this project and old infrastructure may be removed.

3.2.9 Proximity to Cultural Resources

There are no cultural resources, including federal or state historic or heritage sites or Native American religious sites within ½ mile of the Site.

3.2.10 Proximity to Natural Resources

Natural resources will not be endangered by the preferred remedy for the Site.

3.2.11 Off-Site Groundwater Impacts

There are no known wellhead protection areas or specifically designated groundwater recharge areas in the vicinity of the Site.

3.2.12 Proximity to Floodplains

The Site is not located within the 500-year flood zone based upon data from FEMA maps.

3.2.13 Geography and Geology of the Site

Geography and geology of the Site is discussed in Section 2.3.

3.2.14 Current Institutional Controls

As described in the BCP Application, there are currently no ICs on the property.

3.3 SUMMARY OF SELECTED REMEDIAL ACTIONS

The elements of the remedy are:

1. Screening for indications of contamination (by visual means, odor, and monitoring with PID) of all excavated soil during any intrusive Site work;
2. Excavation of soil/fill exceeding Unrestricted Use SCOs to achieve a Track 1 remedy listed in **Table 18** and shown on **Figure 8** as demonstrated by collection and analysis of end-point samples to evaluate the performance of the remedy with respect to attainment of Track 1 SCOs;
3. Installation of an active sub slab depressurization system (SSDS), including a vapor barrier system (minimum thickness 20 mil) under the building foundation's slab and up the foundation walls to prevent any exposure from soil vapor from off-Site exposure pathways as a component of this system;
4. Recording of a short-term Environmental Easement, including Institutional Controls and Engineering Controls, to prevent future exposure to any residual contamination remaining at the Site;
5. Publication of a Site Management Plan for short term management of residual contamination as required by the Environmental Easement, including plans for: (1) Institutional and Engineering Controls, (2) monitoring, (3) operation and maintenance and (4) reporting;
6. Appropriate off-Site disposal of all material removed from the Site in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal;
7. Import of materials to be used for backfill and cover in compliance with: (1) chemical limits and other specifications included in Table 19 (2) all Federal, State and local rules and regulations for handling and transport of backfill material;
8. All responsibilities associated with the Remedial Action, including permitting requirements and pretreatment requirements, will be addressed in accordance with all applicable Federal, State and local rules and regulations.
9. Monitoring of on-Site groundwater conditions to confirm asymptotic conditions.

Remedial activities will be performed at the Site in accordance with this NYSDEC-approved RIR/RAWP and the Department-issued Decision Document. All deviations from the RIR/RAWP and/or Decision Document will be promptly reported to NYSDEC for approval and fully explained in the FER.

4.0 REMEDIAL ACTION PROGRAM

The following sections describe the Remedial Action program.

4.1 GOVERNING DOCUMENTS

The applicable documents governing the remedial action are described below.

4.1.1 Standards, Criteria and Guidance

SCGs were discussed in Section 3.1.2.

4.1.2 Site Specific Health & Safety Plan (HASP)

The Site-specific HASP and the CAMP are included in **Appendix I**. All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal OSHA.

The Volunteer and associated parties preparing the remedial documents submitted to the State and those performing the construction work, are completely responsible for the preparation of an appropriate Health and Safety Plan and for the appropriate performance of work according to that plan and applicable laws.

The HASP and requirements defined in this Remedial Action Work Plan pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion.

The Roux Site Safety Coordinator will be determined prior to implementation of the Remedial Action. A resume will be provided to NYSDEC prior to the start of remedial construction.

Though not anticipated, if required, confined space entry will comply with all OSHA requirements to address the potential risk posed by combustible and toxic gasses.

4.1.3 Quality Assurance Project Plan/Field Sampling Plan (QAPP/FSP)

The Quality Assurance Project Plan/Field Sampling Plan (QAPP/FSP, **Appendix J**) includes all procedures to be followed for sampling and analysis during the remedial action. The QAPP includes all requirements outlined in DER-10 Section 2.4.

4.1.4 Construction Quality Assurance Plan (CQAP)

Quality assurance/quality control procedures for all construction activities associated implementation of the remedial action construction are established in the Construction Quality Assurance Plan (CQAP), which is included in this section of the RIR/RAWP. The CQAP describes the site-specific construction quality assurance and control measures that will be performed during remediation that will be implemented at the Site during implementation of the RIR/RAWP. The CQAP includes a program for construction observation and testing to verify performance of the remedial construction in accordance with the RIR/RAWP.

4.1.4.1 Organization / Personnel

The implementation of the remedial action construction will be sequenced based on construction requirements, environmental considerations, and logistic limitations posed by the size of the Site and proximity of adjacent structures. The project team is comprised of the Owner/Volunteer (Chestnut Commons Apartments, LLC), contractors, and consultants specializing in one or more critical aspects of the project. It is understood by the project team that close coordination and proper sequencing of all activities occurring on the Site will be crucial to the success of the remediation. The project team and associated responsibilities are as follows. If changes are made the project team, the CQAP will be amended.

4.1.4.2 Owner / Volunteer – Site Redevelopment and Regulatory Interaction

Matthew Gross, Project Coordination

As the Site owner, Chestnut Commons Apartments LLC's Project Manager, Matthew Gross of Urban Builders Collaborative will coordinate communications with regulatory agencies and will provide general oversight of all aspects of the remediation. Mr. Gross will be responsible

for the review of all documents, reports, correspondence, etc., required by the RIR/RAWP and/or the BCA with the NYSDEC dated September 14, 2018.

Chestnut Commons Apartments LLC's Project Manager will be responsible for community notifications and addressing concerns with the adjacent property owners and local community on all remediation-related issues. Mr. Gross will be immediately notified by the on-Site team of any complaints or concerns regarding the work raised by the adjacent property owners and or the general public.

4.1.4.3 General Contractor / Construction Manager

Lettire Construction Corp, Project Quality Control Officer

The General Contractor/ Construction Manager and will be responsible for the quality assurance of all of the tasks being implemented and will be determined at a later date. The General Contractor/ Construction Manager will confirm that all components of the Site activities are conducted according to the requirements of the RIR/RAWP. The General Contractor/ Construction Manager will be responsible for verifying that the daily Site construction activities are in compliance with all of the safety requirements and regulations governing the Site activity, however, each subcontractor is responsible for the health and safety of their own personnel.

4.1.4.4 Roux Environmental Engineering and Geology, D.P.C. – RIR/RAWP and Environmental Monitoring Compliance

Jessica Taylor, P.G. – Project Principal-In-Charge
Brian Morrissey, P.E. –Remedial Engineer of Record
Levi Curnutte – Project Manager/Quality Assurance Officer
TBD – Field Manager/ Site Safety Officer (SSO)

Roux will coordinate all Site activities being implemented to achieve the remedial objectives defined in the RIR/RAWP and will act as the SSO. Roux will provide continual review of all quality control measures implemented by the contractors to ensure compliance with the Site's remedial objectives and the Site-specific HASP. As such, Roux will provide oversight services for the duration of the remedial activities. Roux will be responsible for managing the transportation and disposal of contaminated waste and materials generated during the construction, including:

- fill/soil;
- contaminated concrete, bricks or other construction debris; and
- personal protective equipment and other miscellaneous debris.

Roux will implement the CAMP. CAMP monitoring data will be reported daily to the SSO and will be maintained onsite. Action level exceedances will be reported to the SSO, the Chestnut Commons Apartments LLC project manager and appropriate communication and action taken. All CAMP monitoring records will be included in the overall FER that will be submitted to the NYSDEC and NYSDOH and will include all of the CAMP data collected, daily monitoring station location maps, and copies of the action limit reports (if any). If an action limit report is generated due to VOC exceedances, the NYSDEC and NYSDOH will be notified within 24 hours of the exceedance. Action limit exceedances for dust, if any, will be discussed in the daily report. A brief summary of CAMP activities, including any action limit reports generated, will be provided in the daily report.

All on-Site quality control persons identified in the CQAP will provide daily briefings and/or reports to Roux onsite personnel, identifying the tasks completed, the remedial measures achieved, and any other issues of concern. Additionally, Mr. Brian Morrissey, the "Remedial Engineer", a professional engineer licensed in the State of New York, will be responsible for certifying that the remediation construction was completed in substantial conformance with the approved RIR/RAWP and/or any NYSDEC-approved field changes.

4.1.4.5 TBD – Soil Remedial Contractor

Personnel To Be Determined, Construction Quality Control

The soil Remedial Contractor is responsible for the excavation of portions of the Site to the required depths, coordination with the General Contractor for disposal of the contaminated excavated materials, contaminated construction and demolition debris and all other contaminated wastes generated, transportation and disposal of non-contaminated construction and demolition debris (if any), and decontamination of equipment. The primary environmental obligations of the soil Remedial Contractor include safely managing all excavated materials, preventing the contaminated Site soils from leaving the Site, and decontaminating equipment, as necessary.

4.1.4.6 Environmental Laboratory

TestAmerica will be utilized for all remediation construction-related analytical requirements. TestAmerica is a NYSDOH ELAP-certified laboratory. All results will be reported in EDDs prepared in accordance with NYSDEC requirements (Category B). Formal laboratory qualifications and QA/QC information packages for TestAmerica and any other analytical laboratories proposed for the project will be submitted to the NYSDEC, if requested.

4.1.4.7 Surveying Firm

A NYS-licensed surveying firm, will be contracted by Chestnut Commons Apartments LLC to provide lines, grades, boundaries, benchmarks, topographic surveys, as-built drawings, and any other survey work required for the proper execution and documentation of the work as required by the RIR/RAWP.

4.1.4.8 Waste Disposal Facilities

Waste from the Site will be transported to appropriately permitted waste disposal facilities. This CQAP will be updated with the names of the facility or facilities, as required. If any is generated, non-impacted construction debris will be transported to a registered construction and demolition disposal facility.

4.1.4.9 Waste Transporter and Disposal Facility Qualifications

As required, a qualifications package will be provided by each vendor contracted to transport waste from the Site to the designated soil disposal facilities and each designated disposal facility. The package shall include the following:

- proof of insurance and all current necessary waste transport permits for the waste type(s) being transported.
- Letters of Commitment or other appropriate documentation from all waste haulers and from all transfer, treatment, storage and disposal facilities to be used for the project. The letters of commitment shall specifically identify the types and quantities of waste that the facility will be able to accept, the permit numbers for all facilities at which the waste will be accepted and all waste characterization requirements, if additional to waste characterization samples already collected. In the event that a facility (such as a privately-owned treatment works) is prohibited from issuing a letter of commitment without a sample

of the waste, a conditional type letter will be acceptable. Such a conditional letter shall specifically state what types and quantities of waste the facility will accept.

- For each waste hauler:
  - Name and federal and state identification numbers, as applicable.
  - Address.
  - Name of responsible contact for the hauler.
  - Telephone number for the contact.
  - List of types and sizes of all transport vehicles and equipment to be used.
  - A description of proposed transportation route, method and procedures for hauling waste material, including type of vehicles that will be used for each type of waste.
  - Copies of any and all necessary permits and authorizations for each type of waste transported.
- For each transfer, treatment, storage and disposal facility, the Contractor shall submit the following information:
  - Facility name and federal and state identification numbers.
  - Facility location.
  - Name of responsible contact for the facility.
  - Telephone number for contact.
  - Signed letter of agreement to accept waste.
  - Unit of measure utilized at facility for costing purposes.
  - Copies of all permits, licenses, letters of approval, and other authorizations to operate, held by the proposed facility as they pertain to receipt and management of waste derived from this Contract.

4.1.4.10 Construction Quality Control Testing

Implementation of quality control testing and measurement will be performed by the contractors conducting the specific Site tasks, as required. The quality control officers, defined in Section 4.1.4.4, will be responsible for providing documentation of all testing and measurement results to Roux. Roux will be responsible for verifying that all quality control testing has been conducted in compliance with the RIR/RAWP 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' testing equipment is 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.

Specific task-driven testing/certification obligations as they relate to environmental aspects of the project are as follows:

- A New York State-licensed surveyor will conduct all of the necessary measurements.
- Excavated soil will require waste characterization analyses prior to disposal. Waste characterization analysis parameters and frequency for waste leaving the Site, if any, are determined by the waste disposal facility's acceptance requirements. As required, waste 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. This monitoring data will be collected and logged for review daily by Roux Associates/Remedial Engineering 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 the above requirements and will be included in the FER to be prepared by Roux upon completion of all remedial objectives defined in the RIR/RAWP.

4.1.4.11 Project Coordination

During implementation of the remedial action construction, progress meetings/conference calls will be conducted periodically to assess the progress of the work, overall progress to date, quality control requirements, environmental and construction health and safety requirements, and future progress expectations. Those in attendance will include representatives from the Owner/Contractor, Roux and other subcontractors, as necessary. The NYSDEC and NYSDOH will attend the progress meetings at their discretion. 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. Routine task meetings will also be conducted on an

as-needed basis to insure proper communication between the contractors, tradesman, and supervisory personnel.

4.1.5 Soil/Materials Management Plan (SoMP)

The SoMP is included in Section 5.4 of this RIR/RAWP.

4.1.6 Erosion and Sediment Controls

The erosion and sediment controls will be in conformance with requirements presented in the New York State Guidelines for Urban Erosion and Sediment Control.

4.1.7 Community Air Monitoring Plan (CAMP)

All invasive work will be completed in accordance with the CAMP that is included in the HASP as **Appendix I**.

4.1.8 Contractors Site Operations Plan (SOP);

Contractor plans for remediation have not been prepared at this time. The Remedial Engineer is responsible to ensure that all later document submittals for this remedial project, including contractor and sub-contractor document submittals, are in compliance with this RIR/RAWP. All remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

4.1.9 Citizen Participation Plan

A certification of mailing will be sent by the Volunteer to the NYSDEC project manager following the distribution of all Fact Sheets and notices that includes: (1) certification that the Fact Sheets were mailed, (2) the date they were mailed; (3) a copy of the Fact Sheet, (4) a list of recipients (contact list); and (5) a statement that the repository was inspected on (specific date) and that it contained all of applicable project documents.

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

The approved Citizen Participation Plan for this project is attached in **Appendix K**.

Document repositories have been established at the following locations and contain all applicable project documents:

Arlington Branch of Brooklyn Public Library
203 Arlington Ave.
Brooklyn, New York 11207
(718) 277-6105

Brooklyn Community Board 5
404 Pine Street, 3rd Floor
Brooklyn, New York 11208
Telephone: (909) 221-8261
bk05@cb.nyc.gov
District Manager: Melinda Perkins

4.2 GENERAL REMEDIAL CONSTRUCTION INFORMATION

4.2.1 Project Organization

The Remedial Contractors have not been selected to date. Once established, a listing of key personnel involved in the Remedial Action will be provided to the NYSDEC. A copy of professional profiles for the Project Principal and Remedial Engineer for Roux and for the data validator are presented in **Appendix L**.

4.2.2 Remedial Engineer

The Remedial Engineer for this project will be Mr. Brian Morrissey. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program for the Chestnut Commons Atlantic Avenue Site (NYSDEC BCA Index No. C224276-08-29 Site No. C224276). The Remedial Engineer will certify in the Final Engineering Report that the remedial activities were observed by qualified environmental professionals under his supervision and that

the remediation requirements set forth in the RI/RAWP and any other relevant provisions of ECL 27-1419 have been achieved in full conformance with that Plan. Other Remedial Engineer certification requirements are listed later in this RIR/RAWP.

The Remedial Engineer will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of backfill material, and management of waste transport and disposal. The Remedial Engineer will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The Remedial Engineer will review all pre-remedial plans submitted by contractors for compliance with this RI/RAWP and will certify compliance in the Final Engineering Report.

The Remedial Engineer will provide the certifications listed in Section 10.1 in the Final Engineering Report.

4.2.3 Remedial Action Construction Schedule

A schedule for the major elements of the remedial construction and the redevelopment construction are presented below in Section 11.

4.2.4 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings construction code requirements or according to specific variances issued by that agency. DEC will be notified by the Volunteer of any variances issued by the Department of Buildings. NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.5 Site Security

Security for the work, equipment, materials, supplies, facilities, personnel, and incidentals will be provided throughout the performance of the work at the Site. The existing warehouse is currently locked and secured. A construction fence will be installed, as appropriate, by the Volunteer during implementation of the remedial action and redevelopment. The General Contractor/Construction Manager will maintain a sign in/sign out sheet for all visitors to the Site.

4.2.6 Traffic Control

All construction work will occur between 7 A.M. and 6 P.M. from Monday to Friday. The General Contractor may work longer hours and/or weekends, as permitted by the proper authorities. If work beyond these hours or on weekends is required, the proper authorities will be notified. Disturbances to the local community will be minimized to the extent practical.

Trucking for waste disposal from the Site and for backfill materials into the Site will conform to the proposed truck routes for ingress and egress to the Site as shown in Figure 9.

The inbound truck route to the Site is:

- Take Atlantic Avenue west and turn north onto Chestnut Street (right turn)
- Take Dinsmore Place west (left turn)
- Enter Site south (left turn)

The outbound truck route from the Site is:

- Exit the Site west onto Dinsmore Place (left turn)
- Take Logan Street south (left turn)
- Take Atlantic Avenue west (right turn)

All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes. These are the most appropriate routes and take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting offsite queuing of trucks entering the facility, to the extent practicable; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project Site, to the extent practical.

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

The contractors operating on the Site will be responsible for providing all necessary personnel and materials (i.e., traffic lanes, safety cones, etc.) to control traffic entering and exiting the Site and for coordinating traffic control measures with the New York City Police Department,

as necessary. Contractors operating on the Site shall be responsible for all applicable New York City Department of Transportation (NYCDOT) traffic control and notification requirements and incorporating those elements into this Traffic Control Plan.

4.2.7 Contingency Plan

The Contingency Plan is described in Section 5.4.11.

4.2.8 Worker Training and Monitoring

All general Site workers (as defined in OSHA 1910.120 (e)(3)(i)) that will be involved with earth disturbance activities will have received a minimum of 24 hours of initial health and safety training for hazardous waste site operations (24-Hour HAZWOPER training) and meet the medical surveillance requirements included in the HASP.

4.2.9 Agency Approvals

The Volunteer has addressed all SEQRA requirements for this Site. All permits or government approvals required for remedial construction have been, or will be, obtained prior to the start of remedial construction.

The project is consistent with the as-of-right zoning other than two provisions within the Zoning Resolution. The Requestor has submitted applications for a Mayoral Override of two provisions in coordination with HPD and other agencies supportive of the project in New York City, which should be received before the COC is issued.

A complete list of all local, regional and national governmental permits, certificates or other approvals or authorizations required to perform the remedial and development work is attached in **Table 20**. This list includes a citation of the law, statute or code to be complied with, the originating agency, and a contact name and phone number in that agency. This list will be updated in the Final Engineering Report.

4.2.10 NYSDEC BCP Signage

At this time a project sign will not be erected at the Site.

4.2.11 Pre-Construction Meeting with NYSDEC

A project kick-off meeting will be conducted with the Volunteer, Roux, and the major subcontractors prior to the commencement of any intrusive remedial activities proposed in this RAWP. The NYSDEC and NYSDOH will be notified at least seven days in advance of the proposed meeting date and will attend the pre-construction meeting at their discretion.

4.2.12 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in **Table 21**. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

4.2.13 Remedial Action Costs

The total estimated cost of the Remedial Action is $8,408,400. An itemized and detailed summary of estimated costs for all remedial activity is attached as **Table 16**. This will be revised based on actual costs and submitted as an Appendix to the Final Engineering Report.

4.3 SITE PREPARATION

The following sections describe the Site preparation activities associated with the preferred remedy for the Site.

4.3.1 Pre-Design Confirmation Soil Sampling

During the RI, deeper (30-32 ft bls) soil samples collected from two soil borings in the southwest area of the Site, MW-6 and RX-16, exceeded the Unrestricted Use SCOs. Both locations contained low-level exceedances of Unrestricted Use SCOs for 4,4'-DDT and RX-16 also contained an exceedance of the Restricted Residential SCO for indeno[1,2,3-cd]pyrene. Soil at the 30-32 ft bls interval at each of these borings was observed to be native, predominantly sand and gravel; therefore, it is likely that the presence of this compound is due to drill slough and not representative of the native soil at depth. Soil confirmation samples will be collected directly adjacent to these two soil borings to obtain confirmation samples prior to remedial excavation.

Samples will be analyzed for the full list of TCL/TAL +30 parameters and emerging contaminants at a depth of 30-32 ft bls in a location within 2 feet of the original boring location shown on **Figure 2**. The results of this sampling will be used to determine the extent of excavation necessary to achieve Track 1 Unrestricted Use SCOs.

4.3.2 Mobilization

Mobilization and Site preparation activities include:

1. Mobilization of equipment to the work area.
2. Traffic control measures.
3. Work zone demarcation.
4. Installation of erosion and sediment control measures in accordance with the New York Guidelines for Urban Erosion and Sediment Control.
5. Set-up of decontamination facilities.
6. Installation of temporary facilities.
7. Installation of perimeter air monitoring system.

4.3.2 Monitoring Well Decommissioning / Vapor Probe Decommissioning

Existing groundwater monitoring wells will either be protected during remediation and development for use in post-remedial monitoring, or will be properly decommissioned in accordance with NYSDEC policy CP-43. The only exception to this is if the full length of the well is to be excavated during remediation and development.

Similarly, existing soil vapor probes will be properly decommissioned unless they are to be fully removed during remediation/development or used for post-remedial monitoring.

4.3.4 Erosion and Sedimentation Controls

Soil erosion and sediment control measures for management of storm water will be installed in accordance with the New York Guidelines for Urban Erosion and Sediment Control. Hay bales and/or silt fence will be placed by the remedial contractor at locations surrounding excavation areas, within the perimeter fencing, to control storm water runoff and surface water from entering or exiting the excavation. These control measures will be installed prior to initiating the soil excavation.

4.3.5 Stabilized Construction Entrance(s)

Stabilized construction entrances will be installed at the egress points from the Site. Any soil spilled on the sidewalk or street immediately adjacent to the Site will be promptly removed and the street will be cleaned.

4.3.6 Utility Marker and Easements Layout

The Volunteer and its contractors are solely responsible for the identification of utilities that might be affected by work under the RIR/RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RIR/RAWP. The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this RIR/RAWP. The Volunteer and its contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this RIR/RAWP. Approval of this RIR/RAWP by NYSDEC does not constitute satisfaction of these requirements.

The presence of utilities and easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this RIR/RAWP is posed by utilities or easements on the Site.

4.3.7 Sheeting and Shoring

Appropriate management of structural stability of on-Site or off-Site structures during on-Site activities include excavation is the sole responsibility of the Volunteer and its contractors. Sheeting and shoring will be required to implement this remedial action. The Volunteer and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. The Volunteer and its contractors must obtain any local, State or Federal permits or approvals that may be required to perform work under this Plan. Further, the Volunteer and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

4.3.8 Equipment and Material Staging

Equipment and materials for the remedial construction will be onsite in a designated area.

4.3.9 Decontamination Area

A temporary decontamination pad will be constructed to decontaminate excavation equipment prior to leaving the Site. The decontamination pad will be constructed using polyethylene liner sloped to a low-lying sump to collect any liquids. All decontamination material will be collected and properly disposed of off-Site. Decontamination of trucks leaving the Site is discussed in Section 5.4.3.

4.3.10 Site Fencing

The fences and gates will be closed and locked when there is no activity on the Site and any breaks or gaps will be repaired immediately. Temporary fencing (e.g., cones, caution tape, etc.) will supplement the perimeter fencing to delineate and secure the area of ongoing remediation activities within the Site such as soil stockpiles, and health and safety exclusion zones.

4.3.11 Demobilization

The Demobilization plan should address:

- Restoration of areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management area[s], and access area);
- Removal of temporary access areas (whether on-Site or off-Site) and restoration of disturbed access areas to pre-remediation conditions;
- Removal of sediment and erosion control measures and disposal of materials in accordance with acceptable rules and regulations;
- Equipment decontamination; and
- General refuse disposal.

4.4 REPORTING

All daily and monthly Reports will be included in the Final Engineering Report.

4.4.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day following the reporting period and will include:

- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and exported from the Site;
- References to alpha-numeric map for Site activities;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of CAMP finding, including excursions; and
- An explanation of notable Site conditions;
- Site photographs; and
- A look-ahead to upcoming work.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RIR/RAWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily Reports will include a description of daily activities keyed to an alpha-numeric map for the Site that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public.

A Site map that shows a predefined alpha-numeric grid for use in identifying locations described in reports submitted to NYSDEC will be used.

The NYSDEC assigned project number will appear on all reports.

4.4.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers within ten days following the end of the month of the reporting period and will include:

- Activities relative to the Site during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e. tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and,
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

4.4.3 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of the Site prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area and Site structures before, during and after remediation. Photos will be included in the daily reports as needed, and a comprehensive collection of photos will be included in the Final Engineering Report.

Job-site record keeping for all remedial work will be appropriately documented. These records will be maintained on-Site at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

4.4.4 Complaint Management Plan

If an odor or dust complaint is received, the following procedure will be implemented:

1. Work in the affected area will be halted, and the source of odors/dust will be identified.
2. NYSDEC, NYSDOH, and the Volunteer will be notified of the complaint.
3. Nuisance odors, if any, will be abated through covering/containerizing excavated materials, backfilling open excavations in a timely manner; and/or using a foam unit or other appropriate measures.
4. Nuisance dust, if any, will be abated through covering/containerizing excavated materials, and/or using water on excavations.
5. Work will resume in the affected area when the nuisance odors/dust have been abated, as determined by the Roux on-Site personnel.

Noise complaints will be handled through the City of New York.

4.4.5 Deviations from the Remedial Action Work Plan

Deviations from the RIR/RAWP will be reported to NYSDEC for approval and fully explained in the FER. At a minimum, this section should include the following:

- Reasons for deviating from the approved RIR/RAWP;
- Approval process to be followed for changes/editions to the RIR/RAWP; and
- Effect of the deviations on overall remedy.

5.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

Soil containing COCs exceeding the Track 1 Unrestricted Residential Use SCOs will be excavated and disposed off-Site. The remedial excavation depths range from 15 to 20 ft bls. The actual extent of excavations will depend on field observations, technical practicability based on excavation shoring limitations and the risk of undermining adjacent sidewalks and structure, and post excavation samples.

The excavation will be performed by the Soil Remedial Contractor. The excavations will be conducted in a manner that protects the integrity of the adjacent structure. Soil excavation will generally be conducted using traditional excavation equipment. If any underground utilities or other subsurface piping are encountered, the excavation will be performed by hand as required to safely expose and support the utilities.

Hydraulic control measures (i.e., excavation dewatering system) are not expected to be required to manage groundwater as most of the excavation will be above the groundwater table.

All trucks removing contaminated material from the Site will be loaded on-Site and properly decontaminated before leaving the Site.

Excavated unsaturated soil may be used as backfill provided it meets soil reuse criteria as noted in DER-10 Table 5.4 and with subsequent approval of NYSDEC. The soil must be inspected prior to reuse, and must be free from odors or staining. Excavated material to be used for backfill will be stockpiled on Site in accordance with Section 5.4. Any soils that are removed from parcels that were not previously investigated will be laboratory analyzed prior to any on-Site reuse.

Material excavated from the Site and slated for off-Site disposal will be disposed in accordance with the Soil and Materials Management Plan.

Following excavation, end-point soil samples will be collected in accordance with the remedial performance evaluation described in Section 5.2.2.

Groundwater

Dewatering is not expected to be required during excavation activities.

5.1 SOIL CLEANUP OBJECTIVES

The Soil Cleanup Objectives for this Site are listed in **Table 18**.

Soil and materials management on-Site and off-Site will be conducted in accordance with the Soil Management Plan as described below.

Tables 4 through 8 summarize all soil samples that exceed the SCOs proposed for this Remedial Action. A box map that shows all soil samples that exceed the SCOs proposed for this Remedial Action is shown in **Figure 4**.

UST closures, if any, will, at a minimum, conform to criteria defined in DER-10.

5.2 REMEDIAL PERFORMANCE EVALUATION

End-point sampling and reporting will be conducted in accordance with the DER-10 and the QAPP/FSP and is discussed in the sections below.

5.2.1 End-Point Sampling Frequency

End-point samples will be collected to verify compliance with SCOs. End-point excavation bottom samples will be collected at a frequency of one sample per 1,000 square feet of excavation bottom in accordance with NYSDEC DER-10 Section 5.4. End-point sidewall sampling will not be required since excavation will extend to the property line in all directions in order to install the required SOE and no soil exceeding SCGs will potentially remain onsite. The end-point samples will be analyzed for VOCs, SVOCs, metals, PCBs, and pesticides , and

emerging contaminants to demonstrate compliance with the Track 1 unrestricted Residential Use SCOs.

The end-point bottom soil sample results will be compared to the Track 1 Unrestricted Use SCOs and be collected to the extent feasible due to excavation shoring limitations and the risk of undermining adjacent sidewalks and structure. The end-point sample locations are shown on Figure 10.

Note that although not anticipated, should a buried tank be uncovered during excavation activities, Chestnut Commons Apartments, LLC would follow all applicable regulations associated with registering and addressing tanks, as well as revert back to the higher sampling frequency discussed in the NYSDEC DER-10 (i.e., 1/900 SF for bottom and 1/30 LF for sidewall samples) within the relevant area(s).

5.2.2 Methodology

Each sample will be inspected for visual evidence of contamination (i.e., staining, presence of petroleum or odors) and field screened for VOCs using a portable photoionization detector (PID). If samples are free from visual evidence of contamination and PID indicates soil is not contaminated, the sample will be sent to a lab. Soil samples to be submitted for analysis will be place into a laboratory sample jar and transported to the laboratory in an iced container. Laboratory analysis will be performed by a NYSDOH ELAP-approved laboratory.

5.2.3 Reporting of Results

The laboratory will report analytical results for post-excavation confirmation samples in ASP Category B deliverable packages. An EDD in the required NYSDEC format will also be provided by the laboratory.

All post-excavation confirmation sample data generated for the Remedial Action will be logged in a database and organized to facilitate data review and evaluation. The electronic dataset will include the data flags provided in accordance with USEPA Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis and Inorganic Analyses, as well as additional comments of the data review for ASP/CLP analyses. The data flags include such items

as: 1) concentration below required detection limit, 2) estimated concentration due to poor recovery below required detection limit, 3) estimated concentration due to poor spike recovery, and 4) concentration of chemical also found in laboratory blank.

5.2.4 QA/QC

Quality control (QC) samples serve as checks on both the sampling and measurements systems and assist in determining the overall data quality with regard to representation, accuracy, and precision. The QAPP/FSP, included as **Appendix J** to this RIR/RAWP, describes QA/QC procedures and sampling for the project.

5.2.5 DUSR

A DUSR will be prepared to evaluate the pre-excavation confirmation samples by a party independent from the laboratory performing the analysis in accordance with Appendix 2B of DER-10. The QAPP/FSP, included as **Appendix J** to this RIR/RAWP, describes the DUSR to be prepared for the project.

5.2.6 Reporting of End-Point Data in FER

Chemical labs used for all end-point sample results and contingency sampling will be NYSDOH ELAP certified. The FER will provide a tabular and map summary of all end-point sample results and exceedances of SCOs.

5.3 ESTIMATED MATERIAL REMOVAL QUANTITIES

The estimated quantity of soil/fill to be removed from the Site is approximately 21,535 cubic yards. The estimated quantity of soil to be imported into the Site for backfill and cover soil is undetermined at this time. None of the soil/fill excavated as part of the Remedial Action is anticipated to be reused/ relocated on Site.

5.4 Soil/Materials Management Plan

The following sections provide the Soil/Material Management Plan (SoMP) to be implemented during the Remedial Action, as necessary.

5.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by a qualified environmental professional or experienced field geologist under the direction of the Remedial Engineer during all remedial and development excavations into known or potentially contaminated material. Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the COC.

All primary contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. This information will be provided on maps in the Final Engineering Report.

Screening will be performed by qualified environmental professionals. Resumes will be provided for all personnel responsible for field screening (i.e. those representing the Remedial Engineer) of invasive work for unknown contaminant sources during remediation and development work.

5.4.2 Stockpile Methods

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

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

Soil stockpiles, if any, will be continuously encircled with silt fences. Hay bales will be used as needed near catch basins, surface waters and other discharge points.

Water will be available on-site at suitable supply and pressure for use in dust control.

5.4.3 Materials Excavation and Load Out

The Remedial Engineer or a qualified environmental professional under his/her supervision 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.

The presence of utilities and easements on the Site has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this RI/RAWP is posed by utilities or easements on the Site.

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

Vehicles leaving the Site will not be overloaded. The Remedial Engineer's representative will make reasonable efforts to ensure that vehicles are not loaded beyond their NYSDOT weight rating and that all material is secured beneath the truck bed cover.

A truck wash will be operated on-Site. The Remedial Engineer will be responsible for ensuring that all outbound trucks will be washed at the truck wash before leaving the Site until the remedial construction is complete.

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

The Remedial Engineer will be responsible for ensuring that all egress points for truck and equipment transport from the Site will be clean of dirt and other materials derived from the Site during Site remediation and development. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site -derived materials.

The Volunteer and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The Remedial Engineer will ensure that Site development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this Remedial Action Work Plan.

Each hotspot, and structure to be remediated (USTs, vaults and associated piping, transformers, etc.) will be removed and end-point remedial performance sampling completed before excavations related to Site development commence proximal to the hotspot or structure.

Development-related grading cuts and fills will not be performed without NYSDEC approval and will not interfere with, or otherwise impair or compromise, the performance of remediation required by this plan.

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

All primary contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. The survey information will be shown on maps to be reported in the Final Engineering Report.

5.4.4 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.

Truck transport routes are as described in Section 4.2.6. All trucks loaded with Site materials will exit the vicinity of the Site using only these approved truck routes.

Proposed in-bound and out-bound truck routes to the Site are shown in **Figure 9**. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off- Site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

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

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

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

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.

All trucks will be washed prior to leaving the Site. Truck wash waters will be collected and disposed of off-Site in an appropriate manner.

5.4.5 Materials Disposal Off-Site

The disposal locations have not yet been determined. Disposal location established at a later date will be reported to the NYSDEC Project Manager.

The total quantity of material expected to be disposed off-Site is estimated to be approximately 21,535 cubic yards.

All soil/fill/solid waste excavated and removed from the Site will be treated as contaminated and regulated material and will be disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e. clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC's Project Manager. Unregulated off-Site management of materials from this Site is prohibited without formal NYSDEC approval.

Material that does not meet Track 1 Unrestricted Use SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the Remedial Engineer for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the Remedial Engineer or BCP Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter 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 Remedial Engineer. 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 FER.

Non-hazardous historic fill and contaminated soils taken off-Site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2

Historical fill and contaminated soils from the Site are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from the Site are considered by the Division of Materials Management (DMM) in NYSDEC to be Construction and Demolition (C/D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C/D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DMM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DMM, special procedures will include, at a minimum, a letter to the C/D facility that provides a detailed explanation that the material is derived from a DER remediation Site, that the soil material is contaminated and that it must not be redirected to on-Site or off-Site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported.

The Final Engineering Report will include an accounting of the destination of all material removed from the Site during this Remedial Action, including excavated soil, contaminated soil, historic fill, solid waste, and hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will also be presented in a tabular form in the FER.

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 Final Engineering Report.

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

Appropriately licensed haulers will be used for material removed from this Site and will be in full 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. Sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the FER. 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.

5.4.6 Materials Reuse On-Site

Although not planned, on-site soil may be reused for backfill. In the event this occurs, chemical criteria for on-Site reuse of material has been approved by NYSDEC. This criteria is listed in **Table 19**. The Remedial Engineer will ensure that procedures defined for materials reuse in this RIR/RAWP are followed and that unacceptable material will not remain on-Site.

Concrete crushing or processing on-Site is prohibited.

Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site is prohibited for reuse on-Site.

Contaminated on-Site material, including historic fill and contaminated soil, removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. This will be expressed in the final Site Management Plan.

5.4.7 Fluids Management

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Liquids discharged into the New York City sewer system will be addressed through approval by NYCDEP.

Dewatered fluids will not be recharged back to the land surface or subsurface of the Site. Dewatering fluids will be managed off-Site.

Discharge of water generated during remedial construction to surface waters (i.e. a local pond, stream or river) is prohibited without a SPDES permit.

5.4.8 Demarcation

Residual contaminated soil is not expected to be present after completion of excavation. In the event that residual contamination is remaining, after the completion of soil removal and any other invasive remedial activities and prior to backfilling, a land survey will be performed by a New York State licensed surveyor. This survey will define the top of the 'Residuals Management Zone', the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the Site Management Plan. The survey will measure the grade covered by the demarcation layer before the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer placed on this grade surface will constitute the physical and written record of the upper surface of the 'Residuals Management Zone' in the Site Management Plan. A map showing the survey results will be included in the Final Engineering Report and the Site Management Plan.

5.4.9 Backfill from Off-Site Sources

All materials proposed for import onto the Site will be approved by the Remedial Engineer and will be in compliance with provisions in this RIR/RAWP prior to receipt at the Site.

Material from industrial sites, spill sites, other environmental remediation sites or other potentially contaminated sites will not be imported to the Site without prior NYSDEC approval.

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all import of soils from off-Site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the RIR/RAWP".

All imported soils will meet NYSDEC approved backfill or cover soil quality objectives for this Site. These NYSDEC approved backfill or cover soil quality objectives are the lower of

the protection of groundwater or the protection of public health soil cleanup objectives for Track 1 Unrestricted Use as set forth in Table 375-6.8(b) of 6 NYCRR Part 375 and listed in **Table 19**. Non-compliant soils will not be imported onto the Site without prior approval by NYSDEC. Nothing in the approved Remedial Action Work Plan or its approval by NYSDEC should be construed as an approval for this purpose.

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Nothing in this Remedial Action Work Plan should be construed as an approval for this purpose.

Solid waste will not be imported onto the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers.

5.4.10 Stormwater Pollution Prevention

Barriers and hay bale checks will be installed and inspected once a week and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by NYSDEC. All necessary repairs shall be made immediately.

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

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

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

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

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

5.4.11 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-Site remedial excavation or development related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs). These analyses will not be limited to CP-51 Table 2 and 3 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.

5.4.12 Community Air Monitoring Plan

The CAMP is included in the HASP in **Appendix I**. Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

5.4.13 Odor, Dust and Nuisance Control Plan

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan."

5.4.13.1 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-Site. Specific odor control methods to be used on a routine basis will include limiting open excavation areas and covering excavated soil. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors

have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer's Remedial Engineer, who is responsible for certifying the Final Engineering Report.

All necessary means will be employed to prevent on- and off-Site 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) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-Site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-Site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

5.4.13.2 Dust Control Plan

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

- Water will be available on-site at suitable supply and pressure for use in dust control.
- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-Site roads will be limited in total area to minimize the area required for water spraying.

5.4.13.3 Other Nuisances

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

A plan will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to NYCDEP noise control standards.

6.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

The selected Track 1 remedial alternative is designed to reduce the concentrations of Site contaminants to through soil excavation. If the remedial action is unsuccessful (i.e. soil above the Unrestricted Use SCOs remains on-Site or soil vapor mitigation still requires the use of the active SSDS), then ECs and ICs would be required to protect human health and the environment under a Track 2 Contingency. These ECs and ICs are described hereafter as a contingency. Long-term management of EC/ICs and of residual contamination will be executed under a Site-specific SMP that will be developed and included in the FER. The SMP will include a program to monitor and evaluate the need for an operational SSDS after short-term operation.

ECs will be implemented to protect public health and the environment by appropriately managing residual contamination. The Controlled Property (the Site) will have one primary EC system: operation of an active SSDS including a vapor barrier as a component of this system. The vapor barrier will be a sealing methodology used to seal the foundation slab as required in the DOH Guidance document and then the SSDS will be installed.

The FER will report residual contamination on the Site in tabular and map form. This will include presentation of any exceedances that remain on the Site.

7.0 ENGINEERING CONTROLS

Engineering Controls (ECs) will be employed to address any potential residual contamination remaining at the Site. The one primary EC System that may be used at the Site is a Sub-slab depressurization system (SSDS) including a vapor barrier as a component of this system. The vapor barrier will be a sealing methodology used to seal the foundation slab as required in the DOH Guidance document and then the SSDS will be installed.

The FER will include photographs (maximum of two photos per page) of the installation, manufacturer's information on the products installed, and as-built plans showing all components of the ECs. Maintenance of the engineering controls installed as part of this remedy will be described in the SMP in the FER.

7.1 SSDS

Installation of an active SSDS under the building foundations slab, including a vapor barrier system to prevent the potential migration of vapors into the building.

The sub-slab vapor barrier will be a minimum 20-mil vapor barrier made of polyolefin and barrier resins that is ASTM E 1745 Class A, B, and C compliant, resistant to puncturing and has high tensile strength. The permeance of the vapor barrier will be compliant with ASTM E 154 Sections 8, 11, 12, and 13. The vapor barrier will not deteriorate, decompose, or degrade below concrete slabs when buried and has an indefinite life expectancy. The proposed vapor barrier for under slab applications is Grace Preprufe® 300R or approved equal. The vapor barrier system will also be installed for the subgrade walls according to manufacturer specifications and depending on foundation construction methods. The proposed vapor barrier for vertical application is Grace Preprufe® 160R, Grace Bituthene® or approved equal. Manufacturer's specifications are provided as **Appendix M**. All vapor barriers will be installed in accordance with Manufacturer's recommendations including, but not limited to, recommended overlapping distance, tape seam installation, tape seam products, subbase layer preparation, and material. Appropriate subbase layer will include sand, pea gravel, or mud-slab concrete to prevent punctures during installation.

The SSDS will include a network of trenches (i.e., branches) of 4" perforated polyvinyl chloride (PVC) piping within 2-foot wide gravel bedding trenches wrapped in filter fabric. The sub-slab piping network will be installed under the building slab that will be connected to a regenerative blower on the roof via a 6" steel building ventilation exhaust louver pipe which will contain a 6" steel discharge stack. The regenerative blower will have a low vacuum switch, knock-out tank with high level alarm, and an in-line air filter on the inlet. A warning light will be provided for the building and will be located to allow for the notification of the building superintendent if the blower is not operating. Two sub-slab monitoring points will be installed within the cellar at the approximate locations noted on Drawing 1 in **Appendix N** to monitor the effectiveness of the SSDS on a periodic basis. The SSDS will be incorporated into the design the new building and will be installed during construction. Modifications may be made to the SSDS layouts when the new building design is finalized, or as needed based on field conditions. Start up and system

performance verification procedures will be completed and described in the RAR and FER. Upon installation and start up, the need for treatment of effluent vapors will be evaluated.

The proposed SSDS layout and blower specifications are included as **Appendix N**.

8.0 CRITERIA FOR COMPLETION OF REMEDIATION/TERMINATION OF REMEDIAL SYSTEMS

8.1 Groundwater Monitoring

The source of CVOCs in groundwater at low levels above AWQSGVs is suspected to be offsite, based on data collected during the RIR. Groundwater monitoring activities will occur, as determined by NYSDOH and NYSDEC, until residual groundwater concentrations are found to be below NYSDEC standards or have become asymptotic over an extended period. Monitoring will continue until permission to discontinue is granted in writing by NYSDEC and NYSDOH. Monitoring activities will be outlined in the Monitoring Plan of the SMP. It is anticipated that, following remediation, a minimum of eight (8) quarterly monitoring events will be performed.

8.2 Sub-Slab Depressurization System

The components of the SSDS are described in Section 7.0 and a drawing showing the layout and details of the system are provided in **Appendix N**. The active SSDS will not be discontinued without written approval by NYSDEC and NYSDOH. A proposal to discontinue the active SSDS may be submitted by the property owner based on confirmatory data that justifies such request. Systems will remain in place and operational until permission to discontinue use is granted in writing by NYSDEC and NYSDOH.

8.2.1 Startup Performance Monitoring and Routine Operation and Maintenance

8.2.1.1 Startup Performance Monitoring

Performance monitoring will be performed as part of the initial SSDS system startup to verify that each system is operating properly and will consist of the following:

- Confirmation of operation of alarm warning light;

- Collection of vacuum measurements from soil vapor monitoring points and non-operating suction points;
- Collection of PID readings; and
- Collection of confirmation effluent air sampling.

Vacuum measurements will be collected from the soil vapor monitoring points shown on Drawing 1 in **Appendix N** and non-operating suction points (when testing the system during startup some suction points will be turned off to evaluate vacuum response). The vacuum measurements will be collected using a micro-manometer capable of monitoring a minimum of 0.001 inches of water column. If adequate depressurization (e.g., vacuum influence) is not occurring, the cause for the lack of depressurization will be investigated and repaired, and measurements will be collected again.

The performance monitoring of the SSDS will also include monitoring the system effluent VOC concentrations using a PID. In addition, during start-up of the SSDS system, an effluent air sample will be collected from the discharge of each system using a Summa canister and analyzed for VOCs via USEPA TO-15 to determine if vapor treatment would be needed. If the sample results indicate that treatment is required, appropriate treatment options will be evaluated and installed.

8.2.1.2 Routine Operation and Maintenance Procedures

As part of routine SSDS operation, each system will be inspected on a monthly basis (at a minimum) to evaluate if it is operating properly and generating vacuum below the building. The routine system maintenance will be performed in accordance with the manufacturer's requirements as provided in the equipment manuals. The system components to be monitored include, but are not limited to, all accessible piping, blower , exhaust port, air filters, and carbon units, if needed. Vacuum will be checked at the monitoring points. The system will also be inspected to identify if condensate is accumulating in the moisture separator. If condensate is present, it will be removed and the quantity recovered will be recorded.

Full details regarding operation, maintenance and reporting for the SSDS will be included in the SMP.

All as-built drawings, diagrams, calculation and manufacturer documentation for the SSDS will be presented in the FER.

8.2.2 Contingency Requirements and Procedures for SSDS Shutdown

As discussed in Section 3.1.3, the SMP and Environmental Easement will be evaluated within five years to determine if long-term operation of the SSDS is necessary. A baseline indoor air sample will be collected when the cellar construction is complete and is fully enclosed. The initial sample is intended to establish a baseline interior air quality and will be deliberately collected before any building equipment is introduced/operating within the area or any item storage takes place.

Within five years of the issuance of the certification of completion, a soil vapor intrusion (SVI) investigation will take place to determine whether the SSDS is to remain operational long-term. Indoor air quality samples and an outdoor ambient sample will be collected concurrent with the sub-slab soil vapor samples in accordance with procedures specified by the NYSDOH guidance. Sub-slab soil vapor samples will be collected using the sub-slab soil vapor monitoring points installed as part of the SSDS. Samples will be collected for a duration of 8 hours using a six-liter, lab-certified-clean summa canister fitted with a flow controller and analyzed for VOCs via USEPA method TO-15.

For each SVI sampling "round", samples will be collected while the SSDS is operational as well as when it is temporarily shut down to assess air quality conditions inside the building. During each sampling round, upon completion of sampling while the SSDS is operational the SSDS will then be temporarily shut down and additional samples will be collected no less than 24 hours and within 72 hours of system shutdown. The SSDS will be turned on immediately following the completion of SVI sampling. Subsurface soil vapor and indoor air samples will be analyzed against the NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, October 2006 (matrices were updated in May 2017). In accordance with the NYSDOH

guidance, it is expected that a minimum of two sampling rounds will be collected during the heating season.

The SSDS will remain operational until NYSDEC issues a written notice that permanent SSDS shutdown is approved. Any additional post-shutdown monitoring requirements will be discussed with NYSDEC during the decision-making process.

9.0 CONTINGENCY PLAN INSTITUTIONAL CONTROLS

After the remedy is complete, the Remedial Site will have residual contamination remaining in place. Short-term Engineering Controls (ECs) for the residual contamination have been incorporated into the remedy to render the overall Site remedy protective of public health and the environment. Two elements have been designed to ensure continual and proper management of residual contamination in perpetuity: an Environmental Easement and a Site Management Plan.

All as-built drawings, diagrams, calculation and manufacturer documentation for treatment systems will be presented in the FER. A Site -specific Environmental Easement will be recorded with New York City to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Environmental Easement and the grantor's successors and assigns adhere to all Engineering and Institutional Controls (ECs/ICs) placed on this Site by this NYSDEC-approved remedy. ICs provide restrictions on Site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Environmental Easement. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Environmental Easement and grantor's successors and assigns.

9.1 ENVIRONMENTAL EASEMENT

An Environmental Easement, as defined in Article 71 Title 36 of the Environmental Conservation Law, is required when residual contamination is left on-Site after the Remedial Action is complete. As part of this remedy, an Environmental Easement approved by NYSDEC

will be filed and recorded with the New York City Office of the City Register. The Environmental Easement will be submitted as part of the Final Engineering Report.

The Environmental Easement will render the Remedial Area of the Site a Controlled Property as defined by a survey and metes and bonds description. The Environmental Easement must be recorded with the New York City Office of the City Register before the Certificate of Completion can be issued by NYSDEC. A series of Institutional Controls are required under this remedy to implement, maintain and monitor these Engineering Control systems, prevent future exposure to residual contamination by controlling disturbances to the vapor barrier system or SSDS. These Institutional Controls are requirements or restrictions placed on the Site that are listed in, and required by, the Environmental Easement. Institutional Controls can, generally, be subdivided between controls that support Engineering Controls, and those that place general restrictions on Site usage or other requirements. Institutional Controls in both of these groups are closely integrated with the Site Management Plan, which provides all of the methods and procedures to be followed to comply with this remedy.

The Institutional Controls that support Engineering Controls are:

- Compliance with the Environmental Easement by the Grantee and the Grantee's successors and adherence of all elements of the SMP is required;
- All Engineering Controls must be operated and maintained as specified in this SMP;
- All Engineering Controls on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- Data and information pertinent to Site Management for the Controlled Property must be reported at the frequency and in a manner defined in the SMP;
- On-Site environmental monitoring devices, including but not limited to, groundwater monitor wells, and probes for assessing SSDS vacuum generation must be protected and replaced as necessary to ensure proper functioning in the manner specified in the SMP; and
- Engineering Controls may not be discontinued without an amendment or extinguishment of the Environmental Easement.

Adherence to these Institutional Controls for the Site is mandated by the Environmental Easement and will be implemented under the Site Management Plan (discussed in the next section). The Controlled Property (Site) will also have a series of Institutional Controls in the

form of Site restrictions and requirements. The Site restrictions that apply to the Controlled Property are:

- Vegetable gardens and farming on the Controlled Property are prohibited;
- Use of groundwater underlying the Controlled Property is prohibited without treatment rendering it safe for intended purpose;
- All future activities on the Controlled Property that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the Site Management Plan;
- The Conditional Track 1/ Track 2 Remedial Area, as defined by the final easement survey, of the Controlled Property may be used for Restricted Residential use only, provided the long-term Engineering and Institutional Controls included in the Site Management Plan are employed;
- The Conditional Track 1/ Track 2 Remedial Area, as defined by the final easement survey, of the Controlled Property may not be used for a higher level of use, such as unrestricted use without an amendment or extinguishment of this Environmental Easement; and
- Grantor agrees to submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow. This statement must be certified by an expert that the NYSDEC finds acceptable.

9.2 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation and begins with the approval of the Final Engineering Report and issuance of the Certificate of Completion (COC) for the Remedial Action. The Site Management Plan is submitted as part of the FER for any Controlled Property on the Site but will be written in a manner that allows its removal and use as a complete and independent document. Site Management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the Environmental Easement and the Site Management Plan are performed on the Controlled Property.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the Site following completion of the Remedial Action in

accordance with the BCA with the NYSDEC. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls; (2) development and implementation of monitoring systems and a Monitoring Plan; (3) development of a plan to operate and maintain any treatment, collection, containment, or recovery systems (including, where appropriate, preparation of an Operation and Maintenance Manual); (4) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of Site information to NYSDEC; and (5) defining criteria for termination of treatment system operation.

To address these needs, this SMP will include four plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; (3) an Operation and Maintenance Plan for implementation of remedial collection, containment, treatment, and recovery systems; and (4) a Site Management Reporting Plan for submittal of data, information, recommendations, and certifications to NYSDEC. The SMP will be prepared in accordance with the requirements in NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation and the guidelines provided by NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annually, unless otherwise approved or modified by NYSDEC. The Periodic Review Report (PRR) will be based on a calendar year and will be due for submission to NYSDEC by March 1 of the year following the reporting period.

The Site Management Plan in the Final Engineering Report will include a monitoring plan for groundwater at the down-gradient Site perimeter to evaluate Site -wide performance of the remedy.

No exclusions for handling of residual contaminated soils will be provided in the Site Management Plan (SMP). All handling of residual contaminated material will be subject to provisions contained in the SMP.

10.0 FINAL ENGINEERING REPORT

A Final Engineering Report (FER) will be submitted to NYSDEC following implementation of the Remedial Action defined in this RIR/RAWP. The FER provides the documentation that the remedial work required under this RIR/RAWP has been completed and has been performed in compliance with this plan. The FER will provide a comprehensive account of the locations and characteristics of all material removed from the Site including the surveyed map(s) of all sources. The Final Engineering Report will include as-built drawings for all constructed elements, calculation and manufacturer documentation for treatment systems, certifications, manifests, bills of lading as well as the complete Site Management Plan (formerly the Operation and Maintenance Plan). The FER will provide a description of the changes in the Remedial Action from the elements provided in the RIR/RAWP and associated design documents. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10.

Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance and monitoring tasks defined in the Site Management Plan and Environmental Easement. This determination will be made by NYSDEC in the context of the Final Engineering Report review.

The Final Engineering Report will include written and photographic documentation of all remedial work performed under this remedy.

The FER will include an itemized tabular description of actual costs incurred during all aspects of the Remedial Action.

The FER will provide a thorough summary of all residual contamination left on the Controlled Property on the Site after the remedy is complete. Residual contamination includes all contamination that exceeds the Track 1 Unrestricted Use SCO in 6 NYCRR Part 375-6. A table that shows exceedances from Track 1 Unrestricted SCOs for all soil/fill remaining at the Site after

the Remedial Action and a map that shows the location and summarizes exceedances from Track 1 Unrestricted SCOs for all soil/fill remaining at the Site after the Remedial Action will be included in the FER.

The FER will provide a thorough summary of all residual contamination that exceeds the SCOs defined for the Site in the RIR/RAWP and must provide an explanation for why the material was not removed as part of the Remedial Action. A table that shows residual contamination in excess of Site SCOs and a map that shows residual contamination in excess of Site SCOs will be included in the FER.

The Final Engineering Report will include an accounting of the destination of all material removed from the Site, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto the Site.

Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital form on electronic media (PDF).

10.1 CERTIFICATIONS

The following certification will appear in front of the Executive Summary of the Final Engineering Report. The certification will be signed by the Remedial Engineer, Brian Morrissey, who is a Professional Engineer registered in New York State. This certification will be appropriately signed and stamped. The certification will include the following statements:

I, Brian Morrissey, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the Chestnut Commons Atlantic Avenue Site (NYSDEC BCA Index No. C224276-08-29 Site No. C224276).

I certify that the Site description presented in this FER is identical to the Site descriptions presented in the Environmental Easement, the Site Management Plan, and the Brownfield Cleanup Agreement for the Chestnut Commons Atlantic Avenue Site and related amendments.

I certify that the Remedial Action Work Plan dated [month day year] and Stipulations [if any] in a letter dated [month day year] and approved by the NYSDEC were implemented and that all requirements in those documents have been substantively complied with.

I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and all operation and maintenance requirements applicable to the Site are contained in an Environmental Easement created and recorded pursuant ECL 71-3605 and that all affected local governments, as defined in ECL 71-3603, have been notified that such easement has been recorded. A Site Management Plan has been submitted by the Volunteer for the continual and proper operation, maintenance, and monitoring of all Engineering Controls employed at the Site, including the proper maintenance of all remaining monitoring wells, and that such plan has been approved by the NYSDEC.

I certify that the export of all contaminated soil, fill, water or other material from the property was performed in accordance with the Remedial Action Work Plan, and were taken to facilities licensed to accept this material in full compliance with all Federal, State and local laws.

I certify that all import of soils from off-Site, including source approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan.

I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology and soil screening methodology defined in the Remedial Action Work Plan.

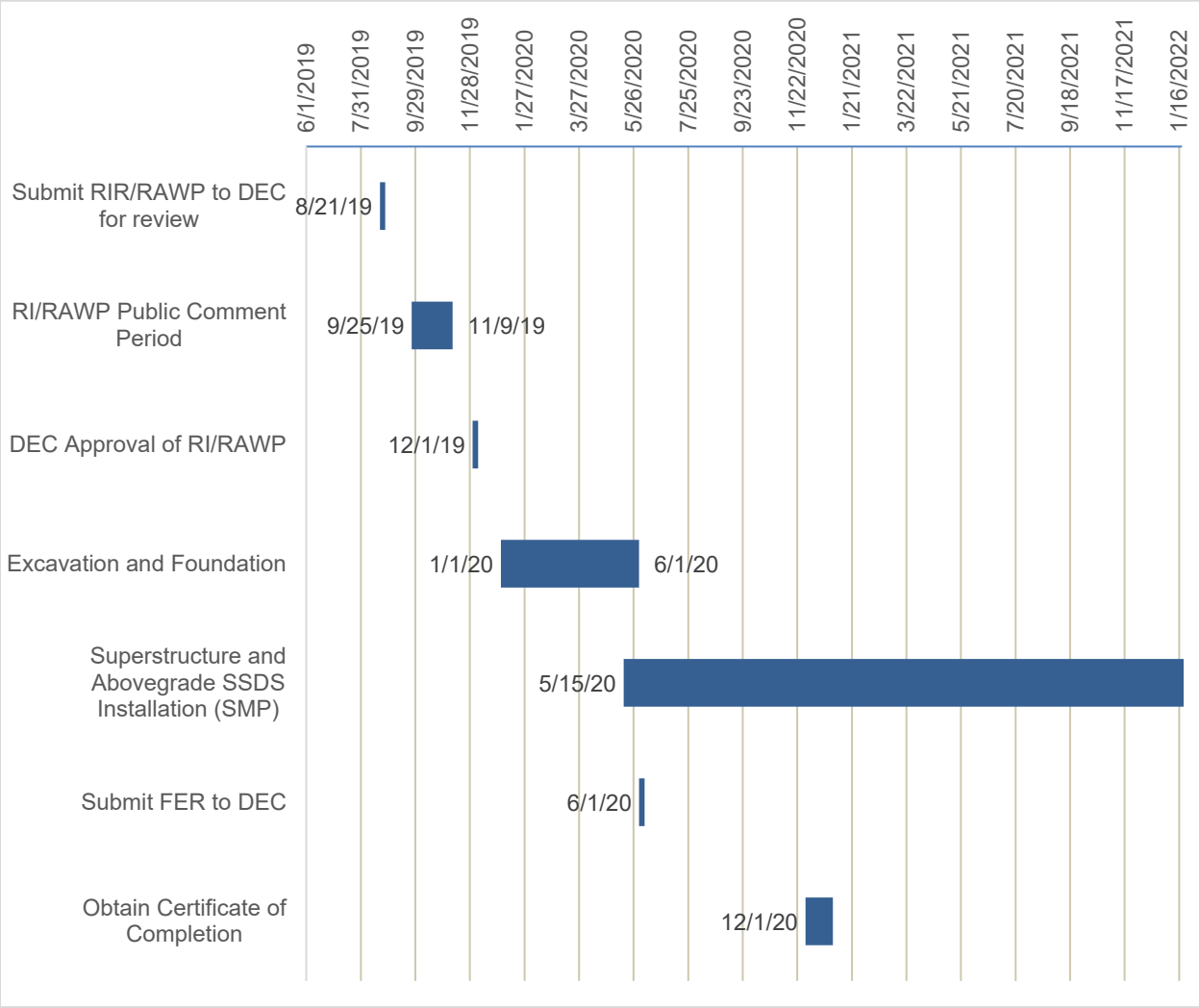
I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law.

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York

State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

11.0 SCHEDULE

A proposed schedule of Remedial Actions is presented below.



TABLES

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Notes Utilized Throughout Tables	
Soil Tables	
J -	Estimated value
U -	Indicates that the compound was analyzed for but not detected
B -	The analyte was found in an associated blank as well as in the sample
T -	Indicates that a quality control parameter has exceeded laboratory limits
ft bls -	Feet below land surface
FD -	Duplicate sample
mg/kg -	Milligrams per kilogram
NYSDEC -	New York State Department of Environmental Conservation
SCO -	Soil Cleanup Objectives
--	No SCO available
Bold data indicates that parameter was detected above the NYSDEC Part 375 Unrestricted Use SCO	
Shaded data indicates that parameter was detected above the NYSDEC Part 375 Restricted Residential SCO	
Groundwater Tables	
J -	Estimated Value
U -	Compound was analyzed for but not detected
T -	Indicates that a quality control parameter has exceeded laboratory limits
P -	The RPD between the results for the two columns exceeds the method-specified criteria
N -	Spiked sample recovery was not within control limits
FD -	Duplicate sample
µg/L -	Micrograms per liter
ng/L -	Nanograms per liter
NYSDEC -	New York State Department of Environmental Conservation
AWQSGVs -	Ambient Water-Quality Standards and Guidance Values
--	No NYSDEC AWQSGV available
NA -	Compound was not analyzed for by laboratory
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs	
Soil Vapor/Ambient Air	
J -	Estimated value
E -	Indicates value exceeded calibration range
T -	Indicates that a quality control parameter has exceeded laboratory limits
U -	Indicates that the compound was analyzed for but not detected
FD -	Duplicate sample
$\mu g/m^3$ -	Micrograms per cubic meter
Bold data indicates that parameter was detected	

Table 1. Summary of Monitoring Well Construction,
Chestnut Commons Apartments LLC, Chesnut Commons Atlantic Ave Site, Brooklyn, New York

Well Identification	Date(s) Installed	Land Surface Elevation (ft relative to 1988 NAVD mean sea level)	Measuring point Elevation (ft relative to 1988 NAVD mean sea level)	Screen Type	Diameter (inches)	Screen Slot Size (inches)	Depth of Boring (ft bls)	Screened Interval (ft bls)	Interval Gravel Packed (ft bls)	Interval Sealed with Bentonite (ft bls)	Screen Setting (ft NAVD88)	Screen Interval
MW-4	4/17/2019	36.51	38.33	PVC	2	0.020	30	20 - 30	1 - 21	21 - 23	13	Water Table
MW-5	4/19/2019	37.98	39.56	PVC	2	0.020	35	25 - 35	1 - 21	21 - 23	15	Water Table
MW-6	4/18/2019	40.64	42.78	PVC	2	0.020	40	30 - 40	1 - 26	26 - 28	13	Water Table
MW-7	4/16/2019	38.73	42.12	PVC	2	0.020	35	25 - 35	1 - 23	23 - 25	17	Water Table
MW-8	4/16/2019	39.40	40.93	PVC	2	0.020	35	25 - 35	1 - 21	21 - 23	16	Water Table

NAVD - North American Vertical Datum
PVC - Polyvinyl chloride schedule 40

Table 2. Summary of Water Level Measurements,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Monitoring Well Identification	Measurement Date	Measuring Point Elevation (ft NAVD 88)	Depth to Water (ft below measuring point)	Water Level Elevation (ft NAVD 88)
MW-4	4/19/2019	38.33	28.65	9.68
MW-5	4/19/2019	39.56	29.89	9.67
MW-6	4/19/2019	42.78	33.35	9.43
MW-7	4/19/2019	42.12	32.61	9.51
MW-8	4/19/2019	40.93	31.41	9.52

Notes:

ft - Feet

NAVD 1988 - North American Vertical Datum of 1988

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
MW-4	(0-2)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-4	(26-28)	Soil	4/17/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-5	(0-2)	Soil	4/16/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-5	(28-30)	Soil	4/16/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-6	(0-2)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
MW-6	(30-32)	Soil	4/18/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-7	(0-2)	Soil	4/16/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-7	(30-32)	Soil	4/16/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-8	(0-2)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
MW-8	(30-32)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
RX-15	(0-2)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
RX-15	(24-26)	Soil	4/17/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
RX-16	(0-2)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
RX-16	(30-32)	Soil	4/15/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-1	(0-6)	Soil	4/18/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-1	(6-12)	Soil	4/18/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-1	(12-18)	Soil	4/18/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-1	(18-20)	Soil	4/18/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-2	(0-6)	Soil	4/18/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-2	(6-12)	Soil	4/18/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed, GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-2	(12-18)	Soil	4/18/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-2	(18-20)	Soil	4/18/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-3	(0-6)	Soil	4/17/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-3	(6-12)	Soil	4/17/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-3	(12-18)	Soil	4/17/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-3	(18-20)	Soil	4/17/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-4	(0-6)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-4	(6-12)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-4	(12-18)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-4	(18-20)	Soil	4/19/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed, GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-5	(0-6)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-5	(6-12)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-5	(12-18)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-5	(18-20)	Soil	4/19/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-6	(0-6)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-6	(6-12)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-6	(12-18)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-6	(18-20)	Soil	4/19/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-7	(0-6)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-7	(6-12)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed,
GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-7	(12-18)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-7	(18-20)	Soil	4/19/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.
WC-8	(0-6)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-8	(6-12)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.
WC-8	(12-18)	Soil	4/19/2019	TCL VOC, TCL BNA/SVOCs, TCL Pesticides, TCL Herbicides, TCL PCBs, TAL Metals (including trivalent and hexavalent chromium), Total Cyanide, Extractable Petroleum Hydrocarbons (EPH), Resource Conservation and Recovery Act (RCRA) Characteristics (reactivity, ignitability, and corrosivity), Paint Filter, and Toxicity Characteristic Leaching Procedure (TCLP) Metals.

Table 3. Summary of Soil, Groundwater, and Soil Vapor Sampling Performed, GO HPS LLC, Hunter's Point South - Parcel F, Queens, New York

Sample ID	Depth (ft bls)-soil only	Sample Matrix	Sample Date	Analyte(s)
WC-8	(18-20)	Soil	4/19/2019	TCL VOC + 10 Tentatively identified compounds (TICs), TCL Base neutral acids (BNA)/SVOCs + 20 TICs, TCL Pesticides, TCL Herbicides, TCL PCBs, Target Analyte List (TAL) Metals (including hexavalent chromium), and Total Cyanide.

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation:	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1
					Sample Date:	04/15/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018
					Sample Depth (ft bls):	0 - 2	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3
					Normal or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,1,2,2-Tetrachloroethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 UJ	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,1,2-Trichloroethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,1-Dichloroethane	0.27	26	0.27	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,1-Dichloroethene	0.33	100	0.33	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,2,3-Trichlorobenzene	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 UT	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,2,4-Trichlorobenzene	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 UT	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,2,4-Trimethylbenzene	3.6	52	3.6	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	NA	NA
1,2-Dibromo-3-Chloropropane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 UT
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,2-Dichlorobenzene	1.1	100	1.1	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,2-Dichloroethane	0.02	3.1	0.02	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,2-Dichloropropane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,3,5-Trimethylbenzene (Mesitylene)	8.4	52	8.4	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	NA	NA
1,3-Dichlorobenzene	2.4	49	2.4	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,4-Dichlorobenzene	1.8	13	1.8	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	mg/kg	0.027 U	0.024 U	0.022 U	0.025 U	0.024 U	0.022 U	0.036 U	0.028 U	0.047 U	0.031 U	0.023 U	0.019 U	0.024 U
2-Hexanone	--	--	--	mg/kg	0.0067 U	0.0061 U	0.0055 U	0.0061 U	0.0059 U	0.0056 U	0.009 U	0.007 U	0.012 U	0.0079 U	0.0059 U	0.0047 U	0.006 U
Acetone	**0.05**	100	0.05	mg/kg	0.0067 U	0.0068 U	0.035 U	0.0061 U	0.014	0.0056 U	0.023	**0.074**	0.012 U	0.0079 U	0.0092	0.0047 U	0.038
Benzene	**0.06**	4.8	0.06	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Bromochloromethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Bromodichloromethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Bromoform	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 UT
Bromomethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Carbon Disulfide	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.00058 J	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Carbon Tetrachloride	0.76	2.4	0.76	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 UT
Chlorobenzene	1.1	100	1.1	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Chloroethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Chloroform	0.37	49	0.37	mg/kg	0.0013 U	0.0012 U	0.00038 J	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Chloromethane	--	--	--	mg/kg	0.0013 UT	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 UT	0.0018 U	0.0014 U	0.0024 UJ	0.0016 UT	0.0012 UT	0.00095 U	0.0012 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00022 J	0.0012 U
Cis-1,3-Dichloropropene	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Cyclohexane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Dibromochloromethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 UT
Dichlorodifluoromethane	--	--	--	mg/kg	0.0013 UT	0.0012 U	0.0011 U	0.0012 UJ	0.0012 UJ	0.0011 UT	0.0018 U	0.0014 UJ	0.0024 UJ	0.0016 UT	0.0012 UT	0.00095 U	0.0012 U
Ethylbenzene	1	41	1	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Isopropylbenzene (Cumene)	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
m,p-Xylene	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Methyl Acetate	--	--	--	mg/kg	0.0067 U	0.0061 U	0.0055 U	0.0061 U	0.0059 U	0.0056 U	0.009 U	0.007 U	0.012 U	0.0079 U	0.0059 U	0.0047 U	0.006 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	mg/kg	0.0067 U	0.0061 U	0.0018 J	0.0061 U	0.0036 J	0.0056 U	0.009 U	0.012	0.012 U	0.0079 U	0.0014 J	0.0047 U	0.0051 J
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	mg/kg	0.0067 U	0.0061 U	0.0055 U	0.0061 U	0.0059 U	0.0056 U	0.009 U	0.007 U	0.012 U	0.0079 U	0.0059 U	0.0047 U	0.006 U
Methylcyclohexane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Methylene Chloride	0.05	100	0.05	mg/kg	0.0013 U	0.00061 J	0.0019	0.0012 U	0.0012 U	0.00092 J	0.00064 J	0.0014 U	0.0024 U	0.0016 U	0.00064 J	0.00095 U	0.0041 B
N-Butylbenzene	12	100	12	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 UT	0.0014 U	0.0024 UJ	0.0016 U	0.0012 U	NA	NA
N-Propylbenzene	3.9	100	3.9	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	NA	NA
O-Xylene (1,2-Dimethylbenzene)	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Sec-Butylbenzene	11	100	11	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 UJ	0.0014 U	0.0024 U	0.0016 U	0.0012 U	NA	NA
Styrene	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
T-Butylbenzene	5.9	100	5.9	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 UJ	0.0014 U	0.0024 U	0.0016 U	0.0012 U	NA	NA
Tert-Butyl Methyl Ether	0.93	100	0.93	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Tetrachloroethylene (PCE)	1.3	19	1.3	mg/kg	0.0013 U	0.00026 J	0.00038 J	0.0012 U	0.00054 J	0.00027 J	0.0018 U	0.0014 U	0.0015 J	0.0016 U	0.00045 J	0.0012	0.0012 U

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

			Sample Designation:		MW-4	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1
			Sample Date:		04/15/2019	04/17/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018
			Sample Depth (ft bls):		0 - 2	26 - 28	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3
			Normal or Field Duplicate:		N	N	FD	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit													
Toluene	**0.7**	100	0.7	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Trans-1,2-Dichloroethene	0.19	100	0.19	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Trans-1,3-Dichloropropene	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Trichloroethylene (TCE)	0.47	21	0.47	mg/kg	0.0013 U	0.0012 U	0.00064 J	0.0012 U	0.0012 U	0.00063 J	0.0036	0.0038	0.0085 J-	0.0016 U	0.005	0.00095 U	0.0012 U
Trichlorofluoromethane	--	--	--	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 U	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Vinyl Chloride	0.02	0.9	0.02	mg/kg	0.0013 U	0.0012 U	0.0011 U	0.0012 U	0.0012 U	0.0011 U	0.0018 U	0.0014 U	0.0024 UJ	0.0016 U	0.0012 U	0.00095 U	0.0012 U
Xylenes, Total	0.26	100	1.6	mg/kg	0.0027 U	0.0024 U	0.0022 U	0.0025 U	0.0024 U	0.00035 J	0.0036 U	0.0028 U	0.0047 U	0.00049 J	0.00034 J	NA	NA

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-1	RX-2	RX-3	RX-3	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7	RX-7	RX-9
Sample Date:					07/25/2018	02/27/2018	07/25/2018	07/25/2018	02/27/2018	07/24/2018	07/24/2018	07/25/2018	02/27/2018	07/25/2018	02/26/2018	02/26/2018	07/24/2018
Sample Depth (ft bls):					13 - 15	3 - 5	0 - 2	13 - 15	1 - 3	13 - 15	13 - 15	0 - 2	2 - 3.5	13 - 15	0.2 - 2.5	0.2 - 2.5	0 - 2
Normal or Field Duplicate:					N	N	N	N	N	N	FD	N	N	N	N	FD	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 UT	0.0011 UT	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 UT
1,1,2,2-Tetrachloroethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,1,2-Trichloroethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,1-Dichloroethane	0.27	26	0.27	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,1-Dichloroethene	0.33	100	0.33	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.00061 J	0.00038 J	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2,3-Trichlorobenzene	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2,4-Trichlorobenzene	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2,4-Trimethylbenzene	3.6	52	3.6	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,2-Dibromo-3-Chloropropane	--	--	--	mg/kg	0.0012 U	0.0015 UT	0.0011 U	0.0012 U	0.0011 UT	0.0012 U	0.0011 U	0.001 U	0.0011 UT	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2-Dichlorobenzene	1.1	100	1.1	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2-Dichloroethane	0.02	3.1	0.02	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,2-Dichloropropane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,3,5-Trimethylbenzene (Mesitylene)	8.4	52	8.4	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1,3-Dichlorobenzene	2.4	49	2.4	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,4-Dichlorobenzene	1.8	13	1.8	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	mg/kg	0.024 U	0.031 U	0.021 U	0.024 U	0.022 U	0.023 U	0.023 U	0.021 U	0.022 U	0.024 U	0.053 U	0.073 U	0.02 U
2-Hexanone	--	--	--	mg/kg	0.0059 U	0.0077 U	0.0053 U	0.006 U	0.0056 U	0.0058 U	0.0056 U	0.0052 U	0.0056 U	0.0059 U	0.013 U	0.018 U	0.005 U
Acetone	**0.05**	100	0.05	mg/kg	0.0059 U	0.011	0.0053 U	0.0057 J	0.0056 U	0.0058 U	0.0048 J	0.0052 U	0.0056 U	0.031	0.013 U	0.018 U	0.005 U
Benzene	**0.06**	4.8	0.06	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Bromochloromethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Bromodichloromethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Bromoform	--	--	--	mg/kg	0.0012 U	0.0015 UT	0.0011 U	0.0012 U	0.0011 UT	0.0012 UJ	0.0011 UJ	0.001 U	0.0011 UT	0.0012 U	0.0026 U	0.0037 U	0.001 UJ
Bromomethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Carbon Disulfide	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0028 J	0.001 U
Carbon Tetrachloride	0.76	2.4	0.76	mg/kg	0.0012 U	0.0015 UT	0.0011 U	0.0012 U	0.0011 UT	0.0012 U	0.0011 U	0.001 U	0.0011 UT	0.0012 U	0.0026 U	0.0037 U	0.001 U
Chlorobenzene	1.1	100	1.1	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Chloroethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Chloroform	0.37	49	0.37	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Chloromethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Cis-1,3-Dichloropropene	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Cyclohexane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Dibromochloromethane	--	--	--	mg/kg	0.0012 U	0.0015 UT	0.0011 U	0.0012 U	0.0011 UT	0.0012 U	0.0011 U	0.001 U	0.0011 UT	0.0012 U	0.0026 U	0.0037 U	0.001 U
Dichlorodifluoromethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Ethylbenzene	1	41	1	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Isopropylbenzene (Cumene)	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
m,p-Xylene	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Methyl Acetate	--	--	--	mg/kg	0.0059 U	0.0077 U	0.0053 U	0.006 U	0.0056 U	0.0058 U	0.0056 U	0.0052 U	0.0056 U	0.0059 U	0.013 U	0.018 U	0.005 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	mg/kg	0.0016 J	0.0077 U	0.0053 U	0.006 U	0.0056 U	0.0058 U	0.0056 U	0.0052 U	0.0056 U	0.0052 J	0.013 U	0.018 U	0.005 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	mg/kg	0.0059 U	0.0077 U	0.0053 U	0.006 U	0.0056 U	0.0058 U	0.0056 U	0.0052 U	0.0056 U	0.0059 U	0.013 U	0.018 U	0.005 U
Methylcyclohexane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Methylene Chloride	0.05	100	0.05	mg/kg	0.0012 U	0.0015 B	0.0011 U	0.0012 U	0.0046 B	0.0012 U	0.0011 U	0.001 U	0.0055 B	0.0012 U	0.0056 B	0.0047 B	0.001 U
N-Butylbenzene	12	100	12	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Propylbenzene	3.9	100	3.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
O-Xylene (1,2-Dimethylbenzene)	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Sec-Butylbenzene	11	100	11	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Styrene	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
T-Butylbenzene	5.9	100	5.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Tert-Butyl Methyl Ether	0.93	100	0.93	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Tetrachloroethylene (PCE)	1.3	19	1.3	mg/kg	0.0012 U	0.0016	0.0011 U	0.00045 J	0.0011 U	0.0012 U	0.0011 U	0.00019 J	0.0011 U	0.0025	0.027	0.041	0.001 U

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

			Sample Designation:		RX-1	RX-2	RX-3	RX-3	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7	RX-7	RX-9
			Sample Date:		07/25/2018	02/27/2018	07/25/2018	07/25/2018	02/27/2018	07/24/2018	07/24/2018	07/25/2018	02/27/2018	07/25/2018	02/26/2018	02/26/2018	07/24/2018
			Sample Depth (ft bls):		13 - 15	3 - 5	0 - 2	13 - 15	1 - 3	13 - 15	13 - 15	0 - 2	2 - 3.5	13 - 15	0.2 - 2.5	0.2 - 2.5	0 - 2
			Normal or Field Duplicate:		N	N	N	N	N	N	FD	N	N	N	N	FD	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit													
Toluene	**0.7**	100	0.7	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Trans-1,2-Dichloroethene	0.19	100	0.19	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Trans-1,3-Dichloropropene	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Trichloroethylene (TCE)	0.47	21	0.47	mg/kg	0.0012 U	0.00086 J	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.00023 J	0.0024 J	0.0031 J	0.001 U
Trichlorofluoromethane	--	--	--	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Vinyl Chloride	0.02	0.9	0.02	mg/kg	0.0012 U	0.0015 U	0.0011 U	0.0012 U	0.0011 U	0.0012 U	0.0011 U	0.001 U	0.0011 U	0.0012 U	0.0026 U	0.0037 U	0.001 U
Xylenes, Total	0.26	100	1.6	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-9 02/26/2018 2 - 4 N	RX-9 07/24/2018 3 - 5 N	RX-9 07/24/2018 13 - 15 N	RX-10 07/24/2018 0 - 2 N	RX-10 02/26/2018 2 - 4 N	RX-10 07/24/2018 13 - 15 N	RX-12 07/24/2018 0 - 2 N	RX-12 02/27/2018 1.5 - 3.5 N	RX-12 07/24/2018 13 - 15 N	RX-14 07/24/2018 13 - 15 N	RX-15 04/15/2019 0 - 2 N	RX-15 04/17/2019 24 - 26 N	RX-16 04/15/2019 0 - 2 N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	mg/kg	0.001 U	0.1 U	0.0012 UT	0.0017 U	0.0047 U	0.0012 U	0.001 UT	0.0011 U	0.0012 U	0.0012 UT	0.0017 U	0.0013 U	0.0013 U
1,1,2,2-Tetrachloroethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,1,2-Trichloroethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,1-Dichloroethane	0.27	26	0.27	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,1-Dichloroethene	0.33	100	0.33	mg/kg	0.001 U	0.1 U	0.00049 J	0.00069 J	0.0047 U	0.0012 U	0.00034 J	0.0011 U	0.0012 U	0.00066 J	0.0017 U	0.0013 U	0.0013 U
1,2,3-Trichlorobenzene	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 UJ	0.0013 U
1,2,4-Trichlorobenzene	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 UJ	0.0013 U
1,2,4-Trimethylbenzene	3.6	52	3.6	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0013 U	0.0013 U
1,2-Dibromo-3-Chloropropane	--	--	--	mg/kg	0.001 U	0.1 UT	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 UT	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,2-Dichlorobenzene	1.1	100	1.1	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 UJ	0.0013 U
1,2-Dichloroethane	0.02	3.1	0.02	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,2-Dichloropropane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,3,5-Trimethylbenzene (Mesitylene)	8.4	52	8.4	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0013 U	0.0013 U
1,3-Dichlorobenzene	2.4	49	2.4	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,4-Dichlorobenzene	1.8	13	1.8	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	mg/kg	0.021 U	5.2 U	0.024 U	0.034 U	0.093 U	0.023 U	0.02 U	0.023 U	0.024 U	0.023 U	0.034 U	0.027 U	0.026 U
2-Hexanone	--	--	--	mg/kg	0.0052 U	0.52 U	0.006 U	0.0085 U	0.023 U	0.0059 U	0.0051 U	0.0057 U	0.0059 U	0.0058 U	0.0085 U	0.0067 U	0.0064 U
Acetone	**0.05**	100	0.05	mg/kg	0.0044 J	0.52 U	0.006 U	0.0085 U	0.023 U	0.0051 J	0.0051 U	0.011	0.0063	0.0044 J	0.0085 U	0.0073 U	0.0064 U
Benzene	**0.06**	4.8	0.06	mg/kg	0.001 U	**4.2**	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Bromochloromethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Bromodichloromethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Bromoform	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 UJ	0.0017 U	0.0047 U	0.0012 U	0.001 UJ	0.0011 UT	0.0012 U	0.0012 UJ	0.0017 U	0.0013 U	0.0013 U
Bromomethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Carbon Disulfide	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0016 J	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Carbon Tetrachloride	0.76	2.4	0.76	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 UT	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Chlorobenzene	1.1	100	1.1	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Chloroethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Chloroform	0.37	49	0.37	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Chloromethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 UT	0.0013 U	0.0013 UT
Cis-1,2-Dichloroethylene	0.25	100	0.25	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Cis-1,3-Dichloropropene	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Cyclohexane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Dibromochloromethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 UT	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Dichlorodifluoromethane	--	--	--	mg/kg	0.001 UT	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 UT	0.0013 U	0.0013 UT
Ethylbenzene	1	41	1	mg/kg	0.001 U	0.51	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Isopropylbenzene (Cumene)	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
m,p-Xylene	--	--	--	mg/kg	0.001 U	0.95	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Methyl Acetate	--	--	--	mg/kg	0.0052 U	0.52 U	0.006 U	0.0085 U	0.023 U	0.0059 U	0.0051 U	0.0057 U	0.0059 U	0.0058 U	0.0085 U	0.0067 U	0.0064 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	mg/kg	0.0052 U	0.52 U	0.006 U	0.0085 U	0.023 U	0.0059 U	0.0051 U	0.0029 J	0.0059 U	0.0058 U	0.0085 U	0.0067 U	0.0064 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	mg/kg	0.0052 U	0.52 U	0.006 U	0.0085 U	0.023 U	0.0059 U	0.0051 U	0.0057 U	0.0059 U	0.0058 U	0.0085 U	0.0067 U	0.0064 U
Methylcyclohexane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Methylene Chloride	0.05	100	0.05	mg/kg	0.0023 B	0.1 U	0.0012 U	0.0017 U	0.011 B	0.0012 U	0.001 U	0.0028 B	0.0012 U	0.0012 U	0.00038 J	0.0023	0.0013 U
N-Butylbenzene	12	100	12	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0013 U	0.0013 U
N-Propylbenzene	3.9	100	3.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0013 U	0.0013 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	mg/kg	0.001 U	0.3	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.00012 J
Sec-Butylbenzene	11	100	11	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0013 U	0.0013 U
Styrene	--	--	--	mg/kg	0.001 U	0.023 J	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.00022 J	0.0012 U	0.0017 U	0.0013 U	0.0013 U
T-Butylbenzene	5.9	100	5.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0017 U	0.0013 UJ	0.0013 U
Tert-Butyl Methyl Ether	0.93	100	0.93	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Tetrachloroethylene (PCE)	1.3	19	1.3	mg/kg	0.00029 J	0.12	0.00056 J	0.0032	0.00094 J	0.0007 J	0.001 U	0.0011 U	0.0012 U	0.00021 J	0.0017 U	0.0013 U	0.0013 U

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

			Sample Designation:		RX-9	RX-9	RX-9	RX-10	RX-10	RX-10	RX-12	RX-12	RX-12	RX-14	RX-15	RX-15	RX-16
			Sample Date:		02/26/2018	07/24/2018	07/24/2018	07/24/2018	02/26/2018	07/24/2018	07/24/2018	02/27/2018	07/24/2018	07/24/2018	04/15/2019	04/17/2019	04/15/2019
			Sample Depth (ft bls):		2 - 4	3 - 5	13 - 15	0 - 2	2 - 4	13 - 15	0 - 2	1.5 - 3.5	13 - 15	13 - 15	0 - 2	24 - 26	0 - 2
			Normal or Field Duplicate:		N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit													
Toluene	**0.7**	100	0.7	mg/kg	0.001 U	**2.7**	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Trans-1,2-Dichloroethene	0.19	100	0.19	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Trans-1,3-Dichloropropene	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Trichloroethylene (TCE)	0.47	21	0.47	mg/kg	0.001 U	0.1 U	0.0012 U	0.0034	0.0091	0.0012 U	0.001 U	0.0011 U	0.00027 J	0.0012 U	0.0017 U	0.0013 U	0.00071 J
Trichlorofluoromethane	--	--	--	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Vinyl Chloride	0.02	0.9	0.02	mg/kg	0.001 U	0.1 U	0.0012 U	0.0017 U	0.0047 U	0.0012 U	0.001 U	0.0011 U	0.0012 U	0.0012 U	0.0017 U	0.0013 U	0.0013 U
Xylenes, Total	0.26	100	1.6	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0034 U	0.0027 U	0.00054 J

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6	WC-7	WC-8
Sample Designation:					RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6	WC-7	WC-8
Sample Date:					04/15/2019	04/18/2019	04/18/2019	04/17/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019
Sample Depth (ft bls):					30 - 32	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
Normal or Field Duplicate:					N	N	N	N	N	N	N	N	N
1,1,1-Trichloroethane (TCA)	0.68	100	0.68	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,1,2,2-Tetrachloroethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,1,2-Trichloroethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,1-Dichloroethane	0.27	26	0.27	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 UT	0.0019 UT	0.0013 UT	0.0014 UT	0.0013 UT
1,1-Dichloroethene	0.33	100	0.33	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2,3-Trichlorobenzene	--	--	--	mg/kg	0.0012 U	0.0014 UJ	0.0012 UT	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2,4-Trichlorobenzene	--	--	--	mg/kg	0.0012 U	0.0014 UJ	0.0012 UT	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2,4-Trimethylbenzene	3.6	52	3.6	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.00017 J	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2-Dibromo-3-Chloropropane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2-Dichlorobenzene	1.1	100	1.1	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2-Dichloroethane	0.02	3.1	0.02	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,2-Dichloropropane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,3,5-Trimethylbenzene (Mesitylene)	8.4	52	8.4	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,3-Dichlorobenzene	2.4	49	2.4	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,4-Dichlorobenzene	1.8	13	1.8	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
1,4-Dioxane (P-Dioxane)	0.1	13	0.1	mg/kg	0.025 U	0.028 U	0.025 U	0.023 U	0.031 U	0.037 U	0.026 U	0.028 U	0.026 U
2-Hexanone	--	--	--	mg/kg	0.0062 U	0.0071 U	0.0061 U	0.0057 U	0.0077 U	0.0093 U	0.0064 U	0.0069 U	0.0066 U
Acetone	**0.05**	100	0.05	mg/kg	0.013	0.0071 U	0.0061 U	0.0057 U	0.0077 U	0.0093 U	0.0064 U	0.0069 U	0.0066 U
Benzene	**0.06**	4.8	0.06	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Bromochloromethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Bromodichloromethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Bromoform	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Bromomethane	--	--	--	mg/kg	0.0012 U	0.0014 UT	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Carbon Disulfide	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Carbon Tetrachloride	0.76	2.4	0.76	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Chlorobenzene	1.1	100	1.1	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Chloroethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Chloroform	0.37	49	0.37	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 UT	0.0019 UT	0.0013 UT	0.0014 UT	0.0013 UT
Chloromethane	--	--	--	mg/kg	0.0012 UT	0.0014 UT	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Cis-1,2-Dichloroethylene	0.25	100	0.25	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 UT	0.0019 UT	0.0013 UT	0.0014 UT	0.0013 UT
Cis-1,3-Dichloropropene	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Cyclohexane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Dibromochloromethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Dichlorodifluoromethane	--	--	--	mg/kg	0.0012 UT	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Ethylbenzene	1	41	1	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Isopropylbenzene (Cumene)	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
m,p-Xylene	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Methyl Acetate	--	--	--	mg/kg	0.0062 U	0.0071 U	0.0061 U	0.0057 U	0.0077 U	0.0093 U	0.0064 U	0.0069 U	0.0066 U
Methyl Ethyl Ketone (2-Butanone)	0.12	100	0.12	mg/kg	0.0018 J	0.0071 U	0.0061 U	0.0057 U	0.0077 U	0.0093 U	0.0064 U	0.0069 U	0.0066 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	--	mg/kg	0.0062 U	0.0071 U	0.0061 U	0.0057 U	0.0077 U	0.0093 U	0.0064 U	0.0069 U	0.0066 U
Methylcyclohexane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Methylene Chloride	0.05	100	0.05	mg/kg	0.00035 J	0.0014 U	0.0012 U	0.00086 J	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
N-Butylbenzene	12	100	12	mg/kg	0.0012 U	0.0014 U	0.0012 UT	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
N-Propylbenzene	3.9	100	3.9	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
O-Xylene (1,2-Dimethylbenzene)	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Sec-Butylbenzene	11	100	11	mg/kg	0.0012 U	0.0014 UJ	0.0012 UJ	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Styrene	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
T-Butylbenzene	5.9	100	5.9	mg/kg	0.0012 U	0.0014 UJ	0.0012 UJ	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Tert-Butyl Methyl Ether	0.93	100	0.93	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 UT	0.0019 UT	0.0013 UT	0.0014 UT	0.0013 UT
Tetrachloroethylene (PCE)	1.3	19	1.3	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.00054 J	0.0013 U

Table 4. Summary of Volatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

			Sample Designation:		RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6	WC-7	WC-8
			Sample Date:		04/15/2019	04/18/2019	04/18/2019	04/17/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019
			Sample Depth (ft bls):		30 - 32	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
			Normal or Field Duplicate:		N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit									
Toluene	**0.7**	100	0.7	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Trans-1,2-Dichloroethene	0.19	100	0.19	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Trans-1,3-Dichloropropene	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Trichloroethylene (TCE)	0.47	21	0.47	mg/kg	0.00054 J	0.0014 U	0.0012 U	0.0008 J	0.0015 U	0.0019 U	0.0013 U	0.00038 J	0.0013 U
Trichlorofluoromethane	--	--	--	mg/kg	0.0012 U	0.0014 U	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Vinyl Chloride	0.02	0.9	0.02	mg/kg	0.0012 U	0.0014 UT	0.0012 U	0.0011 U	0.0015 U	0.0019 U	0.0013 U	0.0014 U	0.0013 U
Xylenes, Total	0.26	100	1.6	mg/kg	0.00036 J	0.0028 U	0.0025 U	0.0023 U	0.0031 U	0.0037 U	0.0026 U	0.0028 U	0.0026 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation:	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1
					Sample Date:	04/15/2019	04/17/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018
					Sample Depth (ft bls):	0 - 2	26 - 28	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3
					Normal or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2,3,4,6-Tetrachlorophenol	--	--	--	mg/kg	0.4 UT	0.36 U	0.36 U	0.38 UT	0.35 UT	0.37 UT	0.36 U	0.38 UT	0.34 UT	0.4 UT	0.35 UT	0.35 U	0.37 U
2,4,5-Trichlorophenol	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2,4,6-Trichlorophenol	--	--	--	mg/kg	0.16 UT	0.15 U	0.14 U	0.15 U	0.14 U	0.15 UT	0.14 U	0.15 U	0.14 U	0.16 UT	0.14 UT	0.14 U	0.15 U
2,4-Dichlorophenol	--	--	--	mg/kg	0.16 UT	0.15 U	0.14 U	0.15 U	0.14 U	0.15 UT	0.14 U	0.15 U	0.14 U	0.16 UT	0.14 UT	0.14 U	0.15 U
2,4-Dimethylphenol	--	--	--	mg/kg	0.066 J	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2,4-Dinitrophenol	--	--	--	mg/kg	0.32 U	0.29 U	0.29 U	0.31 UT	0.28 UT	0.3 U	0.29 R	0.3 UT	0.28 UJ	0.32 U	0.28 U	0.28 U	0.29 UT
2,4-Dinitrotoluene	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.072 U	0.077 U	0.069 U	0.081 U	0.072 U	0.071 U	0.074 U
2,6-Dinitrotoluene	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.072 U	0.077 U	0.069 U	0.081 U	0.072 U	0.071 U	0.074 U
2-Chloronaphthalene	--	--	--	mg/kg	1	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2-Chlorophenol	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2-Methylnaphthalene	--	--	--	mg/kg	0.35 J	0.021 J	0.024 J	0.43	0.37	0.074 J	0.013 J	0.23 J	0.014 J	0.041 J	0.028 J	0.051 J	0.044 J
2-Methylphenol (O-Cresol)	0.33	100	0.33	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2-Nitroaniline	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
2-Nitrophenol	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 UJ	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
3,3'-Dichlorobenzidine	--	--	--	mg/kg	0.16 UJ	0.15 U	0.14 U	0.15 UT	0.14 UT	0.15 UJ	0.14 U	0.15 UT	0.14 UT	0.16 UJ	0.14 UJ	0.14 U	0.15 U
3-Nitroaniline	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
4,6-Dinitro-2-Methylphenol	--	--	--	mg/kg	0.32 U	0.29 U	0.29 U	0.31 UT	0.28 UT	0.3 U	0.29 R	0.3 UT	0.28 UJ	0.32 U	0.28 U	0.28 U	0.29 U
4-Bromophenyl Phenyl Ether	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
4-Chloro-3-Methylphenol	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
4-Chloroaniline	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
4-Chlorophenyl Phenyl Ether	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
4-Methylphenol (P-Cresol)	**0.33**	100	0.33	mg/kg	**0.48**	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
4-Nitroaniline	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 UJ	0.35 UJ	0.37 U	0.36 U	0.38 UJ	0.34 UJ	0.4 U	0.35 U	0.35 U	0.37 U
4-Nitrophenol	--	--	--	mg/kg	0.81 U	0.74 U	0.72 U	0.77 U	0.71 U	0.76 U	0.72 U	0.77 U	0.69 U	0.81 U	0.72 U	0.71 U	0.74 U
Acenaphthene	20	100	98	mg/kg	0.4 U	0.36 U	0.36 U	0.17 J	0.05 J	0.078 J	0.36 U	0.03 J	0.34 U	0.4 U	0.35 U	0.066 J	0.07 J
Acenaphthylene	100	100	107	mg/kg	0.47	0.36 U	0.36 U	0.098 J	0.02 J	0.031 J	0.36 U	0.014 J	0.34 U	0.4 U	0.35 U	0.042 J	0.037 J
Acetophenone	--	--	--	mg/kg	1.5	0.36 U	0.36 U	0.011 J	0.35 U	0.37 U	0.36 U	0.38 U	0.34 UJ	0.4 U	0.35 U	0.014 J	0.37 U
Anthracene	100	100	1000	mg/kg	0.059 J	0.36 U	0.36 U	0.47	0.028 J	0.42	0.01 J	0.024 J	0.34 U	0.4 U	0.35 U	0.3 J	0.21 J
Atrazine	--	--	--	mg/kg	0.07 J	0.15 U	0.14 U	0.15 U	0.14 U	0.15 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U	0.14 U	0.15 U
Benzaldehyde	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.026 J	0.38 U	0.34 UJ	0.4 U	0.35 U	0.35 U	0.37 U
Benzo(A)Anthracene	**1**	1	1	mg/kg	0.049	0.026 J	0.036 U	**1.4**	0.1	**2.1**	0.04	0.081	0.044	0.04 U	0.023 J	**1.1**	0.64
Benzo(A)Pyrene	**1**	1	22	mg/kg	0.13 J	0.02 J	0.036 U	**1.3**	0.09	**2.1**	0.043	0.071	0.037	0.04 U	0.011 J	**1.1**	0.59
Benzo(B)Fluoranthene	**1**	1	1.7	mg/kg	0.56 J	0.029 J	0.036 U	**1.8**	0.13	**3.5**	0.057	0.11	0.051	0.04 U	0.019 J	**1.4**	0.83
Benzo(G,H,I)Perylene	100	100	1000	mg/kg	0.18 J	0.36 U	0.36 U	0.8	0.074 J	1	0.048 J	0.075 J	0.035 J	0.4 U	0.35 U	0.66	0.24 J
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	mg/kg	0.04 R	0.036 U	0.036 U	0.68	0.045	**1**	0.034 J	0.038	0.018 J	0.04 U	0.035 U	0.56	0.29
Benzyl Butyl Phthalate	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.12 J	0.047 J	0.37 U	0.36 UJ	0.38 U	0.34 U	0.4 U	0.35 U	0.033 J	0.016 J
Biphenyl (Diphenyl)	--	--	--	mg/kg	0.58	0.36 U	0.36 U	0.053 J	0.034 J	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Bis(2-Chloroethoxy) Methane	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	mg/kg	0.04 U	0.036 U	0.036 U	0.038 U	0.035 U	0.037 U	0.036 UT	0.038 U	0.034 U	0.04 U	0.035 U	0.035 U	0.037 U
Bis(2-Chloroisopropyl) Ether	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.097 J	0.036 J	0.37 U	0.084 J	0.38 U	0.071 J	0.4 U	0.35 U	0.081 J	0.088 J
Caprolactam	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Carbazole	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.12 J	0.009 J	0.045 J	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.11 J	0.048 J
Chrysene	**1**	3.9	1	mg/kg	0.093 J	0.024 J	0.36 U	**1.3**	0.1 J	**1.9**	0.046 J	0.1 J	0.042 J	0.4 U	0.015 J	**1.1**	0.71
Cresols, M & P	**0.33**	100	0.33	mg/kg	**0.48**	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	NA	NA
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	mg/kg	0.027 J	0.036 U	0.036 U	0.15	0.035 U	0.23	0.024 J	0.038 U	0.034 U	0.04 U	0.035 U	0.19	0.069
Dibenzofuran	7	59	210	mg/kg	0.022 J	0.36 U	0.36 U	0.076 J	0.35 U	0.042 J	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.047 J	0.035 J
Diethyl Phthalate	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Dimethyl Phthalate	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.36	0.37 U
Di-N-Butyl Phthalate	--	--	--	mg/kg	0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.012 J
Di-N-Octylphthalate	--	--	--	mg/kg	0.4 R	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation:	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1
					Sample Date:	04/15/2019	04/17/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018
					Sample Depth (ft bls):	0 - 2	26 - 28	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3
					Normal or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N
Fluoranthene	100	100	1000	mg/kg		0.26 J	0.039 J	0.36 U	2.9	0.18 J	4.2	0.061 J	0.16 J	0.079 J	0.4 U	0.028 J	1.8	1.2
Fluorene	30	100	386	mg/kg		0.13 J	0.36 U	0.36 U	0.15 J	0.035 J	0.08 J	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.077 J	0.075 J
Hexachlorobenzene	0.33	1.2	3.2	mg/kg		0.04 U	0.036 U	0.036 U	0.038 U	0.035 U	0.037 U	0.036 U	0.038 U	0.034 U	0.04 U	0.035 U	0.035 U	0.037 U
Hexachlorobutadiene	--	--	--	mg/kg		0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.072 U	0.077 U	0.069 U	0.081 U	0.072 U	0.071 U	0.074 U
Hexachlorocyclopentadiene	--	--	--	mg/kg		0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 UJ	0.38 U	0.34 UJ	0.4 U	0.35 U	0.35 U	0.37 UT
Hexachloroethane	--	--	--	mg/kg		0.04 U	0.036 U	0.036 U	0.038 U	0.035 U	0.037 U	0.036 U	0.038 U	0.034 UJ	0.04 U	0.035 U	0.035 U	0.037 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	mg/kg		0.16 J	0.036 U	0.036 U	**1**	0.083	**1.5**	0.066	0.075	0.037	0.04 U	0.035 U	**0.75**	0.25
Isophorone	--	--	--	mg/kg		0.16 U	0.15 U	0.14 U	0.15 U	0.14 U	0.15 U	0.14 U	0.15 U	0.14 UJ	0.16 U	0.14 U	0.14 U	0.15 U
Naphthalene	12	100	12	mg/kg		5.5	0.068 J	0.087 J	1.1	0.89	0.23 J	0.049 J	0.6	0.033 J	0.18 J	0.1 J	0.051 J	0.047 J
Nitrobenzene	--	--	--	mg/kg		0.04 U	0.036 U	0.036 U	0.038 U	0.035 U	0.037 U	0.036 U	0.038 U	0.034 UJ	0.04 U	0.035 U	0.035 U	0.037 U
N-Nitrosodimethylamine	--	--	--	mg/kg		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	--	mg/kg		0.04 U	0.036 U	0.036 U	0.038 U	0.035 U	0.037 U	0.036 U	0.038 U	0.034 UJ	0.04 U	0.035 U	0.035 U	0.037 U
N-Nitrosodiphenylamine	--	--	--	mg/kg		0.4 U	0.36 U	0.36 U	0.019 J	0.35 U	0.37 U	0.36 U	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Pentachlorophenol	0.8	6.7	0.8	mg/kg		0.32 UJ	0.29 U	0.29 U	0.31 UJ	0.28 UJ	0.3 UJ	0.29 U	0.3 UJ	0.28 UJ	0.32 UJ	0.28 UJ	0.28 U	0.29 U
Phenanthrene	100	100	1000	mg/kg		0.72	0.027 J	0.36 U	1.9	0.13 J	1.5	0.043 J	0.12 J	0.073 J	0.4 U	0.018 J	1.2	0.88
Phenol	0.33	100	0.33	mg/kg		0.4 U	0.36 U	0.36 U	0.38 U	0.35 U	0.37 U	0.36 UT	0.38 U	0.34 U	0.4 U	0.35 U	0.35 U	0.37 U
Pyrene	100	100	1000	mg/kg		0.24 J	0.04 J	0.36 U	2.6	0.17 J	3.5	0.054 J	0.14 J	0.072 J	0.4 U	0.029 J	1.9	1.2

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-1	RX-2	RX-3	RX-3	RX-3	RX-4	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7
Sample Date:					07/25/2018	02/27/2018	07/25/2018	02/26/2018	07/25/2018	02/27/2018	02/27/2018	07/24/2018	07/24/2018	07/25/2018	02/27/2018	07/25/2018	02/26/2018
Sample Depth (ft bls):					13 - 15	3 - 5	0 - 2	3 - 5	13 - 15	2 - 4	1 - 3	13 - 15	13 - 15	0 - 2	2 - 3.5	13 - 15	0.2 - 2.5
Normal or Field Duplicate:					N	N	N	N	N	N	N	N	FD	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2,3,4,6-Tetrachlorophenol	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2,4,5-Trichlorophenol	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2,4,6-Trichlorophenol	--	--	--	mg/kg	0.14 U	0.31 U	0.15 U	0.16 U	0.14 U	0.15 U	0.15 U	0.14 U	0.14 U	0.15 U	0.15 U	0.15 U	0.17 U
2,4-Dichlorophenol	--	--	--	mg/kg	0.14 U	0.31 U	0.15 U	0.16 U	0.14 U	0.15 U	0.15 U	0.14 U	0.14 U	0.15 U	0.15 U	0.15 U	0.17 U
2,4-Dimethylphenol	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2,4-Dinitrophenol	--	--	--	mg/kg	0.28 UJ	0.63 UT	0.3 U	0.31 U	0.28 U	0.29 UT	0.3 UT	0.27 UJ	0.27 U	0.31 U	0.3 UT	0.29 U	0.34 U
2,4-Dinitrotoluene	--	--	--	mg/kg	0.07 U	0.16 U	0.076 U	0.078 U	0.072 U	0.074 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U
2,6-Dinitrotoluene	--	--	--	mg/kg	0.07 U	0.16 U	0.076 U	0.078 U	0.072 U	0.074 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U
2-Chloronaphthalene	--	--	--	mg/kg	0.34 U	0.099 J	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2-Chlorophenol	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2-Methylnaphthalene	--	--	--	mg/kg	0.34 UJ	0.17 J	0.028 J	0.055 J	0.35 U	0.07 J	0.057 J	0.34 U	0.34 U	0.04 J	0.029 J	0.17 J	0.26 J
2-Methylphenol (O-Cresol)	0.33	100	0.33	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2-Nitroaniline	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
2-Nitrophenol	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
3,3'-Dichlorobenzidine	--	--	--	mg/kg	0.14 U	0.31 U	0.15 U	0.16 U	0.14 U	0.15 U	0.15 U	0.14 U	0.14 U	0.15 U	0.15 U	0.15 U	0.17 U
3-Nitroaniline	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4,6-Dinitro-2-Methylphenol	--	--	--	mg/kg	0.28 U	0.63 U	0.3 U	0.31 U	0.28 U	0.29 U	0.3 U	0.27 UJ	0.27 U	0.31 U	0.3 U	0.29 U	0.34 U
4-Bromophenyl Phenyl Ether	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4-Chloro-3-Methylphenol	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4-Chloroaniline	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4-Chlorophenyl Phenyl Ether	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 UJ	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4-Methylphenol (P-Cresol)	**0.33**	100	0.33	mg/kg	0.34 U	0.071 J	0.37 U	0.38 U	0.35 U	0.36 U	0.011 J	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4-Nitroaniline	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
4-Nitrophenol	--	--	--	mg/kg	0.7 U	1.6 U	0.76 U	0.78 U	0.72 U	0.74 U	0.76 U	0.69 U	0.69 U	0.78 U	0.76 U	0.74 U	0.84 U
Acenaphthene	20	100	98	mg/kg	0.34 U	0.031 J	0.03 J	0.38 U	0.35 U	0.23 J	0.15 J	0.34 U	0.34 U	0.38 U	0.07 J	1	0.42 U
Acenaphthylene	100	100	107	mg/kg	0.34 U	0.28 J	0.05 J	0.019 J	0.35 U	0.024 J	0.051 J	0.34 U	0.34 U	0.012 J	0.062 J	0.016 J	0.041 J
Acetophenone	--	--	--	mg/kg	0.34 UJ	0.063 J	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.0087 J	0.37 U	0.36 U	0.17 J
Anthracene	100	100	1000	mg/kg	0.34 U	0.071 J	0.12 J	0.035 J	0.35 U	0.8	0.35 J	0.34 U	0.34 U	0.062 J	0.41	1.5	0.42 U
Atrazine	--	--	--	mg/kg	0.14 U	0.31 U	0.15 U	0.16 U	0.14 U	0.15 U	0.15 U	0.14 U	0.14 U	0.15 U	0.15 U	0.15 U	0.17 U
Benzaldehyde	--	--	--	mg/kg	0.34 U	0.78 U	0.018 J	0.38 U	0.35 U	0.36 U	0.37 U	0.34 UT	0.34 UT	0.38 U	0.37 U	0.018 J	0.42 U
Benzo(A)Anthracene	**1**	1	1	mg/kg	0.034 U	0.078 U	0.63	0.17	0.035 U	**2.1**	0.86	0.034 U	0.034 U	0.24	**1.3**	**2.3**	0.042 U
Benzo(A)Pyrene	**1**	1	22	mg/kg	0.034 U	0.13	0.7	0.18	0.035 U	**1.9**	0.77	0.034 U	0.034 U	0.22	**1.4**	**2.2**	0.016 J
Benzo(B)Fluoranthene	**1**	1	1.7	mg/kg	0.034 U	0.27	**1.1**	0.3	0.035 U	**3.1**	**1.2**	0.034 U	0.034 U	0.34	**1.9**	**3**	0.065
Benzo(G,H,I)Perylene	100	100	1000	mg/kg	0.34 U	0.11 J	0.47	0.13 J	0.35 U	0.87	0.4	0.34 U	0.34 U	0.16 J	0.66	1.1	0.42 U
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	mg/kg	0.034 U	0.069 J	0.42	0.099	0.035 U	**1**	0.39	0.034 U	0.034 U	0.1	0.7	**0.95**	0.042 U
Benzyl Butyl Phthalate	--	--	--	mg/kg	0.34 U	0.78 U	0.081 J	0.11 J	0.35 U	0.36 U	0.032 J	0.34 U	0.34 U	0.049 J	0.37 U	0.36 U	0.42 U
Biphenyl (Diphenyl)	--	--	--	mg/kg	0.34 U	0.092 J	0.37 U	0.021 J	0.35 U	0.028 J	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.057 J	0.078 J
Bis(2-Chloroethoxy) Methane	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	mg/kg	0.034 UJ	0.078 U	0.037 U	0.038 U	0.035 U	0.036 U	0.037 U	0.034 U	0.034 U	0.038 U	0.037 U	0.036 U	0.042 U
Bis(2-Chloroisopropyl) Ether	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	mg/kg	0.34 U	0.78 U	1.4	0.092 J	0.35 U	0.052 J	0.22 J	0.34 U	0.34 U	0.19 J	0.37 U	0.036 J	0.42 U
Caprolactam	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
Carbazole	--	--	--	mg/kg	0.34 U	0.028 J	0.081 J	0.018 J	0.35 U	0.13 J	0.088 J	0.34 U	0.34 U	0.033 J	0.12 J	0.71	0.42 U
Chrysene	**1**	3.9	1	mg/kg	0.34 U	0.35 J	0.87	0.25 J	0.35 U	**2.1**	0.96	0.34 U	0.34 U	0.25 J	**1.4**	**2.4**	0.19 J
Cresols, M & P	**0.33**	100	0.33	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	mg/kg	0.034 U	0.078 U	0.087	0.035 J	0.035 U	0.22	0.097	0.034 U	0.034 U	0.054	0.21	**0.34**	0.042 U
Dibenzofuran	7	59	210	mg/kg	0.34 U	0.024 J	0.015 J	0.013 J	0.35 U	0.17 J	0.086 J	0.34 U	0.34 U	0.02 J	0.062 J	0.49	0.42 U
Diethyl Phthalate	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
Dimethyl Phthalate	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
Di-N-Butyl Phthalate	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.016 J	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U
Di-N-Octylphthalate	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.36 U	0.42 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-1	RX-2	RX-3	RX-3	RX-3	RX-4	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7
Sample Date:					07/25/2018	02/27/2018	07/25/2018	02/26/2018	07/25/2018	02/27/2018	02/27/2018	07/24/2018	07/24/2018	07/25/2018	02/27/2018	07/25/2018	02/26/2018
Sample Depth (ft bls):					13 - 15	3 - 5	0 - 2	3 - 5	13 - 15	2 - 4	1 - 3	13 - 15	13 - 15	0 - 2	2 - 3.5	13 - 15	0.2 - 2.5
Normal or Field Duplicate:					N	N	N	N	N	N	N	N	FD	N	N	N	N
Fluoranthene	100	100	1000	mg/kg	0.34 U	0.37 J	1.4	0.31 J	0.35 U	4.7	1.9	0.34 U	0.34 U	0.38	2.1	5.5	0.054 J
Fluorene	30	100	386	mg/kg	0.34 U	0.066 J	0.035 J	0.012 J	0.35 U	0.3 J	0.14 J	0.34 U	0.34 U	0.019 J	0.056 J	0.8	0.42 U
Hexachlorobenzene	0.33	1.2	3.2	mg/kg	0.034 U	0.078 U	0.037 U	0.038 U	0.035 U	0.036 U	0.037 U	0.034 U	0.034 U	0.038 U	0.037 U	0.036 U	0.042 U
Hexachlorobutadiene	--	--	--	mg/kg	0.07 U	0.16 U	0.076 U	0.078 U	0.072 U	0.074 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U
Hexachlorocyclopentadiene	--	--	--	mg/kg	0.34 U	0.78 UT	0.37 U	0.38 U	0.35 U	0.36 UT	0.37 UT	0.34 UJ	0.34 U	0.38 U	0.37 UT	0.36 U	0.42 U
Hexachloroethane	--	--	--	mg/kg	0.034 UJ	0.078 U	0.037 U	0.038 U	0.035 U	0.036 U	0.037 U	0.034 U	0.034 U	0.038 U	0.037 U	0.036 U	0.042 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	mg/kg	0.034 U	0.077 J	**0.52**	0.13	0.035 U	**0.96**	0.38	0.034 U	0.034 U	0.2	**0.62**	**1.4**	0.017 J
Isophorone	--	--	--	mg/kg	0.14 UJ	0.31 U	0.15 U	0.16 U	0.14 U	0.15 U	0.15 U	0.14 U	0.14 U	0.15 U	0.15 U	0.15 U	0.17 U
Naphthalene	12	100	12	mg/kg	0.34 U	0.88	0.033 J	0.041 J	0.35 U	0.081 J	0.047 J	0.34 U	0.34 U	0.033 J	0.092 J	0.44	0.3 J
Nitrobenzene	--	--	--	mg/kg	0.034 UJ	0.078 U	0.037 U	0.038 U	0.035 U	0.036 U	0.037 U	0.034 U	0.034 U	0.038 U	0.037 U	0.036 U	0.042 U
N-Nitrosodimethylamine	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	--	mg/kg	0.034 UJ	0.078 U	0.037 U	0.038 U	0.035 U	0.036 U	0.037 U	0.034 U	0.034 U	0.038 U	0.037 U	0.036 U	0.042 U
N-Nitrosodiphenylamine	--	--	--	mg/kg	0.34 U	0.78 U	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 U	0.34 U	0.38 U	0.37 U	0.034 J	0.42 U
Pentachlorophenol	0.8	6.7	0.8	mg/kg	0.28 U	0.63 U	0.3 U	0.31 U	0.28 U	0.29 U	0.3 U	0.27 UJ	0.27 U	0.31 U	0.3 U	0.29 U	0.34 U
Phenanthrene	100	100	1000	mg/kg	0.34 U	0.39 J	0.69	0.21 J	0.35 U	3.2	1.6	0.34 U	0.34 U	0.28 J	1.2	6.2	0.15 J
Phenol	0.33	100	0.33	mg/kg	0.34 U	0.066 J	0.37 U	0.38 U	0.35 U	0.36 U	0.37 U	0.34 UT	0.34 UT	0.38 U	0.37 U	0.36 U	0.42 U
Pyrene	100	100	1000	mg/kg	0.34 U	0.37 J	1.3	0.31 J	0.35 U	3.8	1.7	0.34 U	0.34 U	0.48	2.1	6	0.056 J

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-7	RX-8	RX-9	RX-9	RX-9	RX-9	RX-10	RX-10	RX-10	RX-11	RX-12	RX-12	RX-12
Sample Designation:					RX-7	RX-8	RX-9	RX-9	RX-9	RX-9	RX-10	RX-10	RX-10	RX-11	RX-12	RX-12	RX-12
Sample Date:					02/26/2018	02/27/2018	02/26/2018	07/24/2018	07/24/2018	07/24/2018	07/24/2018	02/26/2018	07/24/2018	02/27/2018	07/24/2018	02/27/2018	07/24/2018
Sample Depth (ft bls):					0.2 - 2.5	2 - 4	2 - 4	0 - 2	3 - 5	13 - 15	0 - 2	2 - 4	13 - 15	3 - 5	0 - 2	1.5 - 3.5	13 - 15
Normal or Field Duplicate:					FD	N	N	N	N	N	N	N	N	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2,3,4,6-Tetrachlorophenol	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2,4,5-Trichlorophenol	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2,4,6-Trichlorophenol	--	--	--	mg/kg	0.17 U	0.15 U	0.15 U	0.15 U	0.7 U	0.15 U	0.15 U	0.15 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U
2,4-Dichlorophenol	--	--	--	mg/kg	0.17 U	0.15 U	0.15 U	0.15 U	0.7 U	0.15 U	0.15 U	0.15 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U
2,4-Dimethylphenol	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2,4-Dinitrophenol	--	--	--	mg/kg	0.34 U	0.31 UT	0.3 U	0.3 U	1.4 U	0.3 U	0.3 U	0.29 U	0.28 U	0.3 UT	0.29 U	0.32 UT	0.28 U
2,4-Dinitrotoluene	--	--	--	mg/kg	0.086 U	0.077 U	0.075 U	0.075 U	0.35 U	0.075 U	0.076 U	0.074 U	0.07 U	0.077 U	0.073 U	0.082 U	0.07 U
2,6-Dinitrotoluene	--	--	--	mg/kg	0.086 U	0.077 U	0.075 U	0.075 U	0.35 U	0.075 U	0.076 U	0.074 U	0.07 U	0.077 U	0.073 U	0.082 U	0.07 U
2-Chloronaphthalene	--	--	--	mg/kg	0.14 J	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.027 J	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2-Chlorophenol	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2-Methylnaphthalene	--	--	--	mg/kg	0.44	0.062 J	0.13 J	0.053 J	1.7 U	0.37 U	0.02 J	0.094 J	0.34 U	0.026 J	0.0099 J	0.4 U	0.35 U
2-Methylphenol (O-Cresol)	0.33	100	0.33	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2-Nitroaniline	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
2-Nitrophenol	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
3,3'-Dichlorobenzidine	--	--	--	mg/kg	0.17 U	0.15 U	0.15 U	0.15 U	0.7 U	0.15 U	0.15 U	0.15 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U
3-Nitroaniline	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4,6-Dinitro-2-Methylphenol	--	--	--	mg/kg	0.34 U	0.31 U	0.3 U	0.3 U	1.4 U	0.3 U	0.3 U	0.29 U	0.28 U	0.3 U	0.29 U	0.32 U	0.28 U
4-Bromophenyl Phenyl Ether	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4-Chloro-3-Methylphenol	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4-Chloroaniline	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4-Chlorophenyl Phenyl Ether	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4-Methylphenol (P-Cresol)	**0.33**	100	0.33	mg/kg	0.037 J	0.38 U	0.02 J	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4-Nitroaniline	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
4-Nitrophenol	--	--	--	mg/kg	0.86 U	0.77 U	0.75 U	0.75 U	3.5 U	0.75 U	0.76 U	0.74 U	0.7 U	0.77 U	0.73 U	0.82 U	0.7 U
Acenaphthene	20	100	98	mg/kg	0.42 U	0.08 J	0.29 J	0.15 J	1.7 U	0.37 U	0.37 U	0.017 J	0.34 U	0.077 J	0.026 J	0.4 U	0.35 U
Acenaphthylene	100	100	107	mg/kg	0.62	0.055 J	0.29 J	0.13 J	1.7 U	0.37 U	0.09 J	0.028 J	0.34 U	0.05 J	0.015 J	0.4 U	0.35 U
Acetophenone	--	--	--	mg/kg	0.25 J	0.38 U	0.37 U	0.0081 J	1.7 U	0.37 U	0.014 J	0.028 J	0.34 U	0.38 U	0.01 J	0.4 U	0.35 U
Anthracene	100	100	1000	mg/kg	0.062 J	0.21 J	0.75	0.55	1.7 U	0.37 U	0.37 U	0.04 J	0.34 U	0.2 J	0.11 J	0.4 U	0.35 U
Atrazine	--	--	--	mg/kg	0.17 U	0.15 U	0.15 U	0.15 U	0.7 U	0.15 U	0.15 U	0.15 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U
Benzaldehyde	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 UT	1.7 UT	0.37 UT	0.028 JT	0.058 J	0.34 UT	0.38 U	0.14 JT	0.4 U	0.35 UT
Benzo(A)Anthracene	**1**	1	1	mg/kg	0.059	0.66	**1.7**	**2.8**	0.16 J	0.027 J	0.037 U	0.24	0.034 U	0.93	0.52	0.081	0.035 U
Benzo(A)Pyrene	**1**	1	22	mg/kg	0.047	0.62	**1.5**	**2.4**	0.052 J	0.025 J	0.016 J	0.19	0.034 U	0.84	0.5	0.065	0.035 U
Benzo(B)Fluoranthene	**1**	1	1.7	mg/kg	0.12	0.99	**1.9**	**2.4**	0.062 J	0.031 J	0.049	0.38	0.034 U	**1.3**	0.71	0.11	0.035 U
Benzo(G,H,I)Perylene	100	100	1000	mg/kg	0.07 J	0.34 J	0.67	1.2	0.089 J	0.019 J	0.02 J	0.12 J	0.34 U	0.41	0.33 J	0.039 J	0.35 U
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	mg/kg	0.042 U	0.32	0.76	0.037 U	0.17 U	0.037 U	0.037 U	0.11	0.034 U	0.51	0.036 U	0.039 J	0.035 U
Benzyl Butyl Phthalate	--	--	--	mg/kg	0.42 U	0.019 J	0.032 J	0.031 J	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.041 J	0.36 U	0.4 U	0.35 U
Biphenyl (Diphenyl)	--	--	--	mg/kg	0.16 J	0.025 J	0.042 J	0.019 J	1.7 U	0.37 U	0.37 U	0.028 J	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Bis(2-Chloroethoxy) Methane	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	mg/kg	0.042 U	0.038 U	0.037 U	0.037 U	0.17 U	0.037 U	0.037 U	0.037 U	0.034 U	0.038 U	0.036 U	0.04 U	0.035 U
Bis(2-Chloroisopropyl) Ether	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	mg/kg	0.42 U	0.11 J	0.064 J	0.1 J	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.11 J	0.12 J	0.4 U	0.35 U
Caprolactam	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Carbazole	--	--	--	mg/kg	0.42 U	0.1 J	0.35 J	0.16 J	1.7 U	0.37 U	0.37 U	0.02 J	0.34 U	0.086 J	0.032 J	0.4 U	0.35 U
Chrysene	**1**	3.9	1	mg/kg	0.33 J	0.74	**1.7**	**3.4**	1.7 U	0.027 J	0.12 J	0.48	0.34 U	0.89	0.5	0.068 J	0.35 U
Cresols, M & P	**0.33**	100	0.33	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	mg/kg	0.032 J	0.1	0.19	**0.35**	0.17 U	0.037 U	0.037 U	0.047	0.034 U	0.11	0.079	0.04 U	0.035 U
Dibenzofuran	7	59	210	mg/kg	0.039 J	0.055 J	0.26 J	0.084 J	1.7 U	0.37 U	0.37 U	0.037 J	0.34 U	0.031 J	0.014 J	0.4 U	0.35 U
Diethyl Phthalate	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Dimethyl Phthalate	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Di-N-Butyl Phthalate	--	--	--	mg/kg	0.42 U	0.012 J	0.021 BJ	0.37 U	1.7 U	0.37 U	0.37 U	0.026 BJ	0.34 U	0.021 J	0.36 U	0.4 U	0.35 U
Di-N-Octylphthalate	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

				Sample Designation:	RX-7	RX-8	RX-9	RX-9	RX-9	RX-9	RX-10	RX-10	RX-10	RX-11	RX-12	RX-12	RX-12
				Sample Date:	02/26/2018	02/27/2018	02/26/2018	07/24/2018	07/24/2018	07/24/2018	07/24/2018	02/26/2018	07/24/2018	02/27/2018	07/24/2018	02/27/2018	07/24/2018
				Sample Depth (ft bls):	0.2 - 2.5	2 - 4	2 - 4	0 - 2	3 - 5	13 - 15	0 - 2	2 - 4	13 - 15	3 - 5	0 - 2	1.5 - 3.5	13 - 15
				Normal or Field Duplicate:	FD	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit													
Fluoranthene	100	100	1000	mg/kg	0.17 J	1.4	3.6	3.4	1.7 U	0.036 J	0.046 J	0.39	0.34 U	1.7	0.9	0.15 J	0.35 U
Fluorene	30	100	386	mg/kg	0.068 J	0.1 J	0.42	0.18 J	1.7 U	0.37 U	0.37 U	0.02 J	0.34 U	0.059 J	0.026 J	0.4 U	0.35 U
Hexachlorobenzene	0.33	1.2	3.2	mg/kg	0.042 U	0.038 U	0.037 U	0.037 U	0.17 U	0.037 U	0.037 U	0.037 U	0.034 U	0.038 U	0.036 U	0.04 U	0.035 U
Hexachlorobutadiene	--	--	--	mg/kg	0.086 U	0.077 U	0.075 U	0.075 U	0.35 U	0.075 U	0.076 U	0.074 U	0.07 U	0.077 U	0.073 U	0.082 U	0.07 U
Hexachlorocyclopentadiene	--	--	--	mg/kg	0.42 U	0.38 UT	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 UT	0.36 U	0.4 UT	0.35 U
Hexachloroethane	--	--	--	mg/kg	0.042 U	0.038 U	0.037 U	0.037 U	0.17 U	0.037 U	0.037 U	0.037 U	0.034 U	0.038 U	0.036 U	0.04 U	0.035 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	mg/kg	0.04 J	0.33	**0.78**	**1.1**	0.17 U	0.019 J	0.016 J	0.13	0.034 U	0.42	0.36	0.035 J	0.035 U
Isophorone	--	--	--	mg/kg	0.17 U	0.15 U	0.15 U	0.15 U	0.7 U	0.15 U	0.15 U	0.15 U	0.14 U	0.15 U	0.14 U	0.16 U	0.14 U
Naphthalene	12	100	12	mg/kg	1.4	0.049 J	0.2 J	0.084 J	1.7 U	0.37 U	0.15 J	0.083 J	0.34 U	0.033 J	0.018 J	0.4 U	0.35 U
Nitrobenzene	--	--	--	mg/kg	0.042 U	0.038 U	0.037 U	0.037 U	0.17 U	0.037 U	0.037 U	0.037 U	0.034 U	0.038 U	0.036 U	0.04 U	0.035 U
N-Nitrosodimethylamine	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	--	mg/kg	0.042 U	0.038 U	0.037 U	0.037 U	0.17 U	0.037 U	0.037 U	0.037 U	0.034 U	0.038 U	0.036 U	0.04 U	0.035 U
N-Nitrosodiphenylamine	--	--	--	mg/kg	0.42 U	0.38 U	0.37 U	0.37 U	1.7 U	0.37 U	0.37 U	0.37 U	0.34 U	0.38 U	0.36 U	0.4 U	0.35 U
Pentachlorophenol	0.8	6.7	0.8	mg/kg	0.34 U	0.31 U	0.3 U	0.3 U	1.4 U	0.3 U	0.3 U	0.29 U	0.28 U	0.3 U	0.29 U	0.32 U	0.28 U
Phenanthrene	100	100	1000	mg/kg	0.39 J	1.1	3.8	2.6	1.7 U	0.021 J	0.14 J	0.4	0.34 U	0.93	0.44	0.075 J	0.35 U
Phenol	0.33	100	0.33	mg/kg	0.42 U	0.38 U	0.37 U	0.37 UT	1.7 UT	0.37 UT	0.37 UT	0.37 U	0.34 UT	0.38 U	0.36 UT	0.4 U	0.35 UT
Pyrene	100	100	1000	mg/kg	0.24 J	1.2	3.7	4.9	1.7 U	0.044 J	0.057 J	0.42	0.34 U	1.6	0.98	0.12 J	0.35 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-13	RX-14	RX-14	RX-15	RX-15	RX-16	RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6
Sample Designation:					RX-13	RX-14	RX-14	RX-15	RX-15	RX-16	RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6
Sample Date:					02/26/2018	02/26/2018	07/24/2018	04/15/2019	04/17/2019	04/15/2019	04/15/2019	04/18/2019	04/18/2019	04/17/2019	04/19/2019	04/19/2019	04/19/2019
Sample Depth (ft bls):					1 - 3	0 - 2	13 - 15	0 - 2	24 - 26	0 - 2	30 - 32	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
Normal or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	N	N	N
1,2,4,5-Tetrachlorobenzene	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2,3,4,6-Tetrachlorophenol	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 UT	0.36 U	0.81 UT	0.35 UT	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2,4,5-Trichlorophenol	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 UT	0.35 UT	0.35 UT
2,4,6-Trichlorophenol	--	--	--	mg/kg	0.15 U	0.15 U	0.14 U	0.15 UT	0.15 U	0.33 UT	0.14 UT	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
2,4-Dichlorophenol	--	--	--	mg/kg	0.15 U	0.15 U	0.14 U	0.15 UT	0.15 U	0.33 UT	0.14 UT	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
2,4-Dimethylphenol	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2,4-Dinitrophenol	--	--	--	mg/kg	0.3 U	0.31 U	0.28 U	0.3 U	0.29 UJ	0.66 U	0.28 U	0.28 R	0.28 R	0.28 U	0.28 U	0.28 U	0.28 U
2,4-Dinitrotoluene	--	--	--	mg/kg	0.076 U	0.077 U	0.071 U	0.076 U	0.074 U	0.17 U	0.071 U	0.072 U	0.069 U	0.07 U	0.07 U	0.07 U	0.07 U
2,6-Dinitrotoluene	--	--	--	mg/kg	0.076 U	0.077 U	0.071 U	0.076 U	0.074 U	0.17 U	0.071 U	0.072 U	0.069 U	0.07 U	0.07 U	0.07 U	0.07 U
2-Chloronaphthalene	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2-Chlorophenol	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2-Methylnaphthalene	--	--	--	mg/kg	0.057 J	0.031 J	0.35 U	0.028 J	0.022 J	0.056 J	0.095 J	0.35 U	0.34 U	0.088 J	0.34 U	0.35 U	0.35 U
2-Methylphenol (O-Cresol)	0.33	100	0.33	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2-Nitroaniline	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
2-Nitrophenol	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 UJ	0.34 UJ	0.35 U	0.34 U	0.35 U	0.35 U
3,3'-Dichlorobenzidine	--	--	--	mg/kg	0.15 U	0.15 U	0.14 U	0.15 UJ	0.15 U	0.33 UJ	0.14 UJ	0.14 U	0.14 U	0.14 U	0.14 UT	0.14 UT	0.14 UT
3-Nitroaniline	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 UT	0.35 UT	0.35 UT
4,6-Dinitro-2-Methylphenol	--	--	--	mg/kg	0.3 U	0.31 U	0.28 U	0.3 U	0.29 U	0.66 U	0.28 U	0.28 R	0.28 R	0.28 U	0.28 U	0.28 U	0.28 U
4-Bromophenyl Phenyl Ether	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
4-Chloro-3-Methylphenol	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
4-Chloroaniline	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 UT	0.35 UT	0.35 UT
4-Chlorophenyl Phenyl Ether	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
4-Methylphenol (P-Cresol)	**0.33**	100	0.33	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
4-Nitroaniline	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
4-Nitrophenol	--	--	--	mg/kg	0.76 U	0.77 U	0.71 U	0.76 U	0.74 U	1.7 U	0.71 U	0.72 U	0.69 U	0.7 U	0.7 U	0.7 U	0.7 U
Acenaphthene	20	100	98	mg/kg	0.14 J	0.024 J	0.35 U	0.38 U	0.36 U	0.099 J	0.13 J	0.35 U	0.34 U	0.065 J	0.34 U	0.35 U	0.35 U
Acenaphthylene	100	100	107	mg/kg	0.053 J	0.15 J	0.35 U	0.38 U	0.36 U	0.066 J	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Acetophenone	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Anthracene	100	100	1000	mg/kg	0.16 J	0.12 J	0.35 U	0.38 U	0.36 U	0.36 J	0.31 J	0.35 U	0.34 U	0.18 J	0.34 U	0.35 U	0.35 U
Atrazine	--	--	--	mg/kg	0.15 U	0.15 U	0.14 U	0.15 U	0.15 U	0.33 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
Benzaldehyde	--	--	--	mg/kg	0.37 U	0.38 U	0.35 UT	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Benzo(A)Anthracene	**1**	1	1	mg/kg	0.61	0.65	0.035 U	0.048	0.023 J	1	0.33	0.034 J	0.034 U	0.2	0.034 U	0.035 U	0.035 U
Benzo(A)Pyrene	**1**	1	22	mg/kg	0.53	0.67	0.035 U	0.035 J	0.017 J	0.83	0.29	0.027 J	0.012 J	0.17	0.034 U	0.035 U	0.035 U
Benzo(B)Fluoranthene	**1**	1	1.7	mg/kg	0.87	**1.1**	0.035 U	0.06	0.028 J	**1.3**	0.39	0.034 J	0.015 J	0.22	0.034 U	0.035 U	0.035 U
Benzo(G,H,I)Perylene	100	100	1000	mg/kg	0.25 J	0.39	0.35 U	0.034 J	0.36 U	0.8 J	1.2	0.35 U	0.024 J	0.11 J	0.34 U	0.35 U	0.35 U
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	mg/kg	0.32	0.4	0.035 U	0.02 J	0.036 U	0.53	0.16	0.012 J	0.0087 J	0.11	0.034 U	0.035 U	0.035 U
Benzyl Butyl Phthalate	--	--	--	mg/kg	0.023 J	0.035 J	0.35 U	0.024 J	0.36 U	0.13 J	0.35 U	0.35 UJ	0.34 UJ	0.35 U	0.34 U	0.35 U	0.35 U
Biphenyl (Diphenyl)	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.023 J	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Bis(2-Chloroethoxy) Methane	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	mg/kg	0.037 U	0.038 U	0.035 U	0.038 U	0.036 U	0.081 U	0.035 U	0.035 UT	0.034 UT	0.035 U	0.034 U	0.035 U	0.035 U
Bis(2-Chloroisopropyl) Ether	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	mg/kg	0.061 J	0.096 J	0.35 U	0.38 U	0.36 U	0.18 J	0.35 U	0.35 U	0.072 J	0.35 U	0.34 U	0.35 U	0.35 U
Caprolactam	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Carbazole	--	--	--	mg/kg	0.088 J	0.048 J	0.35 U	0.38 U	0.36 U	0.14 J	0.081 J	0.35 U	0.34 U	0.06 J	0.34 U	0.35 U	0.35 U
Chrysene	**1**	3.9	1	mg/kg	0.65	0.75	0.35 U	0.047 J	0.026 J	1	0.31 J	0.028 J	0.34 U	0.19 J	0.34 U	0.35 U	0.35 U
Cresols, M & P	**0.33**	100	0.33	mg/kg	NA	NA	NA	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	mg/kg	0.082	0.13	0.035 U	0.038 U	0.036 U	0.12	0.15	0.035 U	0.034 U	0.03 J	0.034 U	0.035 U	0.035 U
Dibenzofuran	7	59	210	mg/kg	0.079 J	0.027 J	0.35 U	0.38 U	0.36 U	0.067 J	0.14 J	0.35 U	0.34 U	0.079 J	0.34 U	0.35 U	0.35 U
Diethyl Phthalate	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Dimethyl Phthalate	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Di-N-Butyl Phthalate	--	--	--	mg/kg	0.37 U	0.012 BJ	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Di-N-Octylphthalate	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

				Sample Designation:	RX-13	RX-14	RX-14	RX-15	RX-15	RX-16	RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6
				Sample Date:	02/26/2018	02/26/2018	07/24/2018	04/15/2019	04/17/2019	04/15/2019	04/15/2019	04/18/2019	04/18/2019	04/17/2019	04/19/2019	04/19/2019	04/19/2019
				Sample Depth (ft bls):	1 - 3	0 - 2	13 - 15	0 - 2	24 - 26	0 - 2	30 - 32	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
				Normal or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit													
Fluoranthene	100	100	1000	mg/kg	1.1	1.1	0.35 U	0.092 J	0.051 J	2.3	0.92	0.072 J	0.34 U	0.52	0.34 U	0.35 U	0.35 U
Fluorene	30	100	386	mg/kg	0.091 J	0.029 J	0.35 U	0.38 U	0.36 U	0.13 J	0.17 J	0.35 U	0.34 U	0.094 J	0.34 U	0.35 U	0.35 U
Hexachlorobenzene	0.33	1.2	3.2	mg/kg	0.037 U	0.038 U	0.035 U	0.038 U	0.036 U	0.081 U	0.035 U	0.035 U	0.034 U	0.035 U	0.034 U	0.035 U	0.035 U
Hexachlorobutadiene	--	--	--	mg/kg	0.076 U	0.077 U	0.071 U	0.076 U	0.074 U	0.17 U	0.071 U	0.072 U	0.069 U	0.07 U	0.07 U	0.07 U	0.07 U
Hexachlorocyclopentadiene	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 UJ	0.34 UJ	0.35 U	0.34 U	0.35 U	0.35 U
Hexachloroethane	--	--	--	mg/kg	0.037 U	0.038 U	0.035 U	0.038 U	0.036 UJ	0.081 U	0.035 U	0.035 U	0.034 U	0.035 U	0.034 U	0.035 U	0.035 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	mg/kg	0.27	0.39	0.035 U	0.037 J	0.036 U	**0.96**	**1.1**	0.018 J	0.016 J	0.12	0.034 U	0.035 U	0.035 U
Isophorone	--	--	--	mg/kg	0.15 U	0.15 U	0.14 U	0.15 U	0.15 U	0.33 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U	0.14 U
Naphthalene	12	100	12	mg/kg	0.085 J	0.064 J	0.35 U	0.084 J	0.065 J	0.084 J	0.21 J	0.35 U	0.34 U	0.22 J	0.34 U	0.35 U	0.35 U
Nitrobenzene	--	--	--	mg/kg	0.037 U	0.038 U	0.035 U	0.038 U	0.036 U	0.081 U	0.035 U	0.035 U	0.034 U	0.035 U	0.034 U	0.035 U	0.035 U
N-Nitrosodimethylamine	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
N-Nitrosodi-N-Propylamine	--	--	--	mg/kg	0.037 U	0.038 U	0.035 U	0.038 U	0.036 U	0.081 U	0.035 U	0.035 U	0.034 U	0.035 U	0.034 U	0.035 U	0.035 U
N-Nitrosodiphenylamine	--	--	--	mg/kg	0.37 U	0.38 U	0.35 U	0.38 U	0.36 U	0.81 U	0.35 U	0.35 U	0.34 U	0.35 U	0.34 U	0.35 U	0.35 U
Pentachlorophenol	0.8	6.7	0.8	mg/kg	0.3 U	0.31 U	0.28 U	0.3 UJ	0.29 U	0.66 UJ	0.28 UJ	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Phenanthrene	100	100	1000	mg/kg	0.86	0.48	0.35 U	0.058 J	0.051 J	1.7	1.1	0.075 J	0.34 U	0.66	0.34 U	0.35 U	0.35 U
Phenol	0.33	100	0.33	mg/kg	0.37 U	0.38 U	0.35 UT	0.38 U	0.36 U	0.81 U	0.35 U	0.35 UT	0.34 UT	0.35 U	0.34 UT	0.35 UT	0.35 UT
Pyrene	100	100	1000	mg/kg	1.1	1.1	0.35 U	0.078 J	0.044 J	1.8	0.69	0.065 J	0.34 U	0.48	0.34 U	0.35 U	0.35 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

				Sample Designation:	WC-7	WC-8
				Sample Date:	04/19/2019	04/19/2019
				Sample Depth (ft bls):	18 - 20	18 - 20
				Normal or Field Duplicate:	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit		
1,2,4,5-Tetrachlorobenzene	--	--	--	mg/kg	0.35 U	0.36 U
2,3,4,6-Tetrachlorophenol	--	--	--	mg/kg	0.35 U	0.36 U
2,4,5-Trichlorophenol	--	--	--	mg/kg	0.35 UT	0.36 UT
2,4,6-Trichlorophenol	--	--	--	mg/kg	0.14 U	0.14 U
2,4-Dichlorophenol	--	--	--	mg/kg	0.14 U	0.14 U
2,4-Dimethylphenol	--	--	--	mg/kg	0.35 U	0.36 U
2,4-Dinitrophenol	--	--	--	mg/kg	0.28 U	0.29 U
2,4-Dinitrotoluene	--	--	--	mg/kg	0.07 U	0.073 U
2,6-Dinitrotoluene	--	--	--	mg/kg	0.07 U	0.073 U
2-Chloronaphthalene	--	--	--	mg/kg	0.35 U	0.36 U
2-Chlorophenol	--	--	--	mg/kg	0.35 U	0.36 U
2-Methylnaphthalene	--	--	--	mg/kg	0.35 U	0.36 U
2-Methylphenol (O-Cresol)	0.33	100	0.33	mg/kg	0.35 U	0.36 U
2-Nitroaniline	--	--	--	mg/kg	0.35 U	0.36 U
2-Nitrophenol	--	--	--	mg/kg	0.35 U	0.36 U
3,3'-Dichlorobenzidine	--	--	--	mg/kg	0.14 UT	0.14 UT
3-Nitroaniline	--	--	--	mg/kg	0.35 UT	0.36 UT
4,6-Dinitro-2-Methylphenol	--	--	--	mg/kg	0.28 U	0.29 U
4-Bromophenyl Phenyl Ether	--	--	--	mg/kg	0.35 U	0.36 U
4-Chloro-3-Methylphenol	--	--	--	mg/kg	0.35 U	0.36 U
4-Chloroaniline	--	--	--	mg/kg	0.35 UT	0.36 UT
4-Chlorophenyl Phenyl Ether	--	--	--	mg/kg	0.35 U	0.36 U
4-Methylphenol (P-Cresol)	**0.33**	100	0.33	mg/kg	0.35 U	0.36 U
4-Nitroaniline	--	--	--	mg/kg	0.35 U	0.36 U
4-Nitrophenol	--	--	--	mg/kg	0.7 U	0.73 U
Acenaphthene	20	100	98	mg/kg	0.35 U	0.36 U
Acenaphthylene	100	100	107	mg/kg	0.35 U	0.36 U
Acetophenone	--	--	--	mg/kg	0.35 U	0.36 U
Anthracene	100	100	1000	mg/kg	0.35 U	0.36 U
Atrazine	--	--	--	mg/kg	0.14 U	0.14 U
Benzaldehyde	--	--	--	mg/kg	0.35 U	0.36 U
Benzo(A)Anthracene	**1**	1	1	mg/kg	0.035 U	0.036 U
Benzo(A)Pyrene	**1**	1	22	mg/kg	0.035 U	0.036 U
Benzo(B)Fluoranthene	**1**	1	1.7	mg/kg	0.035 U	0.036 U
Benzo(G,H,I)Perylene	100	100	1000	mg/kg	0.35 U	0.36 U
Benzo(K)Fluoranthene	**0.8**	3.9	1.7	mg/kg	0.035 U	0.036 U
Benzyl Butyl Phthalate	--	--	--	mg/kg	0.35 U	0.36 U
Biphenyl (Diphenyl)	--	--	--	mg/kg	0.35 U	0.36 U
Bis(2-Chloroethoxy) Methane	--	--	--	mg/kg	0.35 U	0.36 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	--	--	--	mg/kg	0.035 U	0.036 U
Bis(2-Chloroisopropyl) Ether	--	--	--	mg/kg	0.35 U	0.36 U
Bis(2-Ethylhexyl) Phthalate	--	--	--	mg/kg	0.35 U	0.36 U
Caprolactam	--	--	--	mg/kg	0.35 U	0.36 U
Carbazole	--	--	--	mg/kg	0.35 U	0.36 U
Chrysene	**1**	3.9	1	mg/kg	0.35 U	0.36 U
Cresols, M & P	**0.33**	100	0.33	mg/kg	0.35 U	0.36 U
Dibenz(A,H)Anthracene	**0.33**	0.33	1000	mg/kg	0.035 U	0.036 U
Dibenzofuran	7	59	210	mg/kg	0.35 U	0.36 U
Diethyl Phthalate	--	--	--	mg/kg	0.35 U	0.36 U
Dimethyl Phthalate	--	--	--	mg/kg	0.35 U	0.36 U
Di-N-Butyl Phthalate	--	--	--	mg/kg	0.35 U	0.36 U
Di-N-Octylphthalate	--	--	--	mg/kg	0.35 U	0.36 U

Table 5. Summary of Semivolatile Organic Compounds in Soil, Chestnut Commons, Brooklyn, New York

				Sample Designation:	WC-7	WC-8
				Sample Date:	04/19/2019	04/19/2019
				Sample Depth (ft bls):	18 - 20	18 - 20
				Normal or Field Duplicate:	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit		
Fluoranthene	100	100	1000	mg/kg	0.35 U	0.36 U
Fluorene	30	100	386	mg/kg	0.35 U	0.36 U
Hexachlorobenzene	0.33	1.2	3.2	mg/kg	0.035 U	0.036 U
Hexachlorobutadiene	--	--	--	mg/kg	0.07 U	0.073 U
Hexachlorocyclopentadiene	--	--	--	mg/kg	0.35 U	0.36 U
Hexachloroethane	--	--	--	mg/kg	0.035 U	0.036 U
Indeno(1,2,3-C,D)Pyrene	**0.5**	0.5	8.2	mg/kg	0.035 U	0.036 U
Isophorone	--	--	--	mg/kg	0.14 U	0.14 U
Naphthalene	12	100	12	mg/kg	0.35 U	0.36 U
Nitrobenzene	--	--	--	mg/kg	0.035 U	0.036 U
N-Nitrosodimethylamine	--	--	--	mg/kg	NA	NA
N-Nitrosodi-N-Propylamine	--	--	--	mg/kg	0.035 U	0.036 U
N-Nitrosodiphenylamine	--	--	--	mg/kg	0.35 U	0.36 U
Pentachlorophenol	0.8	6.7	0.8	mg/kg	0.28 U	0.29 U
Phenanthrene	100	100	1000	mg/kg	0.35 U	0.36 U
Phenol	0.33	100	0.33	mg/kg	0.35 UT	0.36 UT
Pyrene	100	100	1000	mg/kg	0.35 U	0.36 U

Table 6. Summary of Metals in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation:	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1	RX-1	RX-2
					Sample Date:	04/15/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018	07/25/2018	02/27/2018
					Sample Depth (ft bls):	0 - 2	26 - 28	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3	13 - 15	3 - 5
					Normal or Field Duplicate:	N	N	FD	N	N	N	N	N	N	N	N	N	N	N	N
Aluminum	--	--	--	mg/kg		6050	3150	2420	6400	3200	9700	3590	12800	2450	7940	2820	6120	7560	3170	3120
Antimony	--	--	--	mg/kg		1.2 UJ	0.86 U	0.79 U	1.1 U	1.1 U	1.1 UJ	0.9 UJ	1.1 U	1 UJ	1.2 UJ	1 UJ	3.2 U	4.2 U	3.1 U	4.6 U
Arsenic	**13**	16	16	mg/kg		**39.2**	1.7	0.8	4	1.7	4.6	1.6	4.5	0.76 J	3.8	0.82 J	2.9	4.1	2.3 U	**17.3**
Barium	350	400	820	mg/kg		131	17.6	17.2	114	21.8	75.9	30.7	75.2	11.7	46.6	19.2	92.9	156	22 J	124
Beryllium	7.2	72	47	mg/kg		0.6	0.18 J	0.22 J	0.28 J	0.2 J	0.4 J	0.16 J	0.69	0.41 U	0.47	0.42 U	0.35	0.43	0.24 J	0.45 J
Cadmium	2.5	4.3	7.5	mg/kg		0.91 J	0.86 U	0.79 U	0.64 J	1.1 U	1.1 U	0.9 U	1.1 U	1 U	1.2 U	1 U	1.5	0.77 J	0.63 U	0.93 U
Calcium	--	--	--	mg/kg		9510	1110 J	646 J	11300	1630	4260	10800	3950	526 J	1970	690	26300	26100	479 J	4740
Chromium III	30	180	--	mg/kg		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Hexavalent	1	110	19	mg/kg		2.5 U	2.1 U	2.1 U	2.3 U	2.1 U	2.3 U	2.2 U	2.3 U	2.1 U	2.5 U	2.1 U	NA	NA	NA	NA
Chromium, Total	30	180	--	mg/kg		12.5	28.5 J	8.2 J	16	11.2	15.3	26.2 J	18.2	7.5 J	16.5	21.5	10.4	17.2	9.5	10.4
Cobalt	--	--	--	mg/kg		5.6	3.2	3.3	4.9	3.2	5.1	3.8	5.2	2.5	5.1	2.8	3.3 J	5.3 J	3 J	5.8 J
Copper	**50**	270	1720	mg/kg		**57.5**	10.9	7.3	43.6	11.6	22.6	14.4	18.2	8.7	12	8	36	**56.8**	6.1	48.3
Cyanide	27	27	40	mg/kg		0.19 J	0.24 U	0.25 U	0.14 J	0.24 U	0.23 U	0.22 U	0.28 U	0.21 U	0.25 U	0.25 U	0.096 J	0.1 J	0.24 U	0.26 U
Iron	--	--	--	mg/kg		11200	11000	9300	15900	11900	15500	12100	17700	8970	14500	8430	11600	17500	10800	31700
Lead	**63**	400	450	mg/kg		**172**	9 J	2.5 J	**186**	14.4	**168**	22.3	**65**	8 J	12.4	4.2	**75**	**285**	2.5	**121**
Magnesium	--	--	--	mg/kg		3720	1230	951	3120	1660	2450	3300	2030	1010 J	2690	1050	2150	5950	816	891 J
Manganese	1600	2000	2000	mg/kg		147	214	259	239	204	199	224	274	181	359	216	177	331	231	124
Mercury	**0.18**	0.81	0.73	mg/kg		0.16	0.017 U	0.016 J	**0.19**	0.017 U	**0.36**	0.036	**0.48**	0.016 U	**0.21**	0.018 U	**0.36**	**0.25**	0.018 U	0.089
Nickel	**30**	310	130	mg/kg		14.5	8.6	6.9	14.9	7.8	11.3	9.5	10.7	11.6	12.2	7.3	16.7	16	6.3	14.5
Potassium	--	--	--	mg/kg		465	379	339	595	296	533	479	513	371	953	453	460 J	683 J	335 J	416 J
Selenium	3.9	180	4	mg/kg		1.9 J	4.3 U	4 U	0.33 J	5.3 U	0.5 J	4.5 U	0.49 J	5.2 U	5.8 U	5.2 U	3.2 U	4.2 U	3.1 U	4.6 U
Silver	**2**	180	8.3	mg/kg		1.2 U	0.86 U	0.79 U	1.1 U	1.1 U	1.1 U	0.9 U	1.1 U	1 U	1.2 U	1 U	1.6 U	2.1 U	1.6 U	2.3 U
Sodium	--	--	--	mg/kg		129	97	44.4 J	122	71.7 J	90.3 J	109	63 J	58.8 J	70.9 J	103 J	623 J	136 J	782 U	1160 U
Thallium	--	--	--	mg/kg		0.56	0.34 U	0.32 U	0.42 U	0.42 U	0.42 U	0.36 U	0.45 U	0.41 U	0.46 U	0.42 U	3.2 U	4.2 U	3.1 U	4.6 U
Vanadium	--	--	--	mg/kg		21.7	11.7	10.6	24.3	12.9	23.5	15.4	25.5	11.6	23	10	20.3	24.5	14.4	31.5
Zinc	**109**	10000	2480	mg/kg		**161**	18.5	11.7	**151**	23.3	71	30.5	**140**	12.6	**213**	13.1	101	**247**	12.5	**128**

Table 6. Summary of Metals in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-3 07/25/2018 0 - 2 N	RX-3 02/26/2018 3 - 5 N	RX-3 07/25/2018 13 - 15 N	RX-4 02/27/2018 2 - 4 N	RX-5 02/27/2018 1 - 3 N	RX-5 07/24/2018 13 - 15 N	RX-5 07/24/2018 13 - 15 FD	RX-6 07/25/2018 0 - 2 N	RX-6 02/27/2018 2 - 3.5 N	RX-6 07/25/2018 13 - 15 N	RX-7 02/26/2018 0.2 - 2.5 N	RX-7 02/26/2018 0.2 - 2.5 FD	RX-8 02/27/2018 2 - 4 N	RX-9 02/26/2018 2 - 4 N	RX-9 07/24/2018 0 - 2 N
Aluminum	--	--	--	mg/kg	9530	4650	2960	6640	7620	2970	3170	7770	7800	7650	1800	1650	9050	8370	8200
Antimony	--	--	--	mg/kg	3.6 U	4.4 U	3.4 U	4.1 U	4.3 U	3.6 U	3.9 U	3.7 U	4.3 U	3.4 U	5 U	4.8 U	4.5 U	0.76 J	4 U
Arsenic	**13**	16	16	mg/kg	8.8	**13.5**	2.5 U	3.1	4.7	2.7 U	2.9 U	3.7	4.7	5.2	10.6	8.9	5.5	4.2	3.7
Barium	350	400	820	mg/kg	186	99.6	11.7 J	58.3	138	27 J	29.1 J	125	81.8	135	86.6	75.9	132	167	164
Beryllium	7.2	72	47	mg/kg	0.59	0.34 J	0.24 J	0.36 J	0.4 J	0.25 J	0.23 J	0.51	0.47	0.47	0.38 J	0.39 J	0.51	0.33 J	0.5
Cadmium	2.5	4.3	7.5	mg/kg	1.7	0.51 J	0.68 U	0.39 J	2.1	0.72 U	0.79 U	1.5	0.27 J	0.41 J	0.79 J	0.98	1	0.37 J	0.59 J
Calcium	--	--	--	mg/kg	18900	25400	573 J	14700	15600	510 J	550 J	17300	22000	31700	2200	2420	9420	9200	10200
Chromium III	30	180	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Hexavalent	1	110	19	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Total	30	180	--	mg/kg	25.1	12.2	7.2	22.7	20.3	6.5	7	22.8	19.5	16.6	9.4	6.6	22.1	24.4	20.7
Cobalt	--	--	--	mg/kg	6.4 J	4.5 J	2.8 J	5.1 J	5.3 J	3.4 J	3.4 J	5.7 J	5.4 J	5.5 J	3 J	2.7 J	6.7 J	5.8 J	5.6 J
Copper	**50**	270	1720	mg/kg	**80**	43.6	6.4	44.5	**82.2**	7.4	8.9	**76.3**	**63.2**	34.3	38.8	37.9	**71.4**	**50.7**	**55.2**
Cyanide	27	27	40	mg/kg	0.31	0.27	0.25 U	0.097 J	0.24 U	0.24 U	0.22 U	0.13 J	0.27 U	0.36 J	0.21 J	0.3 U	0.25 U	0.11 J	0.18 J
Iron	--	--	--	mg/kg	50900	11900	10900	15700	21300	10100	7450	22900	17900	16300	22100	20000	27000	19600	19100
Lead	**63**	400	450	mg/kg	**428**	**201**	6.1	**125**	**298**	2.5	4.7	**260**	**198**	**487**	16.3	15	**270**	**217**	**251**
Magnesium	--	--	--	mg/kg	2870	6070	873	6020	2430	1120	1210	4330	3860	6470	359 J	377 J	2690	3800	3690
Manganese	1600	2000	2000	mg/kg	441	169	232	263	273	234	346	280	380	422	28.5	21.6	330	285	281
Mercury	**0.18**	0.81	0.73	mg/kg	**0.3**	0.16	0.018 U	0.13	**0.26**	0.016 U	0.016 U	**0.23**	0.15	0.14	0.035	0.03	**0.51**	**0.41**	**0.26**
Nickel	**30**	310	130	mg/kg	23.5	13.9	5.9 J	16.1	20.1	7.3	8.2	22.1	23.2	13.8	10.9	10	21.1	22.7	22.3
Potassium	--	--	--	mg/kg	690 J	494 J	226 J	768 J	635 J	247 J	223 J	570 J	817 J	670 J	345 J	280 J	754 J	638 J	576 J
Selenium	3.9	180	4	mg/kg	3.6 U	4.4 U	3.4 U	4.1 U	4.3 U	3.6 U	3.9 U	3.7 U	4.3 U	3.4 U	3.3 J	2.3 J	4.5 U	1.3 J	4 U
Silver	**2**	180	8.3	mg/kg	1.8 U	2.2 U	1.7 U	2 U	2.1 U	1.8 U	2 U	1.9 U	2.2 U	1.7 U	2.5 U	2.4 U	2.2 U	2.2 U	2 U
Sodium	--	--	--	mg/kg	90.2 J	1110 U	849 U	149 J	119 J	905 U	983 U	136 J	214 J	408 J	1250 U	1190 U	92.9 J	102 J	988 U
Thallium	--	--	--	mg/kg	3.6 U	4.4 U	3.4 U	4.1 U	4.3 U	3.6 U	3.9 U	3.7 U	4.3 U	3.4 U	5 U	4.8 U	4.5 U	4.4 U	4 U
Vanadium	--	--	--	mg/kg	34.4	19.5	12.6	26.2	26.5	11.7	9.3 J	36.6	25.9	26.3	18.8	16.9	29.4	25.9	25.2
Zinc	**109**	10000	2480	mg/kg	**415**	**204**	16.1	99.1	**215**	14.5	20.7	**221**	**133**	**213**	**542**	**538**	**184**	**209**	**188**

Table 6. Summary of Metals in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation:	RX-9	RX-9	RX-10	RX-10	RX-10	RX-11	RX-12	RX-12	RX-12	RX-13	RX-14	RX-14	RX-15	RX-15	RX-16
					Sample Date:	07/24/2018	07/24/2018	07/24/2018	02/26/2018	07/24/2018	02/27/2018	07/24/2018	02/27/2018	07/24/2018	02/26/2018	02/26/2018	07/24/2018	04/15/2019	04/17/2019	04/15/2019
					Sample Depth (ft bls):	3 - 5	13 - 15	0 - 2	2 - 4	13 - 15	3 - 5	0 - 2	1.5 - 3.5	13 - 15	1 - 3	0 - 2	13 - 15	0 - 2	24 - 26	0 - 2
					Normal or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Aluminum	--	--	--	mg/kg		5060	11900	3320	5370	2390	7530	5270	8410	4390	7060	5680	3210	3630	2790	6710
Antimony	--	--	--	mg/kg		3.9 U	4.5 U	4.5 U	0.57 J	3.8 U	4.5 U	4.2 U	4.8 U	3.7 U	0.84 J	4.3 U	4.2 U	1.1 UJ	0.84 UJ	1.2 UJ
Arsenic	**13**	16	16	mg/kg		1.6 J	2.4 J	**21.8**	10.4	2.9 U	6.3	5.1	11.7	2.8 U	4.3	7.2	3.2 U	1 J	1.1	6.8
Barium	350	400	820	mg/kg		160	124	232	93	9.5 J	138	46.9	99.6	13.5 J	138	94.6	25.4 J	18.3	21.1 J	106
Beryllium	7.2	72	47	mg/kg		0.36 J	0.98	0.86	0.35 J	0.26 J	0.4 J	0.3 J	0.23 J	0.29 J	0.43	0.28 J	0.23 J	0.25 J	0.21 J	0.34 J
Cadmium	2.5	4.3	7.5	mg/kg		0.78 U	0.89 U	0.9 U	1.4	0.77 U	1.3	0.29 J	0.68 J	0.74 U	0.31 J	0.51 J	0.85 U	0.44 J	0.84 U	1.3
Calcium	--	--	--	mg/kg		52300	49100	3020	13500	262 J	13000	31500	7870	566 J	7210	24100	418 J	1060	1290 J	19600
Chromium III	30	180	--	mg/kg		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Hexavalent	1	110	19	mg/kg		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.3 U	2.2 U	2.5 U
Chromium, Total	30	180	--	mg/kg		4.6	23	8.4	14.2	6.2	23	15.3	23.9	10.1	21.1	13.3	10.5	6.6	8.7 J	23.3
Cobalt	--	--	--	mg/kg		6.3 J	6.6 J	5.3 J	6.1 J	2.4 J	5.4 J	4.5 J	7.5 J	3.5 J	6.7 J	4.3 J	3.1 J	2.8	3.3	7
Copper	**50**	270	1720	mg/kg		**60.8**	24.4	**55.5**	**97.6**	6.1	**61.4**	38.2	47.9	7.7	**82.2**	**54.1**	5.8	10.3	8	**94**
Cyanide	27	27	40	mg/kg		0.24 U	0.25 U	0.25	0.45	0.25 U	0.094 J	0.08 J	0.29 U	0.24 U	0.15 J	0.16 J	0.23 U	0.24 U	0.22 U	0.26 U
Iron	--	--	--	mg/kg		16000	19900	23000	24300	12100	20800	18800	39900	9310	18300	14200	11100	7060	9260 J	29100
Lead	**63**	400	450	mg/kg		37.2	31.8	13.5	**269**	2.4	**452**	**75.4**	33.7	3	**226**	**274**	2.2	19.8	8.3 J	**226**
Magnesium	--	--	--	mg/kg		11300	5640	127 J	5680	767 J	4230	13200	2330	1490	3040	12700	855 J	1190	1380	7000
Manganese	1600	2000	2000	mg/kg		159	519	11.4	257	226	297	257	306	218	270	200	239	188	237	322
Mercury	**0.18**	0.81	0.73	mg/kg		0.016 U	0.11	0.021	**0.45**	0.017 U	**0.2**	0.13	0.019 U	0.017 U	0.17	0.14	0.017 U	0.031	0.018 U	**0.27**
Nickel	**30**	310	130	mg/kg		12.4	22.3	14.7	16.7	5.4 J	18.5	20.9	**75.2**	8.6	23.6	13.4	6.3 J	6.1	11 J	23.5
Potassium	--	--	--	mg/kg		589 J	1440	318 J	439 J	194 J	831 J	649 J	1500	365 J	648 J	398 J	246 J	273	456	593
Selenium	3.9	180	4	mg/kg		3.9 U	4.5 U	4.5 U	2.3 J	3.8 U	4.5 U	4.2 U	4.8 U	3.7 U	1.3 J	1.4 J	4.2 U	5.5 U	4.2 U	0.35 J
Silver	**2**	180	8.3	mg/kg		2 U	2.2 U	2.2 U	2.2 U	1.9 U	2.3 U	1 J	**7.1**	1.9 U	2.2 U	2.1 U	2.1 U	1.1 U	0.84 U	1.2 U
Sodium	--	--	--	mg/kg		425 J	155 J	1120 U	87.4 J	959 U	183 J	243 J	1020 J	928 U	96.4 J	133 J	1060 U	49.5 J	108	127
Thallium	--	--	--	mg/kg		3.9 U	4.5 U	0.77 J	4.4 U	3.8 U	4.5 U	4.2 U	4.8 U	3.7 U	4.3 U	4.3 U	4.2 U	0.44 U	0.34 U	0.48 U
Vanadium	--	--	--	mg/kg		91	37.1	25.1	20.6	9.5 J	27.4	40.2	136	12.9	24.6	33.1	12.8	8.6	10.4	27.7
Zinc	**109**	10000	2480	mg/kg		47	47.6	73.2	**488**	13.2	**244**	83.2	68	**182**	**613**	**425**	12.1	38.2	17.7	**215**

Table 6. Summary of Metals in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation: RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6	WC-7	WC-8
					Sample Date: 04/15/2019	04/18/2019	04/18/2019	04/17/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019
					Sample Depth (ft bls): 30 - 32	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
					Normal or Field Duplicate: N	N	N	N	N	N	N	N	N
Aluminum	--	--	--	mg/kg	2970	2870	2810	2520	3580	2430	2300	2690	2970
Antimony	--	--	--	mg/kg	1 UJ	0.84 U	0.81 U	0.81 U	0.81 U	0.92 UJ	0.8 U	0.8 U	0.85 U
Arsenic	**13**	16	16	mg/kg	1.6	0.84	2.5	0.71 J	1.1	0.79 J	1.2	1.4	1.3
Barium	350	400	820	mg/kg	25.2	20	20.3	10.7	10.4	17.7 J	10.2	17.7	24.5
Beryllium	7.2	72	47	mg/kg	0.27 J	0.14 J	0.23 J	0.2 J	0.33 U	0.37 U	0.32 U	0.18 J	0.22 J
Cadmium	2.5	4.3	7.5	mg/kg	1 U	0.84 U	0.81 U	0.81 U	0.81 U	0.92 U	0.8 U	0.8 U	0.85 U
Calcium	--	--	--	mg/kg	1890	432	1490	404	374	562	357	505	430
Chromium III	30	180	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA
Chromium, Hexavalent	1	110	19	mg/kg	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2.1 U	2.2 U	2.1 U	2.2 U
Chromium, Total	30	180	--	mg/kg	14.8	8.2	7.9	6.7	7.4	8.7	7.5	12.1	9.6
Cobalt	--	--	--	mg/kg	3.4	3	3.3	3	3.1	2.7	2.9	2.7	3.6
Copper	**50**	270	1720	mg/kg	14.3	6.2	9.2	4.3	5.7	7.2	7	6.5	7.3
Cyanide	27	27	40	mg/kg	0.21 U	0.22 U	0.22 U	0.21 U	0.23 U	0.21 U	0.21 U	0.22 U	0.23 U
Iron	--	--	--	mg/kg	10900	9420	11200	7140	9440	9940	10800	9480	11800
Lead	**63**	400	450	mg/kg	15.4	2.9	4.9	1.5	2.5	1.7 J	3.4	3.3	2.4
Magnesium	--	--	--	mg/kg	1120	913	1400	924	991	807 J	734	1000	1050
Manganese	1600	2000	2000	mg/kg	250	213	217	191	219	222	186	198	224
Mercury	**0.18**	0.81	0.73	mg/kg	0.018 U	0.018 U	0.016 U	0.018 U	0.017 U	0.017 U	0.016 U	0.016 U	0.017 U
Nickel	**30**	310	130	mg/kg	7.6	6.2	6.5	5.6	6.4	6.4	4.8	6.7	8.1
Potassium	--	--	--	mg/kg	335	324	334	217	299	297	194	295	285
Selenium	3.9	180	4	mg/kg	5.1 U	4.2 U	4.1 U	4 U	4.1 U	4.6 U	4 U	4 U	4.3 U
Silver	**2**	180	8.3	mg/kg	1 U	0.84 U	0.81 U	0.81 U	0.81 U	0.92 U	0.8 U	0.8 U	0.85 U
Sodium	--	--	--	mg/kg	76.3 J	31.8 J	43.3 J	48.3 J	32.6 J	56.9 J	43.3 J	44.8 J	32 J
Thallium	--	--	--	mg/kg	0.41 U	0.34 U	0.32 U	0.32 U	0.33 U	0.37 U	0.32 U	0.32 U	0.34 U
Vanadium	--	--	--	mg/kg	11.6	10.4	11.9	6.5	11.2	10.9	14.2	10.5	13.9
Zinc	**109**	10000	2480	mg/kg	46.7	15.5	22.2	12.4	16.2	11.4	11.1	13.2	14.7

Table 7. Summary of Polychlorinated Biphenyls in Soil, Chestnut Commons, Brooklyn, New York

			Sample Designation:		MW-4	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1	RX-1
			Sample Date:		04/15/2019	04/17/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018	07/25/2018
			Sample Depth (ft bls):		0 - 2	26 - 28	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3	13 - 15
			Normal or Field Duplicate:		N	N	FD	N	N	N	N	N	N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit														
PCB-1016 (Aroclor 1016)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1221 (Aroclor 1221)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1232 (Aroclor 1232)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1242 (Aroclor 1242)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1248 (Aroclor 1248)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1254 (Aroclor 1254)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1260 (Aroclor 1260)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1262 (Aroclor 1262)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
PCB-1268 (Aroclor 1268)	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U
Polychlorinated Biphenyl (PCBs)	0.1	1	3.2	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U	0.07 U

Table 7. Summary of Polychlorinated Biphenyls in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-2	RX-3	RX-3	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7	RX-7	RX-9	RX-9	RX-9
Sample Date:					02/27/2018	07/25/2018	07/25/2018	02/27/2018	07/24/2018	07/24/2018	07/25/2018	02/27/2018	07/25/2018	02/26/2018	02/26/2018	07/24/2018	02/26/2018	07/24/2018
Sample Depth (ft bls):					3 - 5	0 - 2	13 - 15	1 - 3	13 - 15	13 - 15	0 - 2	2 - 3.5	13 - 15	0.2 - 2.5	0.2 - 2.5	0 - 2	2 - 4	3 - 5
Normal or Field Duplicate:					N	N	N	N	N	FD	N	N	N	N	FD	N	N	N
PCB-1016 (Aroclor 1016)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1221 (Aroclor 1221)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1232 (Aroclor 1232)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1242 (Aroclor 1242)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1248 (Aroclor 1248)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1254 (Aroclor 1254)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1260 (Aroclor 1260)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1262 (Aroclor 1262)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
PCB-1268 (Aroclor 1268)	--	--	--	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U
Polychlorinated Biphenyl (PCBs)	0.1	1	3.2	mg/kg	0.079 U	0.076 U	0.072 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U	0.086 U	0.075 U	0.075 U	0.071 U

Table 7. Summary of Polychlorinated Biphenyls in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-9	RX-10	RX-10	RX-10	RX-12	RX-12	RX-12	RX-14	RX-15	RX-15	RX-16	RX-16	WC-1	WC-2
Sample Date:					07/24/2018	07/24/2018	02/26/2018	07/24/2018	07/24/2018	02/27/2018	07/24/2018	07/24/2018	04/15/2019	04/17/2019	04/15/2019	04/15/2019	04/18/2019	04/18/2019
Sample Depth (ft bls):					13 - 15	0 - 2	2 - 4	13 - 15	0 - 2	1.5 - 3.5	13 - 15	13 - 15	0 - 2	24 - 26	0 - 2	30 - 32	18 - 20	18 - 20
Normal or Field Duplicate:					N	N	N	N	N	N	N	N	N	N	N	N	N	N
PCB-1016 (Aroclor 1016)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1221 (Aroclor 1221)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1232 (Aroclor 1232)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1242 (Aroclor 1242)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1248 (Aroclor 1248)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1254 (Aroclor 1254)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1260 (Aroclor 1260)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.062 J	0.071 U	0.072 U	0.07 U
PCB-1262 (Aroclor 1262)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
PCB-1268 (Aroclor 1268)	--	--	--	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U
Polychlorinated Biphenyl (PCBs)	0.1	1	3.2	mg/kg	0.075 U	0.076 U	0.074 U	0.07 U	0.073 U	0.082 U	0.07 U	0.071 U	0.076 U	0.074 U	0.062 J	0.071 U	0.072 U	0.07 U

Table 7. Summary of Polychlorinated Biphenyls in Soil, Chestnut Commons, Brooklyn, New York

			Sample Designation:		WC-3	WC-4	WC-5	WC-6	WC-7	WC-8
			Sample Date:		04/17/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019	04/19/2019
			Sample Depth (ft bls):		18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
			Normal or Field Duplicate:		N	N	N	N	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit						
PCB-1016 (Aroclor 1016)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1221 (Aroclor 1221)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1232 (Aroclor 1232)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1242 (Aroclor 1242)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1248 (Aroclor 1248)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1254 (Aroclor 1254)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1260 (Aroclor 1260)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1262 (Aroclor 1262)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
PCB-1268 (Aroclor 1268)	--	--	--	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U
Polychlorinated Biphenyl (PCBs)	0.1	1	3.2	mg/kg	0.07 U	0.07 U	0.07 U	0.07 U	0.071 U	0.073 U

Table 8. Summary of Pesticides and Herbicides in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	MW-4	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1
Sample Designation:					MW-4	MW-4	MW-4	MW-5	MW-5	MW-6	MW-6	MW-7	MW-7	MW-8	MW-8	RX-1	RX-1
Sample Date:					04/15/2019	04/17/2019	04/17/2019	04/16/2019	04/16/2019	04/15/2019	04/18/2019	04/16/2019	04/16/2019	04/15/2019	04/15/2019	07/25/2018	02/27/2018
Sample Depth (ft bls):					0 - 2	26 - 28	26 - 28	0 - 2	28 - 30	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	30 - 32	0 - 2	1.5 - 3
Normal or Field Duplicate:					N	N	FD	N	N	N	N	N	N	N	N	N	N
2,4-D (Dichlorophenoxyacetic Acid)	--	--	--	mg/kg	0.04 U	0.037 U	0.036 U	0.038 U	0.035 U	0.038 U	0.036 U	0.038 U	0.035 U	0.041 U	0.036 U	NA	NA
Acetic acid, (2,4,5-trichlorophenoxy)-	--	--	--	mg/kg	0.04 U	0.037 U	0.036 U	0.038 U	0.035 U	0.038 U	0.036 U	0.038 U	0.035 U	0.041 U	0.036 U	NA	NA
Aldrin	0.005	0.097	0.19	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	mg/kg	0.0024 U	0.0022 U	0.0021 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0023 U	0.0021 U	0.0024 U	0.0021 U	0.0021 U	0.0022 U
Alpha Endosulfan	2.4	24	102	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	mg/kg	0.0024 U	0.0022 U	0.0021 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0023 U	0.0021 U	0.0024 U	0.0021 U	0.0021 U	0.0022 U
Beta Endosulfan	2.4	24	102	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Chlordane	--	--	--	mg/kg	0.71	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.11
cis-Chlordane	0.094	4.2	2.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	mg/kg	0.0024 U	0.0022 U	0.0021 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0023 U	0.0021 U	0.0024 U	0.0021 U	0.0021 U	0.0022 U
Dieldrin	**0.005**	0.2	0.1	mg/kg	0.0024 U	0.0036	0.0021 U	0.0041 J	0.0021 U	0.0023 U	0.0022 U	0.0023 U	0.0021 U	0.0024 U	0.0021 U	0.0021 U	0.0022 U
Endosulfan Sulfate	2.4	24	1000	mg/kg	0.0081 UT	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 UT	0.0073 U	0.0077 U	0.0069 U	0.0081 UT	0.0071 UT	0.0071 U	0.0074 U
Endrin	0.014	11	0.06	mg/kg	0.0081 UT	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 UT	0.0073 U	0.0077 U	0.0069 U	0.0081 UT	0.0071 UT	0.0071 U	0.0074 U
Endrin Aldehyde	--	--	--	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Endrin Ketone	--	--	--	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	mg/kg	0.0024 U	0.0022 U	0.0021 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0023 U	0.0021 U	0.0024 U	0.0021 U	0.0021 U	0.0022 U
Heptachlor	0.042	2.1	0.38	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Heptachlor Epoxide	--	--	--	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
Methoxychlor	--	--	--	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
4,4'-DDD	**0.0033**	13	14	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
4,4'-DDE	**0.0033**	8.9	17	mg/kg	0.0032 J	0.0074 U	0.0072 U	0.0077 U	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	0.0071 U	0.0074 U
4,4'-DDT	**0.0033**	7.9	136	mg/kg	**0.012 J**	0.0074 U	0.0072 U	**0.019**	0.0071 U	0.0076 U	**0.005 J**	0.0077 U	0.0069 U	0.0081 U	0.0071 U	**0.0052 J**	**0.0068 J**
Silvex (2,4,5-TP)	3.8	100	3.8	mg/kg	0.04 U	0.037 U	0.036 U	0.038 U	0.035 U	0.038 U	0.036 U	0.038 U	0.035 U	0.041 U	0.036 U	NA	NA
Toxaphene	--	--	--	mg/kg	0.081 U	0.074 U	0.072 U	0.077 U	0.071 U	0.076 U	0.073 U	0.077 U	0.069 U	0.081 U	0.071 U	0.071 U	0.074 U
trans-Chlordane	--	--	--	mg/kg	0.0081 U	0.0074 U	0.0072 U	0.0043 J	0.0071 U	0.0076 U	0.0073 U	0.0077 U	0.0069 U	0.0081 U	0.0071 U	NA	NA

Table 8. Summary of Pesticides and Herbicides in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-1	RX-2	RX-3	RX-3	RX-3	RX-4	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7
Sample Designation:					RX-1	RX-2	RX-3	RX-3	RX-3	RX-4	RX-5	RX-5	RX-5	RX-6	RX-6	RX-6	RX-7
Sample Date:					07/25/2018	02/27/2018	07/25/2018	02/26/2018	07/25/2018	02/27/2018	02/27/2018	07/24/2018	07/24/2018	07/25/2018	02/27/2018	07/25/2018	02/26/2018
Sample Depth (ft bls):					13 - 15	3 - 5	0 - 2	3 - 5	13 - 15	2 - 4	1 - 3	13 - 15	13 - 15	0 - 2	2 - 3.5	13 - 15	0.2 - 2.5
Normal or Field Duplicate:					N	N	N	N	N	N	N	N	FD	N	N	N	N
2,4-D (Dichlorophenoxyacetic Acid)	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetic acid, (2,4,5-trichlorophenoxy)-	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.005	0.097	0.19	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	mg/kg	0.0021 U	0.0024 U	0.0023 U	0.0023 U	0.0021 U	0.0022 U	0.0023 U	0.0021 U	0.0021 U	0.0023 U	0.0023 U	0.0022 U	0.0025 U
Alpha Endosulfan	2.4	24	102	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	mg/kg	0.0021 U	0.0024 U	0.0023 U	0.0023 U	0.0021 U	0.0022 U	0.0023 U	0.0021 U	0.0021 U	0.0023 U	0.0023 U	0.0022 U	0.0025 U
Beta Endosulfan	2.4	24	102	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Chlordane	--	--	--	mg/kg	0.07 U	0.079 U	0.27	0.078 U	0.25	0.074 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U
cis-Chlordane	0.094	4.2	2.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	mg/kg	0.0021 U	0.0024 U	0.0023 U	0.0023 U	0.0021 U	0.0022 U	0.0023 U	0.0021 U	0.0021 U	0.0023 U	0.0023 U	0.0022 U	0.0025 U
Dieldrin	**0.005**	0.2	0.1	mg/kg	0.0021 U	0.0024 U	0.0023 U	**0.031**	0.0021 U	0.0022 U	0.0023 U	0.0021 U	0.0021 U	0.0023 U	0.0023 U	0.0022 U	0.0025 U
Endosulfan Sulfate	2.4	24	1000	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Endrin	0.014	11	0.06	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Endrin Aldehyde	--	--	--	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Endrin Ketone	--	--	--	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	mg/kg	0.0021 U	0.0024 U	0.0023 U	0.0023 U	0.0021 U	0.0022 U	0.0023 U	0.0021 U	0.0021 U	0.0023 U	0.0023 U	0.0022 U	0.0025 U
Heptachlor	0.042	2.1	0.38	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Heptachlor Epoxide	--	--	--	mg/kg	0.007 U	0.0079 U	0.006 J	0.0078 U	0.0057 J	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
Methoxychlor	--	--	--	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
4,4'-DDD	**0.0033**	13	14	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	0.0076 U	0.0074 U	0.0084 U
4,4'-DDE	**0.0033**	8.9	17	mg/kg	0.007 U	0.0079 U	0.0076 U	0.0078 U	0.0072 U	0.0074 U	0.0076 U	0.0069 U	0.0069 U	0.0078 U	**0.0078**	0.0074 U	0.0084 U
4,4'-DDT	**0.0033**	7.9	136	mg/kg	0.007 U	**0.0079**	**0.016**	**0.0046 J**	**0.015**	**0.0042 J**	**0.0089**	0.0069 U	0.0069 U	0.0078 U	**0.08**	**0.011**	0.0084 U
Silvex (2,4,5-TP)	3.8	100	3.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	--	--	--	mg/kg	0.07 U	0.079 U	0.076 U	0.078 U	0.072 U	0.074 U	0.076 U	0.069 U	0.069 U	0.078 U	0.076 U	0.074 U	0.084 U
trans-Chlordane	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 8. Summary of Pesticides and Herbicides in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	RX-7	RX-8	RX-9	RX-9	RX-9	RX-9	RX-10	RX-10	RX-10	RX-11	RX-12	RX-12	RX-12
Sample Date:					02/26/2018	02/27/2018	07/24/2018	02/26/2018	07/24/2018	07/24/2018	07/24/2018	02/26/2018	07/24/2018	02/27/2018	07/24/2018	02/27/2018	07/24/2018
Sample Depth (ft bls):					0.2 - 2.5	2 - 4	0 - 2	2 - 4	3 - 5	13 - 15	0 - 2	2 - 4	13 - 15	3 - 5	0 - 2	1.5 - 3.5	13 - 15
Normal or Field Duplicate:					FD	N	N	N	N	N	N	N	N	N	N	N	N
2,4-D (Dichlorophenoxyacetic Acid)	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Acetic acid, (2,4,5-trichlorophenoxy)-	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aldrin	0.005	0.097	0.19	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	mg/kg	0.0026 U	0.0023 U	0.0022 U	0.0022 U	0.0021 U	0.0022 U	0.0023 U	0.0022 U	0.0021 U	0.0023 U	0.0022 U	0.0024 U	0.0021 U
Alpha Endosulfan	2.4	24	102	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	mg/kg	0.0026 U	0.0023 U	0.0022 U	0.0022 U	0.0021 U	0.0022 U	0.0023 U	0.0022 U	0.0021 U	0.0023 U	0.0022 U	0.0024 U	0.0021 U
Beta Endosulfan	2.4	24	102	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Chlordane	--	--	--	mg/kg	0.086 U	0.077 U	0.075 U	0.075 U	0.071 U	0.075 U	0.076 U	0.074 U	0.07 U	0.077 U	0.073 U	0.082 U	0.07 U
cis-Chlordane	0.094	4.2	2.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	mg/kg	0.0026 U	0.0023 U	0.0022 U	0.0022 U	0.0021 U	0.0022 U	0.0023 U	0.0022 U	0.0021 U	0.0023 U	0.0022 U	0.0024 U	0.0021 U
Dieldrin	**0.005**	0.2	0.1	mg/kg	0.0026 U	0.0023 U	0.0022 U	0.0022 U	0.0021 U	0.0022 U	0.0023 U	0.0022 U	0.0021 U	0.0023 U	0.0022 U	0.0024 U	0.0021 U
Endosulfan Sulfate	2.4	24	1000	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Endrin	0.014	11	0.06	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Endrin Aldehyde	--	--	--	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Endrin Ketone	--	--	--	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	mg/kg	0.0026 U	0.0023 U	0.0022 U	0.0022 U	0.0021 U	0.0022 U	0.0023 U	0.0022 U	0.0021 U	0.0023 U	0.0022 U	0.0024 U	0.0021 U
Heptachlor	0.042	2.1	0.38	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Heptachlor Epoxide	--	--	--	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
Methoxychlor	--	--	--	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
4,4'-DDD	**0.0033**	13	14	mg/kg	**0.0037 J**	0.0077 U	0.0075 U	**0.0069 J**	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	0.0077 U	0.0073 U	0.0082 U	0.007 U
4,4'-DDE	**0.0033**	8.9	17	mg/kg	0.0086 U	0.0077 U	0.0075 U	0.0075 U	0.0071 U	0.0075 U	0.0076 U	0.0074 U	0.007 U	**0.0048 J**	0.0073 U	0.0082 U	0.007 U
4,4'-DDT	**0.0033**	7.9	136	mg/kg	0.0086 U	**0.012**	**0.011 J**	**0.011**	0.0031 J	0.0075 U	0.0076 U	0.0074 U	0.007 U	**0.037**	**0.006 J**	0.0082 U	0.007 U
Silvex (2,4,5-TP)	3.8	100	3.8	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Toxaphene	--	--	--	mg/kg	0.086 U	0.077 U	0.075 U	0.075 U	0.071 U	0.075 U	0.076 U	0.074 U	0.07 U	0.077 U	0.073 U	0.082 U	0.07 U
trans-Chlordane	--	--	--	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 8. Summary of Pesticides and Herbicides in Soil, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit	Sample Designation:	RX-13	RX-14	RX-14	RX-15	RX-15	RX-16	RX-16	WC-1	WC-2	WC-3	WC-4	WC-5	WC-6
					Sample Date:	02/26/2018	02/26/2018	07/24/2018	04/15/2019	04/17/2019	04/15/2019	04/15/2019	04/18/2019	04/18/2019	04/17/2019	04/19/2019	04/19/2019	04/19/2019
					Sample Depth (ft bls):	1 - 3	0 - 2	13 - 15	0 - 2	24 - 26	0 - 2	30 - 32	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20	18 - 20
					Normal or Field Duplicate:	N	N	N	N	N	N	N	N	N	N	N	N	N
2,4-D (Dichlorophenoxyacetic Acid)	--	--	--	mg/kg	NA	NA	NA	0.038 U	0.037 U	0.041 U	0.035 U	0.036 U	0.035 U	0.035 U	0.035 U	0.035 U	0.035 U
Acetic acid, (2,4,5-trichlorophenoxy)-	--	--	--	mg/kg	NA	NA	NA	0.038 U	0.037 U	0.041 U	0.035 U	0.036 U	0.035 U	0.035 U	0.035 U	0.035 U	0.035 U
Aldrin	0.005	0.097	0.19	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	mg/kg	0.0023 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0025 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Alpha Endosulfan	2.4	24	102	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	mg/kg	0.0023 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0025 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Beta Endosulfan	2.4	24	102	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Chlordane	--	--	--	mg/kg	0.076 U	0.077 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
cis-Chlordane	0.094	4.2	2.9	mg/kg	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	mg/kg	0.0023 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0025 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Dieldrin	**0.005**	0.2	0.1	mg/kg	0.0023 U	0.0023 U	0.0021 U	0.0023 U	0.0038	0.0025 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Endosulfan Sulfate	2.4	24	1000	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 UT	0.0074 UJ	0.0083 UT	0.0071 UT	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Endrin	0.014	11	0.06	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 UT	0.0074 U	0.0083 UT	0.0071 UT	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Endrin Aldehyde	--	--	--	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 UJ	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Endrin Ketone	--	--	--	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 UJ	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	mg/kg	0.0023 U	0.0023 U	0.0021 U	0.0023 U	0.0022 U	0.0025 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U	0.0021 U
Heptachlor	0.042	2.1	0.38	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Heptachlor Epoxide	--	--	--	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
Methoxychlor	--	--	--	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
4,4'-DDD	**0.0033**	13	14	mg/kg	0.0076 U	**0.0072 J**	0.0071 U	0.0076 U	0.0074 U	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
4,4'-DDE	**0.0033**	8.9	17	mg/kg	0.0076 U	0.0077 U	0.0071 U	0.0076 U	**0.0035 J**	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U
4,4'-DDT	**0.0033**	7.9	136	mg/kg	**0.009**	**0.0038 J**	0.0071 U	0.0076 U	**0.0087**	**0.027**	**0.0037 J**	0.0072 U	0.007 U	**0.0035 J**	0.007 U	0.007 U	0.007 U
Silvex (2,4,5-TP)	3.8	100	3.8	mg/kg	NA	NA	NA	0.038 U	0.037 U	0.041 U	0.035 U	0.036 U	0.035 U	0.035 U	0.035 U	0.035 U	0.035 U
Toxaphene	--	--	--	mg/kg	0.076 U	0.077 U	0.071 U	0.076 U	0.074 U	0.083 U	0.071 U	0.072 U	0.07 U	0.07 U	0.07 U	0.07 U	0.07 U
trans-Chlordane	--	--	--	mg/kg	NA	NA	NA	0.0076 U	0.0022 J	0.0083 U	0.0071 U	0.0072 U	0.007 U	0.007 U	0.007 U	0.007 U	0.007 U

Table 8. Summary of Pesticides and Herbicides in Soil, Chestnut Commons, Brooklyn, New York

				Sample Designation:	WC-7	WC-8
				Sample Date:	04/19/2019	04/19/2019
				Sample Depth (ft bls):	18 - 20	18 - 20
				Normal or Field Duplicate:	N	N
Parameter	NYSDEC Unrestricted Use SCO	NYSDEC Restricted Residential SCO	NYSDEC Protection of Groundwater SCO	Unit		
2,4-D (Dichlorophenoxyacetic Acid)	--	--	--	mg/kg	0.035 U	0.036 U
Acetic acid, (2,4,5-trichlorophenoxy)-	--	--	--	mg/kg	0.035 U	0.036 U
Aldrin	0.005	0.097	0.19	mg/kg	0.0071 U	0.0073 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	0.02	0.48	0.02	mg/kg	0.0021 U	0.0022 U
Alpha Endosulfan	2.4	24	102	mg/kg	0.0071 U	0.0073 U
Beta Bhc (Beta Hexachlorocyclohexane)	0.036	0.36	0.09	mg/kg	0.0021 U	0.0022 U
Beta Endosulfan	2.4	24	102	mg/kg	0.0071 U	0.0073 U
Chlordane	--	--	--	mg/kg	0.071 U	0.073 U
cis-Chlordane	0.094	4.2	2.9	mg/kg	NA	NA
Delta BHC (Delta Hexachlorocyclohexane)	0.04	100	0.25	mg/kg	0.0021 U	0.0022 U
Dieldrin	**0.005**	0.2	0.1	mg/kg	0.0021 U	0.0022 U
Endosulfan Sulfate	2.4	24	1000	mg/kg	0.0071 U	0.0073 U
Endrin	0.014	11	0.06	mg/kg	0.0071 U	0.0073 U
Endrin Aldehyde	--	--	--	mg/kg	0.0071 U	0.0073 U
Endrin Ketone	--	--	--	mg/kg	0.0071 U	0.0073 U
Gamma Bhc (Lindane)	0.1	1.3	0.1	mg/kg	0.0021 U	0.0022 U
Heptachlor	0.042	2.1	0.38	mg/kg	0.0071 U	0.0073 U
Heptachlor Epoxide	--	--	--	mg/kg	0.0071 U	0.0073 U
Methoxychlor	--	--	--	mg/kg	0.0071 U	0.0073 U
4,4'-DDD	**0.0033**	13	14	mg/kg	0.0071 U	0.0073 U
4,4'-DDE	**0.0033**	8.9	17	mg/kg	0.0071 U	0.0073 U
4,4'-DDT	**0.0033**	7.9	136	mg/kg	0.0071 U	0.0073 U
Silvex (2,4,5-TP)	3.8	100	3.8	mg/kg	0.035 U	0.036 U
Toxaphene	--	--	--	mg/kg	0.071 U	0.073 U
trans-Chlordane	--	--	--	mg/kg	0.0071 U	0.0073 U

Table 9. Summary of Volatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit	Sample Designation:	MW-1	MW-2	MW-3	MW-4	MW-4	MW-5	MW-6	MW-7	MW-8
				Sample Date:	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019
				Normal or Field Duplicate:	N	FD	N	N	N	FD	N	N	N	N
1,1,1-Trichloroethane (TCA)	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2,2-Tetrachloroethane	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	--	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1,2-Trichloroethane	1	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethane	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,1-Dichloroethene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,3-Trichlorobenzene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2,4-Trichlorobenzene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromo-3-Chloropropane	0.04	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane (Ethylene Dibromide)	--	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichlorobenzene	3	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethane	0.6	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloropropane	1	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,3-Dichlorobenzene	3	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dichlorobenzene	3	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,4-Dioxane (P-Dioxane)	--	--	µg/L		50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U	50 U
2-Hexanone	--	50	µg/L		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Acetone	--	50	µg/L		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Benzene	1	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromochloromethane	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromodichloromethane	--	50	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	0.66 J
Bromoform	--	50	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Bromomethane	5	--	µg/L		1 UJ	1 UJ	1 UJ	1 UJ	1 U	1 U	1 U	1 U	1 UJ	1 U
Carbon Disulfide	--	60	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbon Tetrachloride	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chlorobenzene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroethane	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Chloroform	**7**	--	µg/L		1.6	1.5	3.5	1.5	**18**	**18**	2.3	3.8	**14**	**23**
Chloromethane	--	--	µg/L		1 U	1 U	0.41 J	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,2-Dichloroethylene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cis-1,3-Dichloropropene	--	5	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Cyclohexane	--	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	--	50	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dichlorodifluoromethane	5	--	µg/L		1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Isopropylbenzene (Cumene)	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
m,p-Xylene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methyl Acetate	--	--	µg/L		5 UT	5 UT	5 UT	5 UT	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Ethyl Ketone (2-Butanone)	--	50	µg/L		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	--	--	µg/L		5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Methylcyclohexane	--	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Methylene Chloride	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
O-Xylene (1,2-Dimethylbenzene)	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Styrene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tert-Butyl Methyl Ether	--	10	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Tetrachloroethylene (PCE)	**5**	--	µg/L		0.43 J	0.31 J	**22**	0.74 J	1.9	1.8	4.7	1.6	**7.3**	**6.2**
Toluene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,2-Dichloroethene	5	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trans-1,3-Dichloropropene	--	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U
Trichloroethylene (TCE)	**5**	--	µg/L		1 U	1 U	2.1	**5.4**	0.37 J	0.35 J	0.46 J	3.3	2.1	1.4
Trichlorofluoromethane	5	--	µg/L		1 U	1 U	1 U	1 U	1 UJ	1 U	1 U	1 U	1 U	1 U
Vinyl Chloride	2	--	µg/L		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U

Table 10. Summary of Semivolatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-1	MW-1	MW-2	MW-3	MW-4	MW-4
			Sample Date:	07/25/2018	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	FD	N	N	N	FD
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit						
1,2,4,5-Tetrachlorobenzene	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
1,4-Dioxane (P-Dioxane)	--	--	µg/L	NA	NA	NA	NA	0.2 U	0.2 U
2,3,4,6-Tetrachlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	--	50	µg/L	10 UT	10 UT	10 UT	10 UT	10 U	10 U
2,4-Dinitrophenol	--	10	µg/L	21 U	21 U	21 U	21 U	20 U	20 U
2,4-Dinitrotoluene	5	--	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U
2,6-Dinitrotoluene	5	--	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U
2-Chloronaphthalene	--	10	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2-Chlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylnaphthalene	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2-Methylphenol (O-Cresol)	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitroaniline	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
2-Nitrophenol	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	5	--	µg/L	10 U	10 U	10 UJ	10 U	10 U	10 U
3-Nitroaniline	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4,6-Dinitro-2-Methylphenol	--	--	µg/L	21 U	21 U	21 U	21 U	20 U	20 U
4-Bromophenyl Phenyl Ether	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Chloroaniline	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Chlorophenyl Phenyl Ether	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Methylphenol (P-Cresol)	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitroaniline	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
4-Nitrophenol	--	--	µg/L	21 U	21 U	21 U	21 U	20 UT	20 UT
Acenaphthene	--	20	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Acenaphthylene	--	20	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Acetophenone	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Anthracene	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Atrazine	--	--	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 UT	2 UT

Table 10. Summary of Semivolatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-1	MW-1	MW-2	MW-3	MW-4	MW-4
			Sample Date:	07/25/2018	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	FD	N	N	N	FD
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit						
Benzaldehyde	--	--	µg/L	10 U	10 U	10 U	10 U	10 UT	10 UT
Benzo(A)Anthracene	--	0.002	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Benzo(A)Pyrene	0	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Benzo(B)Fluoranthene	--	0.002	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Benzo(G,H,I)Perylene	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Benzo(K)Fluoranthene	--	0.002	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Benzyl Butyl Phthalate	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Biphenyl (Diphenyl)	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-Chloroethoxy) Methane	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	1	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Bis(2-Chloroisopropyl) Ether	5	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Bis(2-Ethylhexyl) Phthalate	**5**	--	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Caprolactam	--	--	µg/L	10 U	10 U	10 U	10 U	10 UT	10 UT
Carbazole	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Chrysene	--	0.002	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Dibenz(A,H)Anthracene	--	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Dibenzofuran	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Diethyl Phthalate	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Dimethyl Phthalate	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Di-N-Butyl Phthalate	50	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Di-N-Octylphthalate	--	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Fluoranthene	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Fluorene	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Hexachlorobenzene	0.04	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorocyclopentadiene	5	--	µg/L	10 UT	10 UT	10 UT	10 UT	10 U	10 U
Hexachloroethane	5	--	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 UT	2 UT
Indeno(1,2,3-C,D)Pyrene	--	0.002	µg/L	2.1 U	2.1 U	2.1 U	2.1 U	2 U	2 U
Isophorone	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Naphthalene	--	10	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Nitrobenzene	0.4	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U

Table 10. Summary of Semivolatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-1	MW-1	MW-2	MW-3	MW-4	MW-4
			Sample Date:	07/25/2018	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	FD	N	N	N	FD
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit						
N-Nitrosodi-N-Propylamine	--	--	µg/L	1 U	1 U	1 U	1 U	1 U	1 U
N-Nitrosodiphenylamine	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Pentachlorophenol	1	--	µg/L	21 U	21 U	21 U	21 U	20 U	20 U
Phenanthrene	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Phenol	1	--	µg/L	10 U	10 U	10 U	10 U	10 U	10 U
Pyrene	--	50	µg/L	10 U	10 U	10 U	10 U	10 U	10 U

Table 10. Summary of Semivolatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-5	MW-6	MW-7	MW-8
			Sample Date:	04/30/2019	04/30/2019	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	N	N	N
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit				
1,2,4,5-Tetrachlorobenzene	--	--	µg/L	10 U	10 U	10 U	10 U
1,4-Dioxane (P-Dioxane)	--	--	µg/L	0.2 U	0.64	0.2 U	0.2 U
2,3,4,6-Tetrachlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U
2,4,5-Trichlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U
2,4,6-Trichlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U
2,4-Dichlorophenol	5	--	µg/L	10 U	10 U	10 U	10 U
2,4-Dimethylphenol	--	50	µg/L	10 U	10 U	10 U	10 U
2,4-Dinitrophenol	--	10	µg/L	20 U	20 U	20 U	20 U
2,4-Dinitrotoluene	5	--	µg/L	2 U	2 U	2 U	2 U
2,6-Dinitrotoluene	5	--	µg/L	2 U	2 U	2 U	2 U
2-Chloronaphthalene	--	10	µg/L	10 U	10 U	10 U	10 U
2-Chlorophenol	--	--	µg/L	10 U	10 U	10 U	10 U
2-Methylnaphthalene	--	--	µg/L	10 U	10 U	10 U	10 U
2-Methylphenol (O-Cresol)	--	--	µg/L	10 U	10 U	10 U	10 U
2-Nitroaniline	5	--	µg/L	10 U	10 U	10 U	10 U
2-Nitrophenol	--	--	µg/L	10 U	10 U	10 U	10 U
3,3'-Dichlorobenzidine	5	--	µg/L	10 U	10 U	10 U	10 U
3-Nitroaniline	5	--	µg/L	10 U	10 U	10 U	10 U
4,6-Dinitro-2-Methylphenol	--	--	µg/L	20 U	20 U	20 U	20 U
4-Bromophenyl Phenyl Ether	--	--	µg/L	10 U	10 U	10 U	10 U
4-Chloro-3-Methylphenol	--	--	µg/L	10 U	10 U	10 U	10 U
4-Chloroaniline	5	--	µg/L	10 U	10 U	10 U	10 U
4-Chlorophenyl Phenyl Ether	--	--	µg/L	10 U	10 U	10 U	10 U
4-Methylphenol (P-Cresol)	--	--	µg/L	10 U	10 U	10 U	10 U
4-Nitroaniline	5	--	µg/L	10 U	10 U	10 U	10 U
4-Nitrophenol	--	--	µg/L	20 UT	20 UT	20 UT	20 UT
Acenaphthene	--	20	µg/L	10 U	10 U	10 U	10 U
Acenaphthylene	--	20	µg/L	10 U	10 U	10 U	10 U
Acetophenone	--	--	µg/L	10 U	10 U	10 U	10 U
Anthracene	--	50	µg/L	10 U	10 U	10 U	10 U
Atrazine	--	--	µg/L	2 UT	2 UT	2 UT	2 UT

Table 10. Summary of Semivolatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-5	MW-6	MW-7	MW-8
			Sample Date:	04/30/2019	04/30/2019	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	N	N	N
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit				
Benzaldehyde	--	--	µg/L	10 UT	10 UT	10 UT	10 UT
Benzo(A)Anthracene	--	0.002	µg/L	1 U	1 U	1 U	1 U
Benzo(A)Pyrene	0	--	µg/L	1 U	1 U	1 U	1 U
Benzo(B)Fluoranthene	--	0.002	µg/L	2 U	2 U	2 U	2 U
Benzo(G,H,I)Perylene	--	--	µg/L	10 U	10 U	10 U	10 U
Benzo(K)Fluoranthene	--	0.002	µg/L	1 U	1 U	1 U	1 U
Benzyl Butyl Phthalate	--	50	µg/L	10 U	10 U	10 U	10 U
Biphenyl (Diphenyl)	--	--	µg/L	10 U	10 U	10 U	10 U
Bis(2-Chloroethoxy) Methane	5	--	µg/L	10 U	10 U	10 U	10 U
Bis(2-Chloroethyl) Ether (2-Chloroethyl Ether)	1	--	µg/L	1 U	1 U	1 U	1 U
Bis(2-Chloroisopropyl) Ether	5	--	µg/L	10 U	10 U	10 U	10 U
Bis(2-Ethylhexyl) Phthalate	**5**	--	µg/L	2 U	**18**	2 U	2 U
Caprolactam	--	--	µg/L	10 UT	10 UT	10 UT	10 UT
Carbazole	--	--	µg/L	10 U	10 U	10 U	10 U
Chrysene	--	0.002	µg/L	2 U	2 U	2 U	2 U
Dibenz(A,H)Anthracene	--	--	µg/L	1 U	1 U	1 U	1 U
Dibenzofuran	--	--	µg/L	10 U	10 U	10 U	10 U
Diethyl Phthalate	--	50	µg/L	10 U	10 U	10 U	10 U
Dimethyl Phthalate	--	50	µg/L	10 U	10 U	10 U	10 U
Di-N-Butyl Phthalate	50	--	µg/L	10 U	10 U	10 U	10 U
Di-N-Octylphthalate	--	--	µg/L	10 U	10 U	10 U	10 U
Fluoranthene	--	50	µg/L	10 U	10 U	10 U	10 U
Fluorene	--	50	µg/L	10 U	10 U	10 U	10 U
Hexachlorobenzene	0.04	--	µg/L	1 U	1 U	1 U	1 U
Hexachlorobutadiene	0.5	--	µg/L	1 U	1 U	1 U	1 U
Hexachlorocyclopentadiene	5	--	µg/L	10 U	10 U	10 U	10 U
Hexachloroethane	5	--	µg/L	2 UT	2 UT	2 UT	2 UT
Indeno(1,2,3-C,D)Pyrene	--	0.002	µg/L	2 U	2 U	2 U	2 U
Isophorone	--	50	µg/L	10 U	10 U	10 U	10 U
Naphthalene	--	10	µg/L	10 U	10 U	10 U	10 U
Nitrobenzene	0.4	--	µg/L	1 U	1 U	1 U	1 U

Table 10. Summary of Semivolatile Organic Compounds in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-5	MW-6	MW-7	MW-8
			Sample Date:	04/30/2019	04/30/2019	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	N	N	N
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit				
N-Nitrosodi-N-Propylamine	--	--	µg/L	1 U	1 U	1 U	1 U
N-Nitrosodiphenylamine	--	50	µg/L	10 U	10 U	10 U	10 U
Pentachlorophenol	1	--	µg/L	20 U	20 U	20 U	20 U
Phenanthrene	--	50	µg/L	10 U	10 U	10 U	10 U
Phenol	1	--	µg/L	10 U	10 U	10 U	10 U
Pyrene	--	50	µg/L	10 U	10 U	10 U	10 U

Table 11. Summary of Metals in Groundwater, Chestnut Commons, Brooklyn, New York

Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit	Sample Designation:	MW-1	MW-1	MW-1	MW-1	MW-2	MW-2	MW-3	MW-3	MW-4	MW-4	MW-4	MW-4	MW-5	MW-5	MW-6
				Sample Date:	07/25/2018	07/25/2018	07/25/2018	07/25/2018	07/25/2018	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019
				Normal or Field Duplicate:	N	N	FD	FD	N	N	N	N	N	N	FD	FD	N	N	N
					Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total	Dissolved	Total
Aluminum	--	--	µg/L		515 J	40 UJ	98.3 J	40 UJ	569	40 UJ	104000	40 UJ	40 U	40 UJ	40 U	40 UJ	28.5 J	40 UJ	9810
Antimony	3	--	µg/L		2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U
Arsenic	25	--	µg/L		2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	24.3	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	3.8
Barium	1000	--	µg/L		35.1	31 J	33	30.8 J	57.6	52 J	759	44.1 J	9	9.8 J	10.1	10.6 J	49.7	52.6 J	154
Beryllium	--	**3**	µg/L		0.8 U	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ	**6.5**	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ	0.56 J
Cadmium	5	--	µg/L		2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	0.87 J	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U
Calcium	--	--	µg/L		42400	41900 J	43300	41700 J	39900	38300 J	73700	63700 J	16700	16400 J	16200	16300 J	91300	87500 J	69500
Chromium, Hexavalent	50	--	µg/L		NA	NA	NA	NA	NA	NA	NA	NA	10 U	NA	10 U	NA	3.1 J	NA	20 U
Chromium, Total	**50**	--	µg/L		1.7 J	4 UJ	4 U	4 UJ	3.2 J	4 UJ	**402**	4 UJ	4 U	4 UJ	4 U	4 UJ	4 U	4 UJ	31.3
Cobalt	--	--	µg/L		3 J	2.1 J	2.4 J	1.9 J	2.5 J	1.4 J	154	1.4 J	4 U	4 UJ	4 U	4 UJ	4 U	4 UJ	17.4
Copper	**200**	--	µg/L		2.2 J	4 UJ	4 U	4 UJ	2.1 J	4 UJ	**254**	4 UJ	4 U	4 UJ	4 U	4 UJ	4 U	4 UJ	36.1
Cyanide	200	--	µg/L		10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U	NA	10 U
Iron	**300**	--	µg/L		**898 J**	120 UJ	177 J	120 UJ	**1070**	120 UJ	**216000**	120 UJ	120 U	120 UJ	120 U	120 UJ	98.8 J	120 UJ	**21300**
Lead	**25**	--	µg/L		0.55 J	1.2 UJ	1.2 U	1.2 UJ	1.5	1.2 UJ	**100**	1.2 UJ	1.2 U	1.2 UJ	1.2 U	1.2 UJ	1.2 U	1.2 UJ	**36.2**
Magnesium	--	**35000**	µg/L		7930	6910 J	7940	6930 J	5550	4720 J	**52200**	7050 J	2260	2150 J	2190	2190 J	11600	11000 J	14300
Manganese	**300**	--	µg/L		**575**	**507 J**	**512**	**441 J**	**954 J**	**793 J**	**10100**	**546 J**	9.5	8.6 J	9.7	8.2 J	32.7	27 J	**1380**
Mercury	0.7	--	µg/L		0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 UJ	0.2 U
Nickel	**100**	--	µg/L		16.7	12.7 J	14.9	11.5 J	15	10.4 J	**503**	3.5 J	4 U	4 UJ	4 U	4 UJ	4 U	4 UJ	41.3
Potassium	--	--	µg/L		4790	4670 J	4540	4430 J	5010	4690 J	19800	6210 J	2050	1910 J	1970	1990 J	4520	4270 J	6260
Selenium	10	--	µg/L		1.3 J	1.4 J	1.4 J	1.5 J	1.6 J	1.7 J	1.6 J	1.5 J	10 U	10 UJ	10 U	10 UJ	10 U	10 UJ	10 U
Silver	50	--	µg/L		2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U	2 UJ	2 U
Sodium	**20000**	--	µg/L		**51100**	**45900 J**	**52500**	**46300 J**	**111000**	**99600 J**	**21500**	19900 J	**25400 J**	**25500 J**	**48100 J**	**22500 J**	**107000**	**101000 J**	**42900**
Thallium	--	**0.5**	µg/L		0.8 U	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ	**1.3**	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ	0.25 J
Vanadium	--	--	µg/L		1.2 J	4 UJ	4 U	4 UJ	1.3 J	4 UJ	283	4 UJ	4 U	4 UJ	4 U	4 UJ	4 U	4 UJ	25.9
Zinc	--	2000	µg/L		16 U	16 UJ	16 U	16 UJ	16 U	5.4 J	405	16 UJ	16 U	16 UJ	16 U	16 UJ	16 U	16 UJ	84.6

Table 11. Summary of Metals in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-6	MW-7	MW-7	MW-8	MW-8
			Sample Date:	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	N	N	N	N
				Dissolved	Total	Dissolved	Total	Dissolved
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit					
Aluminum	--	--	µg/L	45.5 J	5330	40 UJ	266	40 UJ
Antimony	3	--	µg/L	2 UJ	2 U	2 UJ	2 U	2 UJ
Arsenic	25	--	µg/L	2 UJ	1.5 J	2 UJ	2 U	2 UJ
Barium	1000	--	µg/L	41.3 J	62.6	23.8 J	12.3	11 J
Beryllium	--	**3**	µg/L	0.8 UJ	0.29 J	0.8 UJ	0.8 U	0.8 UJ
Cadmium	5	--	µg/L	2 UJ	2 U	2 UJ	2 U	2 UJ
Calcium	--	--	µg/L	57300 J	36500	37000 J	24200	22900 J
Chromium, Hexavalent	50	--	µg/L	NA	20 U	NA	10 U	NA
Chromium, Total	**50**	--	µg/L	4 UJ	20.8	4 UJ	4 U	4 UJ
Cobalt	--	--	µg/L	4 UJ	7.8	4 UJ	4 U	4 UJ
Copper	**200**	--	µg/L	4 UJ	19.5	4 UJ	4 U	4 UJ
Cyanide	200	--	µg/L	NA	10 U	NA	10 U	NA
Iron	**300**	--	µg/L	54.5 J	**11300**	120 UJ	**443**	120 UJ
Lead	**25**	--	µg/L	2.1 J	7	1.2 UJ	1.2 U	1.2 UJ
Magnesium	--	**35000**	µg/L	8710 J	12000	10200 J	8140	7510 J
Manganese	**300**	--	µg/L	**304 J**	**944**	**425 J**	71.1	24.3 J
Mercury	0.7	--	µg/L	0.2 UJ	0.2 U	0.2 UJ	0.2 U	0.2 UJ
Nickel	**100**	--	µg/L	3.3 J	21.4	2.6 J	4 U	4 UJ
Potassium	--	--	µg/L	4210 J	4070	3130 J	1830	1680 J
Selenium	10	--	µg/L	10 UJ	10 U	10 UJ	10 U	10 UJ
Silver	50	--	µg/L	2 UJ	2 U	2 UJ	2 U	2 UJ
Sodium	**20000**	--	µg/L	**47700 J**	**34400**	**35400 J**	**37800**	**34600 J**
Thallium	--	**0.5**	µg/L	0.8 UJ	0.8 U	0.8 UJ	0.8 U	0.8 UJ
Vanadium	--	--	µg/L	4 UJ	12.3	4 UJ	1.1 J	4 UJ
Zinc	--	2000	µg/L	24.8 J	27.3	16 UJ	16 U	16 UJ

Table 12. Summary of Polychlorinated Biphenyls in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-1	MW-1	MW-2	MW-3	MW-4	MW-4	MW-5	MW-6	MW-7	MW-8
			Sample Date:	07/25/2018	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	FD	N	N	N	FD	N	N	N	N
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit										
PCB-1016 (Aroclor 1016)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1221 (Aroclor 1221)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1232 (Aroclor 1232)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1242 (Aroclor 1242)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1248 (Aroclor 1248)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1254 (Aroclor 1254)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1260 (Aroclor 1260)	--	--	µg/L	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1262 (Aroclor 1262)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PCB-1268 (Aroclor 1268)	--	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
Polychlorinated Biphenyl (PCBs)	0.09	--	µg/L	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

Table 13. Summary of Pesticides and Herbicides in Groundwater, Chestnut Commons, Brooklyn, New York

			Sample Designation:	MW-1	MW-1	MW-2	MW-3	MW-4	MW-4	MW-5	MW-6	MW-7	MW-8
			Sample Date:	07/25/2018	07/25/2018	07/25/2018	07/25/2018	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019
			Normal or Field Duplicate:	N	FD	N	N	N	FD	N	N	N	N
Parameter	NYSDEC Ambient Water-Quality Standards	NYSDEC Ambient Water-Quality Guidance Values	Unit										
2,4-D (Dichlorophenoxyacetic Acid)	50	--	µg/L	NA	NA	NA	NA	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Acetic acid, (2,4,5-trichlorophenoxy)-	--	--	µg/L	NA	NA	NA	NA	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Aldrin	0	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Alpha Bhc (Alpha Hexachlorocyclohexane)	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Alpha Endosulfan	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Beta Bhc (Beta Hexachlorocyclohexane)	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Beta Endosulfan	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Chlordane	**0.05**	--	µg/L	**1.4 NJ**	**1.2 NJ**	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Delta BHC (Delta Hexachlorocyclohexane)	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Dieldrin	0.004	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endosulfan Sulfate	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin	0	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Aldehyde	5	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Endrin Ketone	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Gamma Bhc (Lindane)	--	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor	0.04	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Heptachlor Epoxide	0.03	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Methoxychlor	35	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDD	0.3	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDE	0.2	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
4,4'-DDT	0.2	--	µg/L	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Silvex (2,4,5-TP)	0.26	--	µg/L	NA	NA	NA	NA	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Toxaphene	0.06	--	µg/L	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U

Table 14. Summary of Per- and Polyfluoroalkyl Substances in Groundwater, Chestnut Commons, Brooklyn, New York

Sample Designation:		MW-4	MW-4	MW-5	MW-6	MW-7	MW-8
Sample Date:		04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019
Normal or Field Duplicate:		N	FD	N	N	N	N
Parameter	Unit						
2-(N-methyl perfluorooctanesulfonamido) acetic acid	ng/L	1.57 U	1.56 U	7.49 U	7.94 U	1.5 U	1.56 U
N-Ethyl-N-((heptadecafluorooctyl)sulphonyl) glycine	ng/L	1.39 U	1.37 U	6.61 U	7 U	1.33 U	1.38 U
Perfluorobutanesulfonic acid (PFBS)	ng/L	0.45 U	0.45 U	30.4	2.32 J	3.68	2.05
Perfluorobutanoic Acid	ng/L	0.92 U	0.92 U	15	15.6	12.8	9.18
Perfluorodecane Sulfonic Acid	ng/L	0.83 U	0.82 U	3.97 U	4.2 U	0.8 U	0.83 U
Perfluorodecanoic acid (PFDA)	ng/L	4.67	4.41	3.39 U	3.59 U	1.15 J	0.71 U
Perfluorododecanoic acid (PFDoA)	ng/L	0.54 U	0.54 U	2.6 U	2.75 U	0.52 U	0.54 U
Perfluoroheptane Sulfonate (PFHPS)	ng/L	0.88 U	0.87 U	4.19 U	4.43 U	0.84 U	0.87 U
Perfluoroheptanoic acid (PFHpA)	ng/L	6.74	5.94	9.28	10.8	93.3	73.5
Perfluorohexanesulfonic acid (PFHxS)	ng/L	0.74 U	0.73 U	7.84 J	7.35 J	2.74	1.23 J
Perfluorohexanoic acid (PFHxA)	ng/L	3.84	3.53	14.1	8.06 J	37.5	26.5
Perfluorononanoic acid (PFNA)	ng/L	3.61	3.19	3.08 J	3.4 J	6.18	6.33
Perfluorooctane Sulfonamide (FOSA)	ng/L	0.59 U	0.59 U	2.82 U	2.99 U	0.57 U	0.59 U
Perfluorooctanesulfonic acid (PFOS)	ng/L	37.2	35.2	32.6	24.7	47.3	32
Perfluorooctanoic acid (PFOA)	ng/L	14.8	14.6	80.8 J	71.4 J	44.6	34.7
Perfluoropentanoic Acid (PFPeA)	ng/L	5.3	4.12	14.7	19.1	31.1	30.4
Perfluorotetradecanoic acid (PFTA)	ng/L	0.85 U	0.84 U	4.05 U	4.29 U	0.81 U	0.84 U
Perfluorotridecanoic Acid (PFTriA)	ng/L	0.55 U	0.55 U	2.64 U	2.8 U	0.53 U	0.55 U
Perfluoroundecanoic Acid (PFUnA)	ng/L	0.49 U	0.49 U	2.34 U	2.47 U	0.47 U	0.49 U
Sodium 1H,1H,2H,2H-Perfluorodecane Sulfonate (8:2)	ng/L	2.68 U	2.65 U	12.8 U	13.5 U	2.56 U	2.66 U
Sodium 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2)	ng/L	4.36 J	4.21 U	20.3 U	21.5 U	4.07 U	4.22 U

Table 15. Summary of Volatile Organic Compounds in Soil Vapor, Chestnut Commons, Brooklyn, New York

Sample Designation:		SV-1	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	SV-7	SV-8	SV-9	SV-9	SV-10	SV-11
Sample Date:		07/24/2018	07/24/2018	07/24/2018	07/24/2018	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	05/07/2019
Normal or Field Duplicate:		N	FD	N	N	N	N	N	N	N	N	FD	N	N
Parameter	Unit													
1,1,1-Trichloroethane (TCA)	µg/m³	**3**	**3.3**	**3.1**	68 U	**0.9 J**	5.5 U	**1.3**	**0.73 J**	2.2 U	2.2 U	4.4 U	**0.57 J**	51 U
1,1,2,2-Tetrachloroethane	µg/m³	2.7 U	**2.9**	2.7 U	86 U	1.4 U	6.9 U	1.4 U	1.4 U	2.7 U	2.7 U	5.5 U	1.4 U	64 U
1,1,2-Trichloro-1,2,2-Trifluoroethane	µg/m³	3.1 U	3.1 U	3.1 U	95 U	**0.37 J**	7.7 U	**0.42 J**	**0.43 J**	**0.49 J**	**0.61 J**	6.1 U	**0.47 J**	72 U
1,1,2-Trichloroethane	µg/m³	2.2 U	2.2 U	2.2 U	68 U	1.1 U	5.5 U	1.1 U	1.1 U	2.2 U	2.2 U	4.4 U	1.1 U	51 U
1,1-Dichloroethane	µg/m³	1.6 U	1.6 U	1.6 U	50 U	0.81 U	4 U	0.81 U	0.81 U	1.6 U	1.6 U	3.2 U	0.81 U	38 U
1,1-Dichloroethene	µg/m³	1.6 U	1.6 U	1.6 U	49 U	0.14 U	0.7 U	0.14 U	**0.55**	0.28 U	0.28 U	0.56 U	0.14 U	6.5 U
1,2,4-Trichlorobenzene	µg/m³	7.4 U	7.4 U	7.4 U	230 U	3.7 U	19 U	3.7 U	3.7 U	7.4 U	7.4 U	15 U	3.7 U	170 U
1,2,4-Trimethylbenzene	µg/m³	**40**	**57**	**37**	61 U	**0.41 J**	4.9 U	0.98 U	0.98 U	2 U	2 U	3.9 U	**0.46 J**	46 U
1,2-Dibromoethane (Ethylene Dibromide)	µg/m³	3.1 U	3.1 U	3.1 U	96 U	1.5 U	7.7 U	1.5 U	1.5 U	3.1 U	3.1 U	6.1 U	1.5 U	72 U
1,2-Dichlorobenzene	µg/m³	2.4 U	2.4 U	2.4 U	75 U	1.2 U	6 U	1.2 U	1.2 U	2.4 U	2.4 U	4.8 U	1.2 U	56 U
1,2-Dichloroethane	µg/m³	1.6 U	1.6 U	1.6 U	50 U	0.81 U	4 U	0.81 U	0.81 U	1.6 U	1.6 U	3.2 U	0.81 U	38 U
1,2-Dichloropropane	µg/m³	1.8 U	1.8 U	1.8 U	58 U	0.92 U	4.6 U	0.92 U	0.92 U	1.8 U	1.8 U	3.7 U	0.92 U	43 U
1,2-Dichlorotetrafluoroethane	µg/m³	2.8 U	2.8 U	2.8 U	87 U	1.4 U	7 U	1.4 U	1.4 U	2.8 U	2.8 U	5.6 U	1.4 U	65 U
1,3,5-Trimethylbenzene (Mesitylene)	µg/m³	**13**	**17**	**12**	61 U	0.98 U	4.9 U	0.98 U	0.98 U	2 U	2 U	3.9 U	0.98 U	46 U
1,3-Butadiene	µg/m³	**18 J**	**10 J**	**4.2**	28 U	0.44 U	**2.8**	**0.67**	0.44 U	0.88 U	**0.79 J**	**0.95 J**	**0.3 J**	**6.8 J**
1,3-Dichlorobenzene	µg/m³	2.4 U	2.4 U	2.4 U	75 U	1.2 U	6 U	1.2 U	1.2 U	2.4 U	2.4 U	4.8 U	1.2 U	56 U
1,4-Dichlorobenzene	µg/m³	2.4 U	2.4 U	2.4 U	75 U	1.2 U	6 U	1.2 U	1.2 U	2.4 U	2.4 U	4.8 U	1.2 U	56 U
1,4-Dioxane (P-Dioxane)	µg/m³	36 U	36 U	36 U	1100 U	18 U	90 U	18 U	18 U	36 U	36 U	72 U	18 U	840 U
2,2,4-Trimethylpentane	µg/m³	**14 J**	**5.6 J**	**11**	58 U	**0.47 J**	4.7 U	0.93 U	**0.47 J**	1.9 U	**0.86 J**	3.7 U	**0.6 J**	44 U
2-Chlorotoluene	µg/m³	2.1 U	2.1 U	2.1 U	65 U	1 U	5.2 U	1 U	1 U	2.1 U	2.1 U	4.1 U	1 U	48 U
2-Hexanone	µg/m³	**19**	**21**	4.1 U	130 U	2 U	**240**	**5.3**	2 U	**6**	4.1 U	8.2 U	**7.4**	**220**
4-Ethyltoluene	µg/m³	**12**	**16**	**12**	61 U	0.98 U	4.9 U	0.98 U	0.98 U	2 U	2 U	3.9 U	0.98 U	46 U
Acetone	µg/m³	**2200 ET**	**2100 ET**	**1800 ET**	**2200 T**	**34**	**960 D**	**320 D**	**84**	**280 D**	**160**	**160**	**130 D**	**3300**
Allyl Chloride (3-Chloropropene)	µg/m³	3.1 U	3.1 U	3.1 U	97 U	1.6 U	7.8 U	1.6 U	1.6 U	3.1 U	3.1 U	6.3 U	1.6 U	73 U
Benzene	µg/m³	**28 J**	**18 J**	**40**	40 U	**0.87**	3.2 U	**0.48 J**	**0.8**	**0.7 J**	**0.85 J**	2.6 U	**0.67**	30 U
Benzyl Chloride	µg/m³	2.1 U	2.1 U	2.1 U	65 U	1 U	5.2 U	1 U	1 U	2.1 U	2.1 U	4.1 U	1 U	48 U
Bromodichloromethane	µg/m³	2.7 U	2.7 U	2.7 U	83 U	1.3 U	**16**	1.3 U	1.3 U	2.7 U	2.7 U	5.4 U	1.3 U	63 U
Bromoform	µg/m³	4.1 U	4.1 U	4.1 U	130 U	2.1 U	10 U	2.1 U	2.1 U	4.1 U	4.1 U	8.3 U	2.1 U	97 U
Bromomethane	µg/m³	1.6 U	1.6 U	1.6 U	48 U	0.78 U	3.9 U	0.78 U	0.78 U	1.6 U	1.6 U	3.1 U	0.78 U	36 U
Butane	µg/m³	**44 J**	**27 J**	**24**	**100**	**3.5**	**42**	**5.4**	**3.3**	**6.7**	**11**	**9.3**	**8.5**	**60**
Carbon Disulfide	µg/m³	**4.5**	3.1 U	**9.1**	97 U	**1.9**	7.8 U	**2.6**	**1.5 J**	**3.1**	**2.5 J**	**3.1 J**	**2.9**	73 U
Carbon Tetrachloride	µg/m³	0.5 U	0.5 U	0.5 U	16 U	**0.53**	1.1 U	**0.2 J**	**0.45**	**0.54**	**0.38 J**	0.88 U	**0.37**	10 U
Chlorobenzene	µg/m³	1.8 U	1.8 U	1.8 U	57 U	0.92 U	4.6 U	0.92 U	0.92 U	1.8 U	1.8 U	3.7 U	0.92 U	43 U
Chlorodifluoromethane	µg/m³	3.5 U	3.5 U	3.5 U	110 U	1.8 U	8.8 U	1.8 U	**1.6 J**	3.5 U	3.5 U	7.1 U	1.8 U	83 U
Chloroethane	µg/m³	2.6 U	2.6 U	2.6 U	82 U	1.3 U	6.6 U	1.3 U	1.3 U	2.6 U	2.6 U	5.3 U	1.3 U	62 U
Chloroform	µg/m³	**2.9**	**3.3**	**3**	61 U	**1.2**	**300**	**5**	**5.4**	**3.1**	**9.9**	**12**	**3.3**	46 U
Chloromethane	µg/m³	2.1 U	2.1 U	2.1 U	64 U	**0.66 J**	5.2 U	1 U	1 U	2.1 U	2.1 U	4.1 U	1 U	48 U
Cis-1,2-Dichloroethylene	µg/m³	1.6 U	1.6 U	1.6 U	**74**	0.2 U	1 U	**2.8**	**550 D**	**1.4**	0.4 U	0.8 U	0.2 U	9.3 U
Cis-1,3-Dichloropropene	µg/m³	1.8 U	1.8 U	1.8 U	57 U	0.91 U	4.5 U	0.91 U	0.91 U	1.8 U	1.8 U	3.6 U	0.91 U	42 U
Cyclohexane	µg/m³	**9.4 J**	**4.1 J**	**7.3**	43 U	**0.43 J**	3.4 U	0.69 U	0.69 U	1.4 U	**0.48 J**	2.8 U	0.69 U	32 U
Cymene	µg/m³	2.2 U	2.2 U	2.2 U	68 U	1.1 U	5.5 U	1.1 U	1.1 U	2.2 U	2.2 U	4.4 U	1.1 U	51 U
Dibromochloromethane	µg/m³	3.4 U	3.4 U	3.4 U	110 U	1.7 U	8.5 U	1.7 U	1.7 U	3.4 U	3.4 U	6.8 U	1.7 U	80 U
Dichlorodifluoromethane	µg/m³	4.9 U	4.9 U	4.9 U	150 U	**2.1 J**	**5.2 J**	**2.8**	**3.8**	**2.4 J**	**3.2 J**	9.9 U	**2.5**	120 U
Dichloroethylenes	µg/m³	3.2 U	3.2 U	3.2 U	99 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
Ethylbenzene	µg/m³	**47**	**34**	**42**	54 U	**1.9**	**2.6 J**	**1.6**	**2.3**	**1.9**	**3.2**	**3.1 J**	**2.4**	41 U
Hexachlorobutadiene	µg/m³	4.3 U	4.3 U	4.3 U	130 U	2.1 U	11 U	2.1 U	2.1 U	4.3 U	4.3 U	8.5 U	2.1 U	100 U
Isopropanol	µg/m³	25 U	25 U	25 U	770 U	12 U	**90**	**5.9 J**	12 U	25 U	25 U	49 U	**8.6 J**	570 U
Isopropylbenzene (Cumene)	µg/m³	**2.9**	**2.6**	**3**	61 U	0.98 U	4.9 U	0.98 U	0.98 U	2 U	2 U	3.9 U	0.98 U	46 U
m,p-Xylene	µg/m³	**140**	**110**	**130**	140 U	**8**	**8.9 J**	**4.8**	**10**	**7.7**	**12**	**11**	**8.8**	100 U
Methyl Ethyl Ketone (2-Butanone)	µg/m³	**82**	**100**	**60**	92 U	**42**	**540 D**	**120**	**46**	**160**	**91**	**100**	**130 D**	**1600 B**

Table 15. Summary of Volatile Organic Compounds in Soil Vapor, Chestnut Commons, Brooklyn, New York

Sample Designation:		SV-1	SV-1	SV-2	SV-3	SV-4	SV-5	SV-6	SV-7	SV-8	SV-9	SV-9	SV-10	SV-11
Sample Date:		07/24/2018	07/24/2018	07/24/2018	07/24/2018	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	04/30/2019	05/07/2019
Normal or Field Duplicate:		N	FD	N	N	N	N	N	N	N	N	FD	N	N
Parameter	Unit													
Methyl Isobutyl Ketone (4-Methyl-2-Pentanone)	µg/m^3	**5.3**	4.1 U	4.1 U	130 U	2 U	10 U	2 U	2 U	4.1 U	4.1 U	8.2 U	2 U	96 U
Methyl Methacrylate	µg/m^3	4.1 U	4.1 U	4.1 U	130 U	2 U	10 U	2 U	2 U	4.1 U	4.1 U	8.2 U	2 U	96 U
Methylene Chloride	µg/m^3	3.5 U	**6.1**	3.5 U	110 U	**83**	**8.5 J**	1.7 U	**0.85 J**	3.5 U	**1.9 J**	6.9 U	1.7 U	81 U
Naphthalene	µg/m^3	5.2 U	5.2 U	5.2 U	160 U	2.6 U	13 U	2.6 U	2.6 U	5.2 U	5.2 U	10 U	2.6 U	120 U
N-Butylbenzene	µg/m^3	**3**	**3.2**	2.2 U	68 U	1.1 U	5.5 U	1.1 U	1.1 U	2.2 U	2.2 U	4.4 U	1.1 U	51 U
N-Heptane	µg/m^3	**32 J**	**16 J**	**51**	51 U	**0.96**	**19**	**1.1**	0.82 U	**1.4 J**	**1.9**	3.3 U	**4.6**	38 U
N-Hexane	µg/m^3	**35 J**	**17 J**	**30**	44 U	**38**	**21**	**1.2**	**0.61 J**	**1.6**	**2.5**	2.8 U	**3.2**	33 U
N-Propylbenzene	µg/m^3	**10**	**11**	**9.3**	61 U	0.98 U	4.9 U	0.98 U	0.98 U	2 U	2 U	3.9 U	0.98 U	46 U
O-Xylene (1,2-Dimethylbenzene)	µg/m^3	**52**	**45**	**50**	54 U	**1.4**	**1.8 J**	**0.55 J**	**1.4**	**0.92 J**	**2.3**	**2 J**	**1.7**	41 U
Sec-Butylbenzene	µg/m^3	2.2 U	2.2 U	2.2 U	68 U	1.1 U	5.5 U	1.1 U	1.1 U	2.2 U	2.2 U	4.4 U	1.1 U	51 U
Styrene	µg/m^3	**2.4**	**2.4**	1.7 U	53 U	**0.37 J**	4.3 U	0.85 U	0.85 U	1.7 U	1.7 U	3.4 U	0.85 U	40 U
T-Butylbenzene	µg/m^3	2.2 U	2.2 U	2.2 U	68 U	1.1 U	5.5 U	1.1 U	1.1 U	2.2 U	2.2 U	4.4 U	1.1 U	51 U
Tert-Butyl Alcohol	µg/m^3	30 U	30 U	30 U	940 U	**21**	**220**	**41**	**27**	**48**	**54**	**38 J**	**65**	**440 J**
Tert-Butyl Methyl Ether	µg/m^3	1.4 U	1.4 U	1.4 U	45 U	0.72 U	3.6 U	0.72 U	0.72 U	1.4 U	1.4 U	2.9 U	0.72 U	34 U
Tetrachloroethene (PCE)	µg/m^3	**31 J**	**62 J**	**320**	**13000**	**3**	**130**	**7.3**	**7**	**3.9**	**5.5**	**10**	**3.6**	**15 J**
Tetrahydrofuran	µg/m^3	29 U	29 U	29 U	920 U	15 U	74 U	15 U	15 U	29 U	29 U	59 U	15 U	690 U
Toluene	µg/m^3	**150 J**	**76 J**	**120**	**100**	**5.1**	**14**	**1.5**	**1.6**	**2.8**	**2.2**	**2.4 J**	**2.1**	35 U
Trans-1,2-Dichloroethene	µg/m^3	1.6 U	1.6 U	1.6 U	49 U	0.79 U	4 U	0.79 U	**2.8**	1.6 U	1.6 U	3.2 U	0.79 U	37 U
Trans-1,3-Dichloropropene	µg/m^3	1.8 U	1.8 U	1.8 U	57 U	0.91 U	4.5 U	0.91 U	0.91 U	1.8 U	1.8 U	3.6 U	0.91 U	42 U
Trichloroethene (TCE)	µg/m^3	**150**	**230**	**210**	**4600**	**1.6**	**34**	**56**	**130**	**680 D**	**730 J**	**1800 J**	**470 D**	**1700**
Trichlorofluoromethane	µg/m^3	**39**	**40**	**21**	70 U	**6.3**	**5.3 J**	**8.3**	**4**	**4.3**	**2.6**	**2.8 J**	**4.1**	52 U
Vinyl Bromide	µg/m^3	1.7 U	1.7 U	1.7 U	55 U	0.87 U	4.4 U	0.87 U	0.87 U	1.7 U	1.7 U	3.5 U	0.87 U	41 U
Vinyl Chloride	µg/m^3	0.2 U	0.2 U	0.2 U	6.4 U	0.2 U	1 U	0.2 U	**0.88**	0.4 U	0.4 U	0.8 U	0.2 U	9.3 U
Xylenes, Total	µg/m^3	**190**	**160**	**180**	190 U	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 16. Remedial Cost Estimate for Remedial Alternative 1
Track 1 Scenario
Chestnut Commons, Brooklyn, New York

Item	Description	Estimated Quantity	Unit		Unit Price		Cost
Capital Costs							
SITE PREPARATION							
	Mobilization/Demobilization	1	LS	$	250,000		$250,000
	Soil Staging Area, Erosion Control, Temp. Facilities, Decon Pad	1	LS	$	65,000		$65,000
	Perimeter Fencing/Temporary Fencing	1	LS	$	100,000		$100,000
	Permitting/Insurance/Project Management	1	LS	$	1,000,000		$1,000,000
EXCAVATION							
	SOE	1	LS	$	1,517,016		$1,517,016
	Soil Excavation and Handling	21,785	CY	$	20		$435,700
	Backfill	500	CY	$	55		$27,500
	Surveying	1	LS	$	10,000		$10,000
	Documentation Sampling	15	each	$	1,126		$16,890
	Well Abandonment	1	LS	$	5,000		$5,000
	Handling of Saturated Soils (Hot Spots)	1	LS	$	25,000		$25,000
ENGINEERING CONTROLS							
	Vapor Barrier, All Materials and Installation	1	LS	$	175,650		$175,650
	Subsurface Depressurization System	1	LS	$	265,000		$265,000
DISPOSAL							
	Solid Waste Transportation and Disposal	31,200	tons	$	65		$2,028,000
		Subtotal Remediation Construction Cost					**$5,920,756**
Supplemental Remedial Costs							
	Remedial Investigation Implementation	1	LS	$	78,000		$78,000
	In Situ Waste Characterization	1	LS	$	60,000		$60,000
	Backfill Sampling for VOCs	5	each	$	65		$325
	Backfill Sampling for all other parameters	2	each	$	1,000		$2,000
	Vapor, Dust, and Odor Suppression	6.5	Month	$	25,000		$162,500
	Excavation Oversight, CAMP Implementation, Monthly Reporting and Engineering Support	6.5	Month	$	35,000		$227,500
		Subtotal Supplemental Remediation Cost					**$530,325**
Brownfield Cleanup Program (BCP) Reporting/Record Keeping							
	Remedial Investigation Work Plan, Remedial Investigation Report/Remedial Action Work Plan	1	LS	$	78,000		$78,000
	Final Engineering Report	1	LS	$	40,000		$40,000
		Subtotal Supplemental BCP Reporting and Record Keeping					**$118,000**
		Subtotal Capital Costs including Supplemental Costs and BCP Reporting					**$6,569,081**
		Contingency			**20%**		**$1,313,816**
		Sales Tax on contractor materials, labor and supplies			**8.875%**		**$525,467**
	TOTAL REMEDIAL CONSTRUCTION, SUPPLEMENTAL AND BCP RECORD KEEPING/REPORTING						**$8,408,400**
Annual Monitoring Cost							
	Annual Inspection of Institutional Controls and Periodic Report	5	years	$	40,000	$	200,000
	TOTAL MONITORING COST					$	**200,000**

NOTES
1 New York general sales tax rate is 8.875% on contractor materials, labor and supplies

Table 17. Remedial Cost Estimate for Remedial Alternative 2
Track 2 Scenario
Chestnut Commons, Brooklyn, New York

Item	Description	Estimated Quantity	Unit		Unit Price		Cost
Capital Costs							
SITE PREPARATION							
	Mobilization/Demobilization	1	LS	$	250,000		$250,000
	Soil Staging Area, Erosion Control, Temp. Facilities, Decon Pad	1	LS	$	65,000		$65,000
	Perimeter Fencing/Temporary Fencing	1	LS	$	100,000		$100,000
	Permitting/Insurance/Project Management	1	LS	$	1,000,000		$1,000,000
EXCAVATION							
	SOE	1	LS	$	1,517,016		$1,517,016
	Soil Excavation and Handling	21,285	CY	$	20		$425,700
	Backfill	0	CY	$	55		$0
	Surveying	1	LS	$	10,000		$10,000
	Documentation Sampling	15	each	$	1,126		$16,890
	Well Abandonment	1	LS	$	5,000		$5,000
	Handling of Saturated Soils (Hot Spots)	1	LS	$	25,000		$25,000
ENGINEERING CONTROLS							
	Vapor Barrier, All Materials and Installation	1	LS	$	175,650		$175,650
	Subsurface Depressurization System	1	LS	$	265,000		$265,000
DISPOSAL							
	Solid Waste Transportation and Disposal	30,500	tons	$	65		$1,982,500
		Subtotal Remediation Construction Cost					**$5,837,756**
Supplemental Remedial Costs							
	Remedial Investigation Implementation	1	LS	$	78,000		$78,000
	In Situ Waste Characterization	1	LS	$	60,000		$60,000
	Backfill Sampling for VOCs	0	each	$	65		$0
	Backfill Sampling for all other parameters	0	each	$	1,000		$0
	Vapor, Dust, and Odor Suppression	6	Month	$	25,000		$150,000
	Excavation Oversight, CAMP Implementation, Monthly Reporting and Engineering Support	6	Month	$	35,000		$210,000
		Subtotal Supplemental Remediation Cost					**$498,000**
Brownfield Cleanup Program (BCP) Reporting/Record Keeping							
	Remedial Investigation Work Plan, Remedial Investigation Report/Remedial Action Work Plan	1	LS	$	78,000		$78,000
	Final Engineering Report	1	LS	$	40,000		$40,000
		Subtotal Supplemental BCP Reporting and Record Keeping					**$118,000**
		Subtotal Capital Costs including Supplemental Costs and BCP Reporting					**$6,453,756**
		Contingency			**20%**		**$1,290,751**
		Sales Tax on contractor materials, labor and supplies			**8.875%**		**$518,101**
	TOTAL REMEDIAL CONSTRUCTION, SUPPLEMENTAL AND BCP RECORD KEEPING/REPORTING						**$8,262,600**
Annual Monitoring Cost							
	Annual Inspection of Institutional Controls and Periodic Report	5	years	$	40,000	$	200,000
	TOTAL MONITORING COST					$	**200,000**

NOTES
1 New York general sales tax rate is 8.875% on contractor materials, labor and supplies

Table 18. Tracks 1 and 2 Soil Cleanup Objectives
Chestnut Commons, Brooklyn, New York

Parameter	Track 1 Soil Cleanup Objectives*	Track 2 Soil Cleanup Objectives**
Volatile Organic Compounds (Concentrations in µg/kg)		
1,1,1-Trichloroethane	680	100000
1,1-Dichloroethane	270	26000
1,1-Dichloroethene	330	100000
1,2,4-Trimethylbenzene	3600	52000
1,3,5-Trimethylbenzene	8400	52000
1,2-Dichlorobenzene	1100	100000
1,2-Dichloroethane	20	3100
1,3-Dichlorobenzene	2400	49000
1,4-Dichlorobenzene	1800	13000
1,4-Dioxane	100	13000
2-Butanone (MEK)	120	100000
Acetone	50	100000
Benzene	60	4800
n-Butylbenzene	12000	100000
Carbon tetrachloride	760	2400
Chlorobenzene	1100	100000
Chloroform	370	49000
cis-1,2-Dichloroethene	250	100000
Ethylbenzene	1000	41000
Methylene chloride	50	100000
MTBE	930	100000
n-Propylbenzene	3900	100000
sec-Butylbenzene	11000	100000
tert-Butylbenzene	5900	100000
Tetrachloroethene	1300	19000
Toluene	700	100000
trans-1,2-Dichloroethene	190	100000
Trichloroethene	470	21000
Vinyl chloride	20	900
Xylenes (total)	260	100000
Semivolatile Organic Compounds (Concentrations in µg/kg)		
1,4-Dioxane	100	13000
2-Methylphenol	330	100000
3&4-Methylphenol	330	100000
Acenaphthene	20000	100000
Acenaphthylene	100000	100000
Anthracene	100000	100000
Benzo[a]anthracene	1000	1000
Benzo[a]pyrene	1000	1000
Benzo[b]fluoranthene	1000	1000
Benzo[g,h,i]perylene	100000	100000
Benzo[k]fluoranthene	800	3900
Chrysene	1000	3900
Dibenzo[a,h]anthracene	330	330
Dibenzofuran	7000	59000
Fluoranthene	100000	100000
Fluorene	30000	100000
Hexachlorobenzene	330	1200
Indeno[1,2,3-cd]pyrene	500	500
Naphthalene	12000	100000
Pentachlorophenol	800	6700

Table 18. Tracks 1 and 2 Soil Cleanup Objectives
Chestnut Commons, Brooklyn, New York

Parameter	Track 1 Soil Cleanup Objectives*	Track 2 Soil Cleanup Objectives**
Phenanthrene	100000	100000
Phenol	330	100000
Pyrene	100000	100000
Metals (Concentrations in mg/kg)		
Arsenic	13	16
Barium	350	400
Beryllium	7.2	72
Cadmium	2.5	4.3
Chromium, Hexavalent	1	110
Chromium	30	180
Copper	50	270
Cyanide, Total	27	27
Lead	63	400
Manganese	1600	2000
Mercury	0.18	0.81
Nickel	30	310
Selenium	3.9	180
Silver	2	180
Zinc	109	10000
Pesticides (Concentrations in µg/kg)		
2,4,5-TP	3800	100000
4,4'-DDD	3.3	13000
4,4'-DDE	3.3	8900
4,4'-DDT	3.3	7900
Aldrin	5	97
alpha-BHC	20	480
alpha-Chlordane	94	4200
beta-BHC	36	360
delta-BHC	40	100000
Dieldrin	5	200
Endosulfan I	2400	24000
Endosulfan II	2400	24000
Endosulfan sulfate	2400	24000
Endrin	14	11000
gamma-BHC (Lindane)	100	1300
Heptachlor	42	2100
Pentachlorophenol	800	6700
Total Polychlorinated Biphenyls (Concentrations in µg/kg)		
Total Polychlorinated Biphenyls	100	1000

* Soil cleanup objectives for the Track 1 remedy are the NYSDEC Part 375 Unrestricted Use SCOs.
** Soil cleanup objectives for the Track 2 remedy are the NYSDEC Part 375 Restricted Residential Use SCOs.
µg/kg - Micrograms per kilogram
mg/kg - Milligrams per kilogram

NYSDEC - New York State Department of Environmental Conservation
SCOs - Soil Cleanup Objectives

Table 19. Backfill/On-Site Soil Reuse Soil Cleanup Objectives
Chestnut Commons, Brooklyn, New York

Parameter	Track 1 Backfill/Soil Reuse Soil Cleanup Objectives*	Track 2 Backfill/Soil Reuse Soil Cleanup Objectives**
Volatile Organic Compounds (Concentrations in µg/kg)		
1,1,1-Trichloroethane	680	680
1,1-Dichloroethane	270	270
1,1-Dichloroethene	330	330
1,2,4-Trimethylbenzene	3600	3600
1,3,5-Trimethylbenzene	8400	8400
1,2-Dichlorobenzene	1100	1100
1,2-Dichloroethane	20	20
1,3-Dichlorobenzene	2400	2400
1,4-Dichlorobenzene	1800	1800
1,4-Dioxane	100	100
2-Butanone (MEK)	120	120
Acetone	50	50
Benzene	60	60
n-Butylbenzene	12000	12000
Carbon tetrachloride	760	760
Chlorobenzene	1100	1100
Chloroform	370	370
cis-1,2-Dichloroethene	250	250
Ethylbenzene	1000	1000
Methylene chloride	50	50
MTBE	930	930
n-Propylbenzene	3900	3900
sec-Butylbenzene	11000	11000
tert-Butylbenzene	5900	5900
Tetrachloroethene	1300	1300
Toluene	700	700
trans-1,2-Dichloroethene	190	190
Trichloroethene	470	470
Vinyl chloride	20	20
Xylenes (total)	260	1600
Semivolatile Organic Compounds (Concentrations in µg/kg)		
1,4-Dioxane	100	100
2-Methylphenol	330	330
3&4-Methylphenol	330	330
Acenaphthene	20000	98000
Acenaphthylene	100000	100000
Anthracene	100000	100000
Benzo[a]anthracene	1000	1000
Benzo[a]pyrene	1000	1000
Benzo[b]fluoranthene	1000	1000
Benzo[g,h,i]perylene	100000	100000
Benzo[k]fluoranthene	800	1700
Chrysene	1000	1000
Dibenzo[a,h]anthracene	330	330
Dibenzofuran	7000	59000
Fluoranthene	100000	100000
Fluorene	3000	100000
Hexachlorobenzene	330	1200
Indeno[1,2,3-cd]pyrene	500	500
Naphthalene	12000	12000
Pentachlorophenol	800	800
Phenanthrene	100000	100000
Phenol	330	330
Pyrene	100000	100000

Table 19. Backfill/On-Site Soil Reuse Soil Cleanup Objectives
Chestnut Commons, Brooklyn, New York

Parameter	Track 1 Backfill/Soil Reuse Soil Cleanup Objectives*	Track 2 Backfill/Soil Reuse Soil Cleanup Objectives**
Metals (Concentrations in mg/kg)		
Arsenic	13	16
Barium	350	400
Beryllium	7.2	47
Cadmium	2.5	4.3
Chromium, Hexavalent	1	19
Chromium	30	180
Copper	50	270
Cyanide, Total	27	27
Lead	63	400
Manganese	1600	2000
Mercury	0.18	0.73
Nickel	30	130
Selenium	3.9	4
Silver	2	8.3
Zinc	109	2480
Pesticides (Concentrations in µg/kg)		
2,4,5-TP	3800	3800
4,4'-DDD	3.3	13000
4,4'-DDE	3.3	8900
4,4'-DDT	3.3	7900
Aldrin	5	97
alpha-BHC	20	20
alpha-Chlordane	94	2900
beta-BHC	36	90
delta-BHC	40	250
Dieldrin	5	100
Endosulfan I	2400	24000
Endosulfan II	2400	24000
Endosulfan sulfate	2400	24000
Endrin	14	60
gamma-BHC (Lindane)	100	100
Heptachlor	42	380
Pentachlorophenol	800	800
Total Polychlorinated Biphenyls (Concentrations in µg/kg)		
Total Polychlorinated Biphenyls	100	100
Perfluorinated Alkyl Acids (Concentrations in µg/kg)		
1H,1H,2H,2H-PERFLUORODECANESULFONIC ACID (8:2FTS)	--	--
1H,1H,2H,2H-PERFLUOROOCTANESULFONIC ACID (6:2FTS)	--	--
N-ETHYL PERFLUOROOCTANESULFONAMIDOACETIC ACID (NETFOSAA)	--	--
N-METHYL PERFLUOROOCTANESULFONAMIDOACETIC ACID (NMEFOSA	--	--
PERFLUOROBUTANESULFONIC ACID (PFBS)	--	--
PERFLUOROBUTANOIC ACID (PFBA)	--	--
PERFLUORODECANESULFONIC ACID (PFDS)	--	--
PERFLUORODECANOIC ACID (PFDA)	--	--
PERFLUORODODECANOIC ACID (PFDOA)	--	--
PERFLUOROHEPTANESULFONIC ACID (PFHPS)	--	--
PERFLUOROHEPTANOIC ACID (PFHPA)	--	--
PERFLUOROHEXANESULFONIC ACID (PFHXS)	--	--
PERFLUOROHEXANOIC ACID (PFHXA)	--	--
PERFLUORONONANOIC ACID (PFNA)	--	--

Table 19. Backfill/On-Site Soil Reuse Soil Cleanup Objectives
Chestnut Commons, Brooklyn, New York

Parameter	Track 1 Backfill/Soil Reuse Soil Cleanup Objectives*	Track 2 Backfill/Soil Reuse Soil Cleanup Objectives**
PERFLUOROOCTANESULFONAMIDE (FOSA)	--	--
PERFLUOROOCTANESULFONIC ACID (PFOS)	--	--
PERFLUOROOCTANOIC ACID (PFOA)	--	--
PERFLUOROPENTANOIC ACID (PFPEA)	--	--
PERFLUOROTETRADECANOIC ACID (PFTA)	--	--
PERFLUOROTRIDECANOIC ACID (PFTRDA)	--	--
PERFLUOROUNDECANOIC ACID (PFUNA)	--	--
PFOA/PFOS, TOTAL	--	--

* Backfill soil cleanup objectives for the Track 1 remedy are the NYSDEC Part 375 Unrestricted Residential Use SCOs.

** Backfill soil cleanup objectives for the Track 2 remedy are the lower of the NYSDEC Part 375 Protection of Groundwater or Restricted Residential Use SCOs. If Track 2 Remedy is not met, these SCOs will be used for the Track 4 Remedy.
µg/kg - Micrograms per kilogram
mg/kg - Milligrams per kilogram
NYSDEC - New York State Department of Environmental Conservation
SCOs - Soil Cleanup Objectives
--Standards not yet determined

Table 20. List of Required Permits
Chestnut Commons, Brooklyn, New York

Regulatory Agency	Permit
NYCDEP	Dewatering Permit (for temporary discharge during construction)
NYCDEP	Sewer Certification and Sewer Permit (for new building connection)
NYCDOB	New Building (NB) Permit
NYCDOB	Fence Permit
NYCDOB	Foundation/Earthwork Permit
NYCDOB	Builder's Paving Plan
NYCDOB	Underground Plumbing Permit
NYSDEC	Long Island Well Permit (depending on dewatering system design and flow rate

Note: This list only accounts for permits required from the street level and below and bulhead. Permits for aboveground portions of the building are not listed.

NYCDEP - New York City Department of Environmental Protection

NYCDOB - New York City Department of Buildings

NYCDOT - New York City Department of Buildings

NYCDPR - New York City Department of Parks & Recreation

NYSDEC - New York State Department of Environmental Conservation

NYSDOS - New York State Department of State

TABLE 21

Project Management/Health and Safety Personnel

Title	Contact	Telephone/Cell
Chestnut Commons Apartments, LLC (Owner)		
Project Manager	Ismene Speliotis c/o Matthew Gross	(212) 996-6640
Roux Environmental Engineering and Geology, D.P.C.		
Project Principal	Jessica Taylor	(631) 630-2395
Project Engineer	Brian Morrissey	(631) 630-2330
Field Manager/Site Safety Officer	TBD	-
Corporate Health and Safety Manager	Brian Hobbs	(631) 630-2419
Office Health and Safety Manager	Levi Curnutte	(631) 630-2371

Emergency Phone Numbers

Emergency Medical Service 911

Police: New York City Police Department (NYPD) 911

Fire: New York City Fire Department (FDNY) 911

Hospital: NYU Langone Medical Center 718-630-7000

National Response Center..... 800-424-8802

Poison Control Center 800-222-1222

CHEMTREC® 800-262-8200

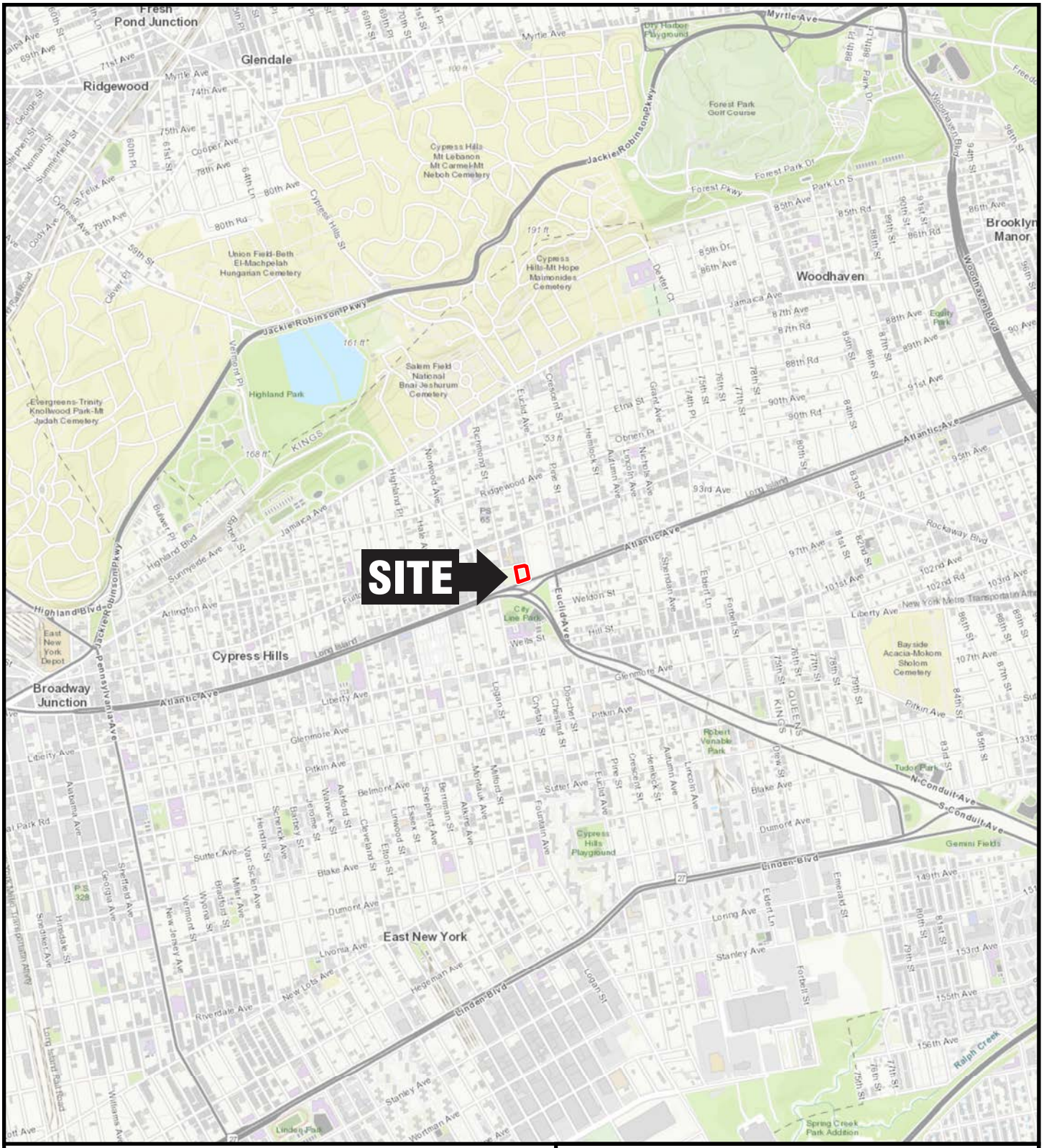
Centers for Disease Control 800-311-3435

USEPA (Region II) 212-637-5000

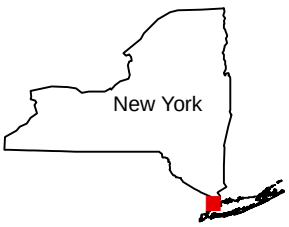
NYSDEC Emergency Spill Response 800-457-7362

FIGURES

1. Site Location Map
2. Sample Plan with Sampling Locations
3. Groundwater Elevation Contours
4. Summary of Exceedances in Soil
5. Summary of Exceedances in Groundwater
6. Summary of Detections in Soil Vapor
7. Remedial Alternative 1 (Track 1 Unrestricted Use)
8. Remedial Alternative 2 (Track 2 Restricted Use)
9. Truck Route Map
10. End-Point Soil Sample Locations



QUADRANGLE LOCATION



N

1,000 0 1,000'

Title:

SITE LOCATION MAP

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 06/12/19	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	1
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.1.mxd		

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DINSMORE PLACE

CHESTNUT STREET

ATLANTIC AVENUE

RX-15/SV-4
RX-1/MW-1
WC-1
RX-2
MW-4
RX-3
SV-5
WC-5
RX-4
RX-5/SV-1
RX-6
MW-5
RX-7
SV-6
WC-6
WC-2
SV-7
RX-8
RX-9/SV-2
RX-10/MW-2
SV-10
MW-6
WC-3/SV-8
WC-7
MW-7
RX-11
RX-13
RX-14/SV-3
RX-12/MW-3
WC-4
SV-9
MW-8
WC-8
RX-16/SV-11

N

LEGEND

- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2018
- LOCATION OF SOIL BORING, TEMPORARY MONITORING WELL, AND SOIL VAPOR POINT COMPLETED IN 2018
- LOCATION OF SOIL BORING COMPLETED IN 2018
- LOCATION OF MONITORING WELL COMPLETED IN 2019
- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- SITE BOUNDARY

30 0 30'

Title:

SITE PLAN WITH SAMPLING LOCATIONS

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 07/02/19
Prepared by: M.S.R.	Scale: AS SHOWN
Project Mgr: L.C.	Project: 3002.0004Y000
File: 3002.0004Y115.2.mxd	

FIGURE 2

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DINSMORE PLACE

CHESTNUT STREET

ATLANTIC AVENUE

9.60

9.50

MW-4
9.68

MW-5
9.67

MW-6
9.43

MW-7
9.51

MW-8
9.52

9.60

9.50

N

LEGEND

- LOCATION OF MONITORING WELL COMPLETED IN 2019
- –9.50– LINE OF EQUAL GROUNDWATER ELEVATION (DASHED WHERE INFERRED) (NAVD1988)
- INFERRED GROUNDWATER FLOW DIRECTION
- SITE BOUNDARY
- 1.51 GROUNDWATER ELEVATION IN FEET ABOVE MEAN SEA LEVEL (NAVD1988)

NOTES

1. GROUNDWATER ELEVATIONS BASED ON GAUGING DATA COLLECTED ON MAY 24, 2019
2. NAVD88 REFERS TO NORTH AMERICAN VERTICAL DATUM OF 1988

30 0 30'

Title:

GROUNDWATER ELEVATION CONTOUR MAP

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 07/22/19	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	3
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.6.mxd		

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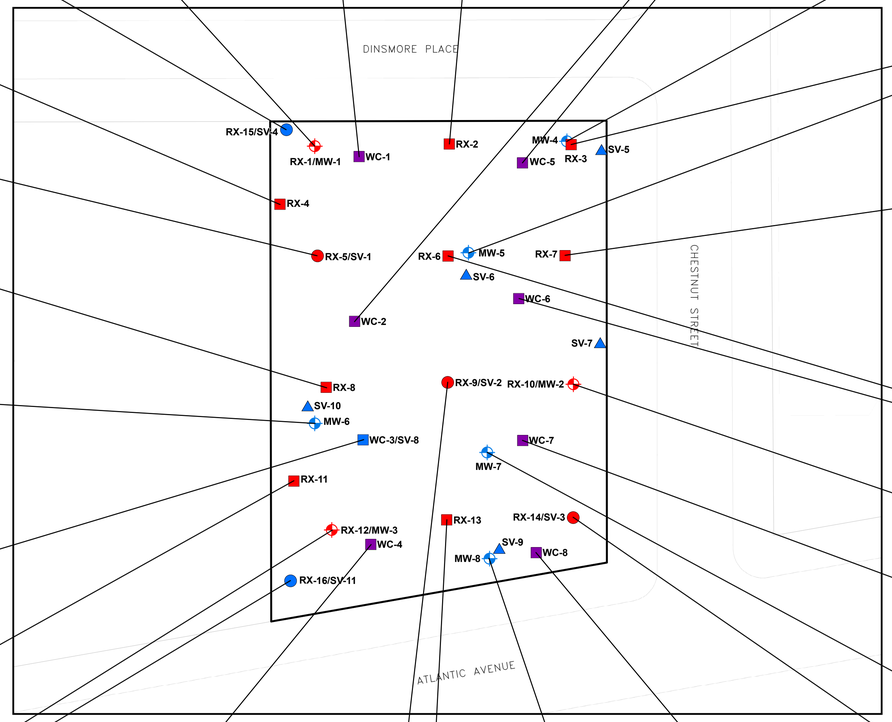

RX-1	7/25/18	2/27/18	7/25/18
Depth (ft bls)	0 - 2	1.5 - 3	13 - 15
SVOCs			
Benzo[a]anthracene	1.1	NE	ND
Benzo[a]pyrene	1.1	NE	ND
Benzo[b]fluoranthene	1.4	NE	ND
Chrysene	1.1	NE	ND
Indeno[1,2,3-cd]pyrene	0.75	NE	ND
Metals			
Copper	NE	56.8	NE
Lead	75	285	NE
Mercury	0.36	0.25	ND
Zinc	NE	247	NE
Pesticides			
4,4'-DDT	0.0052 J	0.0068 J	ND

WC-1	4/18/19	4/18/19	4/18/19	4/18/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
SVOCs				
Benzo[a]anthracene	NE	ND	2.8	NE
Benzo[a]pyrene	NE	NE	2.7	NE
Benzo[b]fluoranthene	NE	ND	3.5	NE
Benzo[k]fluoranthene	NE	ND	1.2	NE
Chrysene	NE	ND	2.5	NE
Indeno[1,2,3-cd]pyrene	NE	1.6	1.5	NE
Metals				
Cadmium	5.5	NE	ND	ND
Lead	152	NE	NE	NE
Mercury	0.25	NE	NE	ND
Zinc	188	NE	NE	NE
Pesticides				
4,4'-DDT	ND	0.0078	ND	ND

RX-2	2/27/18
Depth (ft bls)	3 - 5
Metals	
Arsenic	17.3
Lead	121
Zinc	128
Pesticides	
4,4'-DDT	0.0079

WC-2	4/18/19	4/18/19	4/18/19	4/18/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
SVOCs				
Benzo[a]anthracene	NE	4.8	NE	ND
Benzo[a]pyrene	NE	4.6	NE	NE
Benzo[b]fluoranthene	NE	5.9	NE	NE
Benzo[k]fluoranthene	NE	3.1	NE	NE
Chrysene	NE	5	NE	ND
Dibenzo[a,h]anthracene	NE	0.53	NE	ND
Indeno[1,2,3-cd]pyrene	NE	2.2	NE	ND
Metals				
Copper	53.4	NE	NE	NE
Lead	181	331	85.2	NE
Mercury	0.2	0.19	NE	ND
Zinc	140	338	NE	NE
Pesticides				
4,4'-DDT	ND	ND	0.0086 J	ND

WC-5	4/19/19	4/19/19	4/19/19	4/19/19	4/19/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	12 - 18 DUP	18 - 20
Metals					
Lead	113	NE	NE	NE	NE
Mercury	0.4	ND	NE	ND	ND
Zinc	189	NE	NE	NE	NE
Pesticides					
4,4'-DDT	0.0076 J	ND	ND	ND	ND
Dieldrin	0.0087 J	ND	ND	ND	ND

MW-4	4/15/19	4/17/19	4/17/19
Depth (ft bls)	0 - 2	26 - 28	26 - 28 DUP
SVOCs			
3&4-Methylphenol	0.48	ND	ND
Metals			
Arsenic	39.2	NE	NE
Copper	57.5	NE	NE
Lead	172	NE	NE
Zinc	161	NE	NE
Pesticides			
4,4'-DDT	0.012 J	ND	ND

RX-3	7/25/18	2/26/18	7/25/18
Depth (ft bls)	0 - 2	3 - 5	13 - 15
SVOCs			
Benzo[b]fluoranthene	1.1	NE	ND
Indeno[1,2,3-cd]pyrene	0.52	NE	ND
Metals			
Arsenic	NE	13.5	NE
Copper	80	NE	NE
Lead	429	201	NE
Mercury	0.3	NE	NE
Zinc	415	204	NE
Pesticides			
4,4'-DDT	0.016	0.0046 J	0.015
Dieldrin	NE	0.031	NE

RX-4	2/27/18
Depth (ft bls)	2 - 4
SVOCs	
Benzo[a]anthracene	2.1
Benzo[a]pyrene	1.9
Benzo[b]fluoranthene	3.1
Benzo[k]fluoranthene	1
Chrysene	2.1
Indeno[1,2,3-cd]pyrene	0.96
Metals	
Lead	125
Pesticides	
4,4'-DDT	0.0042 J

RX-5	2/27/18	7/24/18	7/24/18
Depth (ft bls)	1 - 3	13 - 15	13 - 15 DUP
SVOCs			
Benzo[b]fluoranthene	1.2	ND	ND
Metals			
Copper	82.2	NE	NE
Lead	298	NE	NE
Mercury	0.26	ND	ND
Zinc	215	NE	NE
Pesticides			
4,4'-DDT	0.0089	ND	ND

MW-5	4/16/19	4/16/19
Depth (ft bls)	0 - 2	28 - 30
SVOCs		
Benzo[a]anthracene	1.4	NE
Benzo[a]pyrene	1.3	NE
Benzo[b]fluoranthene	1.8	NE
Chrysene	1.3	NE
Indeno[1,2,3-cd]pyrene	1	NE
Metals		
Lead	186	NE
Mercury	0.19	ND
Zinc	151	NE
Pesticides		
4,4'-DDT	0.019	ND

RX-7	2/26/18	2/26/18
Depth (ft bls)	0.2 - 2.5	0.2 - 2.5 DUP
Metals		
Zinc	542	538
Pesticides		
4,4'-DDD	ND	0.0037 J

RX-8	2/27/18
Depth (ft bls)	2 - 4
Metals	
Copper	71.4
Lead	270
Mercury	0.51
Zinc	184
Pesticides	
4,4'-DDT	0.012

RX-6	7/25/18	2/27/18	7/25/18
Depth (ft bls)	0 - 2	2 - 3.5	13 - 15
SVOCs			
Benzo[a]anthracene	NE	1.3	2.3
Benzo[a]pyrene	NE	1.4	2.2
Benzo[b]fluoranthene	NE	1.9	3
Benzo[k]fluoranthene	NE	NE	0.95
Chrysene	NE	1.4	2.4
Dibenzo[a,h]anthracene	NE	NE	0.34
Indeno[1,2,3-cd]pyrene	NE	0.62	1.4
Metals			
Copper	76.3	63.2	NE
Lead	260	198	467
Mercury	0.23	NE	NE
Zinc	221	133	213
Pesticides			
4,4'-DDE	ND	0.0078	ND
4,4'-DDT	ND	0.08	0.011

MW-6	4/15/19	4/18/19
Depth (ft bls)	0 - 2	30 - 32
SVOCs		
Benzo[a]anthracene	2.1	NE
Benzo[a]pyrene	2.1	NE
Benzo[b]fluoranthene	3.6	NE
Benzo[k]fluoranthene	1	NE
Chrysene	1.9	NE
Indeno[1,2,3-cd]pyrene	1.5	NE
Metals		
Lead	168	NE
Mercury	0.36	NE
Pesticides		
4,4'-DDT	ND	0.0095 J

WC-6	4/19/19	4/19/19	4/19/19	4/19/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
Metals				
Arsenic	NE	14.3	ND	NE
Copper	51	NE	NE	NE
Lead	227	NE	NE	NE
Zinc	132	NE	NE	NE
Pesticides				
4,4'-DDT	0.0055 J	ND	ND	ND

WC-3	4/17/19	4/17/19	4/17/19	4/17/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
SVOCs				
4-Methylphenol	ND	0.79	ND	ND
Benzo[a]anthracene	2.3	NE	10	NE
Benzo[a]pyrene	2.3	NE	16	NE
Benzo[b]fluoranthene	3	NE	21	NE
Benzo[k]fluoranthene	1.1	NE	8.1	NE
Chrysene	2.9	NE	18	NE
Dibenzo[a,h]anthracene	0.47	NE	2	NE
Dibenzofuran	NE	NE	9.5	NE
Indeno[1,2,3-cd]pyrene	1.8	NE	7.8	NE
Metals				
Copper	NE	145	NE	NE
Lead	NE	665	87.1	NE
Zinc	NE	424	NE	NE
Pesticides				
4,4'-DDD	ND	ND	0.0041 J	ND
4,4'-DDT	0.0052 J	0.017	0.0075	0.0035 J

RX-10	7/24/18	2/26/18	7/24/18
Depth (ft bls)	0 - 2	2 - 4	13 - 15
Metals			
Arsenic	21.8	NE	ND
Copper	55.5	97.6	NE
Lead	NE	269	NE
Mercury	NE	0.45	ND
Zinc	NE	488	NE

RX-11	2/27/18
Depth (ft bls)	3 - 5
SVOCs	
Benzo[b]fluoranthene	1.3
Metals	
Copper	61.4
Lead	452
Mercury	0.2
Zinc	244
Pesticides	
4,4'-DDE	0.0048 J
4,4'-DDT	0.037

WC-7	4/19/19	4/19/19	4/19/19	4/19/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
Metals				
Arsenic	NE	23.8	NE	NE
Copper	60	NE	NE	NE
Lead	305	396	NE	NE
Mercury	NE	0.19	NE	ND
Zinc	473	253	NE	NE
Pesticides				
4,4'-DDE	0.0062 J	ND	ND	ND
4,4'-DDT	0.0095	0.0036 J	ND	ND

RX-12	7/24/18	2/27/18	7/24/18
Depth (ft bls)	0 - 2	1.5 - 3.5	13 - 15
Metals			
Lead	75.4	NE	NE
Nickel	NE	75.2	NE
Silver	NE	7.1	ND
Zinc	NE	NE	182
Pesticides			
4,4'-DDT	0.006 J	ND	ND

MW-7	4/16/19	4/15/19
Depth (ft bls)	0 - 2	30 - 32
VOCs		
Acetone	0.074	ND
Metals		
Lead	65	NE
Mercury	0.48	ND
Zinc	140	NE

RX-16	4/15/19	4/15/19
SCO	0 - 2	30 - 32
SVOCs		
Benzo[b]fluoranthene	1.3	NE
Indeno[1,2,3-cd]pyrene	0.96	1.1
Metals		
Copper	94	NE
Lead	226	NE
Mercury	0.27	ND
Zinc	215	NE
Pesticides		
4,4'-DDT	0.027	0.0037 J

WC-4	4/19/19	4/19/19	4/19/19	4/19/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
Metals				
Lead	341	238	NE	NE
Zinc	204	169	NE	NE
Pesticides				
4,4'-DDT	0.014 J	ND	ND	ND

RX-9	7/24/18	2/26/18	7/24/18	7/24/18
Depth (ft bls)	0 - 2	2 - 4	3 - 5	13 - 15
VOCs				
Benzene	ND	ND	4.2	ND
Toluene	ND	ND	2.7	ND
SVOCs				
Benzo[a]anthracene	2.8	1.7	NE	NE
Benzo[a]pyrene	2.4	1.5	NE	NE
Benzo[b]fluoranthene	2.4	1.9	NE	NE
Chrysene	3.4	1.7	ND	NE
Dibenzo[a,h]anthracene	0.35	NE	ND	ND
Indeno[1,2,3-cd]pyrene	1.1	0.78	ND	NE
Metals				
Copper	55.2	50.7	60.8	NE
Lead	251	217	NE	NE
Mercury	0.26	0.41	ND	NE
Zinc	188	209	NE	NE
Pesticides				
4,4'-DDT	0.011	0.011	NE	ND

RX-13	2/26/18
Depth (ft bls)	1 - 3
Metals	
Copper	82.2
Lead	226
Zinc	613
Pesticides	
4,4'-DDT	0.009

MW-8	4/15/19	4/15/19
Depth (ft bls)	0 - 2	30 - 32
Metals		
Mercury	0.21	ND
Zinc	213	NE

WC-8	4/19/19	4/19/19	4/19/19	4/19/19
Depth (ft bls)	0 - 6	6 - 12	12 - 18	18 - 20
SVOCs				
Benzo[a]anthracene	1.2	NE	ND	ND
Benzo[b]fluoranthene	1.2	NE	NE	ND
Chrysene	1.3	NE	NE	ND
Indeno[1,2,3-cd]pyrene	0.64	NE	ND	ND
Metals				
Lead	87.2	NE	NE	NE
Mercury	0.26	NE	NE	ND
Zinc	110	NE	NE	NE
Pesticides				
4,4'-DDT	0.013	ND	ND	ND

RX-14	2/26/18	7/24/18
Depth (ft bls)	0 - 2	13 - 15
SVOCs		
Benzo[b]fluoranthene	1.1	ND
Metals		
Copper	54.1	NE
Lead	274	NE
Zinc	425	NE
Pesticides		
4,4'-DDD	0.0072 J	ND
4,4'-DDT	0.0038 J	ND

LEGEND

- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL BORING, TEMPORARY MONITORING WELL, AND SOIL VAPOR POINT COMPLETED IN 2018
- LOCATION OF SOIL BORING AND COMPLETED IN 2019
- LOCATION OF MONITORING WELL COMPLETED IN 2019
- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- SITE BOUNDARY

Parameter	NYSDEC Part 375 Unrestricted Use SCO	NYSDEC Part 375 Restricted Residential Use SCO	NYSDEC Part 375 Protection of Groundwater Use SCO
VOCs			
Acetone	**0.05**	100	0.05
Benzene	**0.06**	4.8	0.06
Toluene	**0.7**	100	0.7
SVOCs			
3&4-Methylphenol	**0.33**	100	0.33
4-Methylphenol	**0.33**	100	0.33
Benzo[a]anthracene	**1**	1	1
Benzo[a]pyrene	**1**	1	22
Benzo[b]fluoranthene	**1**	1	1.7
Benzo[k]fluoranthene	**0.8**	3.9	1.7
Chrysene	**1**	3.9	1
Dibenzo[a,h]anthracene	**0.33**	0.33	1000
Dibenzofuran	**7**	59	210
Indeno[1,2,3-cd]pyrene	**0.5**	0.5	8.2
Metals			
Arsenic	**13**	16	16
Cadmium	**2.5**	4.3	7.5
Copper	**50**	270	1720
Lead	**63**	400	450
Mercury	**0.18**	0.81	0.73
Nickel	**30**	310	130
Silver	**2**	180	8.3
Zinc	**109**	10000	2480
Pesticides			
4,4'-DDD	**0.0033**	13	14
4,4'-DDE	**0.0033**	8.9	17
4,4'-DDT	**0.0033**	7.9	136
Dieldrin	**0.005**	0.2	0.1

NOTES

1. CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (MG/KG)
2. BOLD DATA INDICATES AN EXCEEDANCE OF NYSDEC PART 375 UNRESTRICTED USE SCO
3. SHADED DATA INDICATES AN EXCEEDANCE OF NYSDEC PART 375 RESTRICTED USE SCO
4. RED DATA INDICATES AN EXCEEDANCE OF NYSDEC PART 375 PROTECTION OF GROUNDWATER SCO

NYSDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DUP - DUPLICATE SAMPLE
FT BLS - FEET BELOW LAND SURFACE
J - ESTIMATED VALUE
ND - NO DETECTION
NE - NO EXCEEDANCE
SCO - SOIL CLEANUP OBJECTIVE
SVOC - SEMIVOLATILE ORGANIC COMPOUNDS
VOCS - VOLATILE ORGANIC COMPOUNDS

30 0 30'

Title:

SUMMARY OF EXCEEDANCES IN SOIL

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 07/26/19	FIGURE 4
Prepared by: M.S.R.	Scale: AS SHOWN	
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.3.mxd		

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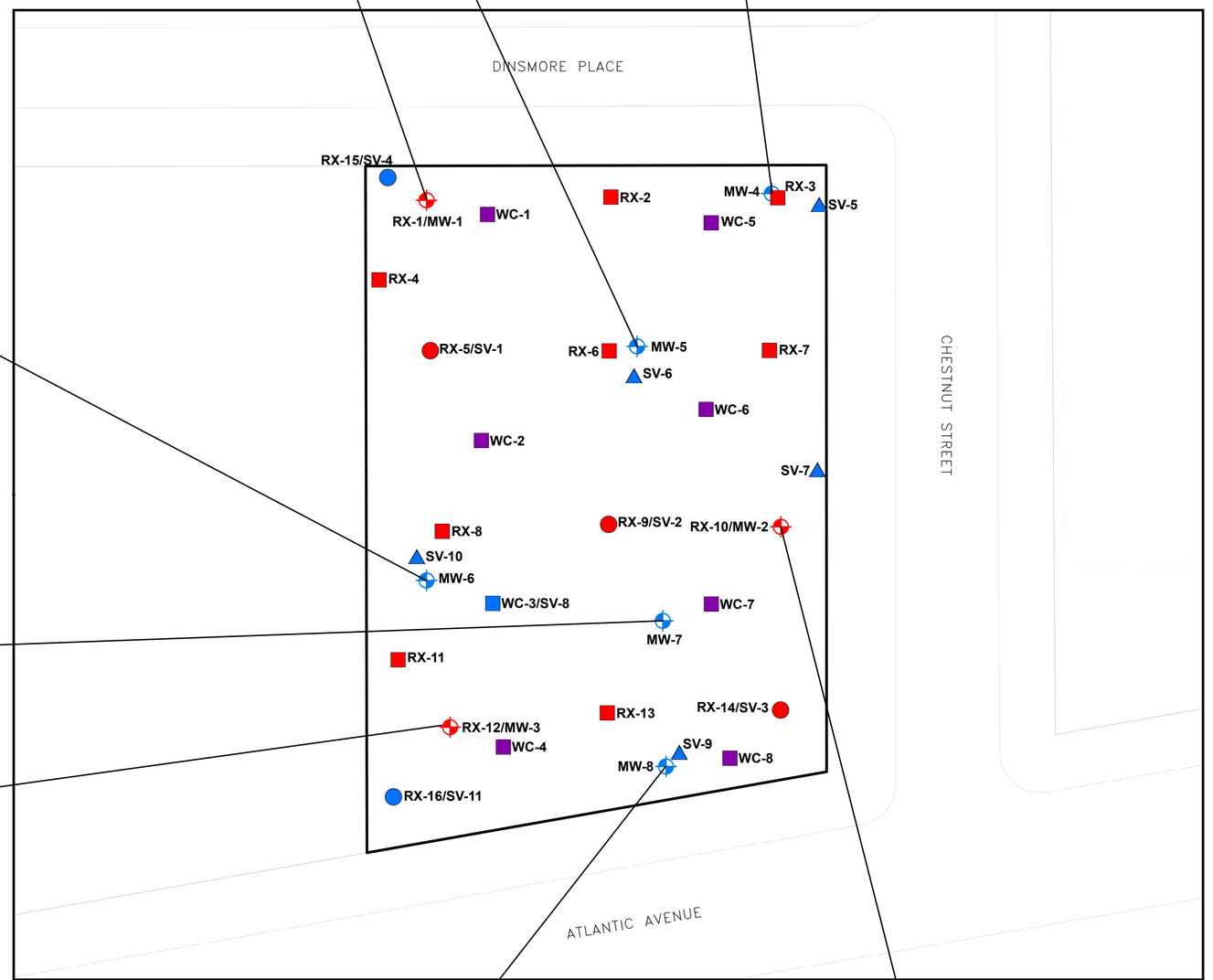

MW-1	7/25/18	7/25/18 DUP
Metals, Total		
Iron	**898**	NE
Manganese	**575**	**512**
Sodium	**51100**	**52500**
Metals, Dissolved		
Manganese	**507**	**441**
Sodium	**45900**	**46300**
Pesticides		
Chlordane	**1.4 P**	**1.2 P**

MW-5	4/30/19
Metals, Total	
Sodium	**107000**
Metals, Dissolved	
Sodium	**101000**

MW-4	4/30/19	4/30/19 DUP
VOCs		
Chloroform	**18**	**18**
Metals, Total		
Sodium	**25400**	**48100**
Metals, Dissolved		
Sodium	**25500**	**22500**

MW-6	4/30/19
SVOCs	
Bis(2-ethylhexyl) phthalate	**18**
Metals, Total	
Iron	**21300**
Lead	**36.2**
Manganese	**1380**
Sodium	**42900**
Metals, Dissolved	
Manganese	**304**
Sodium	**47700**

MW-7	4/30/19
VOCs	
Chloroform	**14**
Tetrachloroethene	**7.3**
Metals, Total	
Iron	**11300**
Manganese	**944**
Sodium	**34400**
Metals, Dissolved	
Manganese	**425**
Sodium	**35400**

MW-3	7/25/18
VOCs	
Trichloroethene	**5.4**
Metals, Total	
Beryllium	**6.5**
Chromium	**402**
Copper	**254**
Iron	**216000**
Lead	**100**
Magnesium	**52200**
Manganese	**10100**
Nickel	**503**
Sodium	**21500**
Thallium	**1.3**
Metals, Dissolved	
Manganese	**546**

MW-8	4/30/19
VOCs	
Chloroform	**23**
Tetrachloroethene	**6.2**
Metals, Total	
Iron	**443**
Sodium	**37800**
Metals, Dissolved	
Sodium	**34600**

MW-2	7/25/18
VOCs	
Tetrachloroethene	**22**
Metals, Total	
Iron	**1070**
Manganese	**954**
Sodium	**111000**
Metals, Dissolved	
Manganese	**793**
Sodium	**99600**

N

LEGEND

- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL BORING, TEMPORARY MONITORING WELL, AND SOIL VAPOR POINT COMPLETED IN 2018
- LOCATION OF SOIL BORING AND COMPLETED IN 2019
- LOCATION OF MONITORING WELL COMPLETED IN 2019
- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- SITE BOUNDARY

Parameter	NYSDEC AWQSGVS
VOCs	
Chloroform	**7**
Tetrachloroethene	**5**
Trichloroethene	**5**
SVOCs	
Bis(2-ethylhexyl) phthalate	**5**
Metals	
Beryllium	**3**
Chromium	**50**
Copper	**200**
Iron	**300**
Lead	**25**
Magnesium	**35000**
Manganese	**300**
Nickel	**100**
Sodium	**20000**
Thallium	**0.5**
PCBs	NE
Pesticides	
Chlordane	**0.05**

NOTES

1. CONCENTRATIONS IN MICROGRAMS PER LITER (µG/L)
2. BOLD DATA INDICATES AN EXCEEDANCE OF NYSDEC AWQSGVS

AWQSGVS - AMBIENT WATER-QUALITY STANDARDS AND GUIDANCE VALUES
NYSDEC - NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DUP - DUPLICATE SAMPLE
P - THE RPD BETWEEN THE RESULTS FOR THE TWO COLUMNS EXCEED THE METHOD-SPECIFIED CRITERIA
NE - NO EXCEEDANCE
PCBS - POLYCHLORINATED BIPHENYLS
SVOC - SEMIVOLATILE ORGANIC COMPOUNDS
VOCS - VOLATILE ORGANIC COMPOUNDS

30 0 30'

Title:

SUMMARY OF EXCEEDANES IN GROUNDWATER

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 07/26/19	FIGURE 5
Prepared by: M.S.R.	Scale: AS SHOWN	
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.4.mxd		

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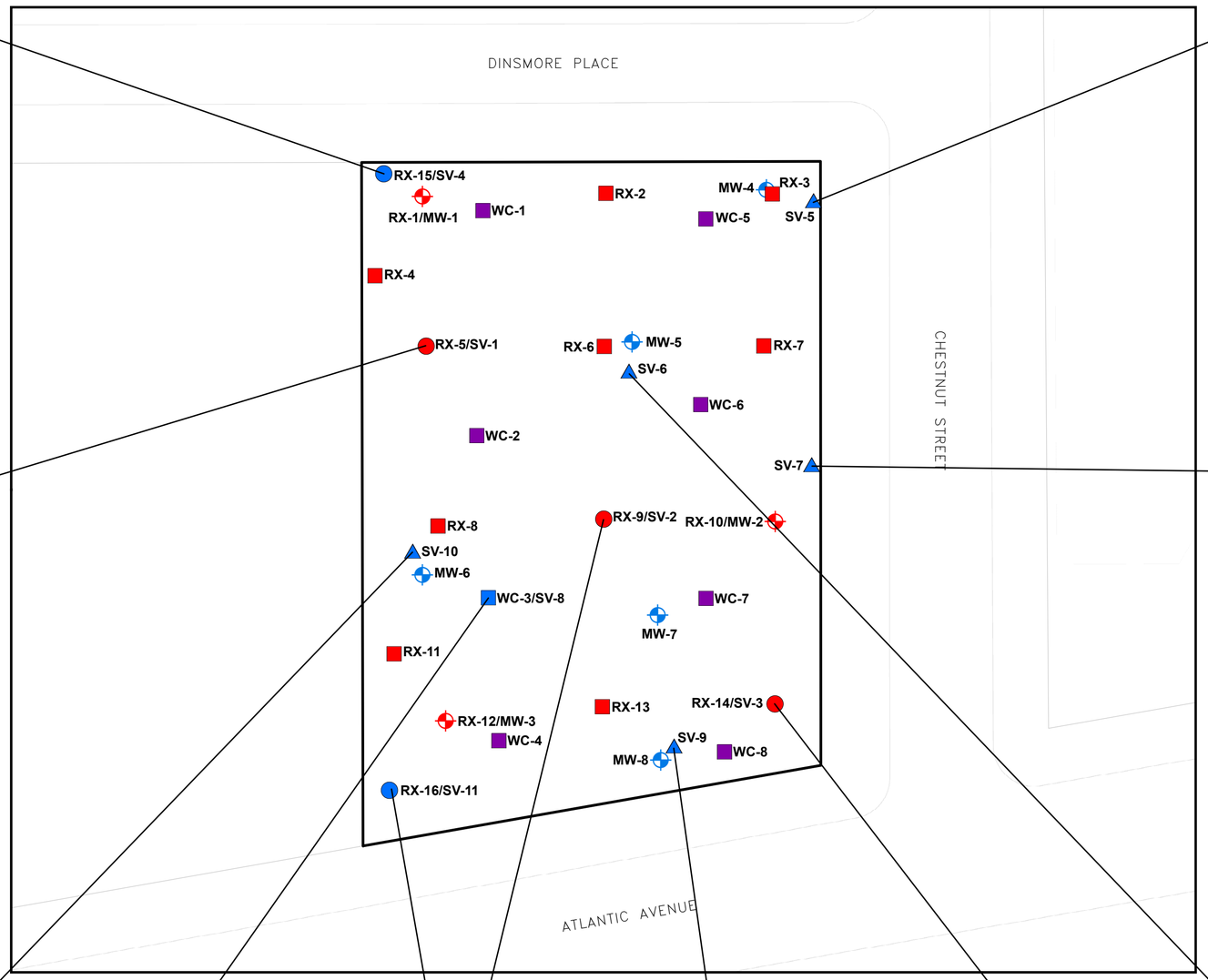

SV-4	4/30/19
VOCs	
1,1,1-Trichloroethane	**0.90 J**
1,2,4-Trimethylbenzene	**0.41 J**
2-Butanone (MEK)	**42**
Acetone	**34**
Benzene	**0.87**
Butane	**3.5**
Carbon disulfide	**1.9**
Carbon tetrachloride	**0.53**
Chloroform	**1.2**
Chloromethane	**0.66 J**
Cyclohexane	**0.43 J**
Dichlorodifluoromethane	**2.1 J**
Ethylbenzene	**1.9**
1,1,2-Trichloro-1,2,2-Trifluoroethane	**0.37 J**
2,2,4-Trimethylpentane	**0.47 J**
m+p-Xylene	**8**
Methylene chloride	**83**
n-Heptane	**0.96**
n-Hexane	**38**
o-Xylene	**1.4**
Styrene	**0.37 J**
t-Butyl Alcohol	**21**
Tetrachloroethene	**3**
Toluene	**5.1**
Trichloroethene	**1.6**
Trichlorofluoromethane	**6.3**

SV-5	4/30/19
VOCs	
1,3-Butadiene	**2.8**
2-Butanone (MEK)	**540 D**
2-Hexanone	**240**
Acetone	**960 D**
Bromodichloromethane	**16**
Butane	**42**
Chloroform	**300**
Dichlorodifluoromethane	**5.2 J**
Ethylbenzene	**2.6 J**
Isopropanol	**90**
m+p-Xylene	**8.9 J**
Methylene chloride	**8.5 J**
n-Heptane	**19**
n-Hexane	**21**
o-Xylene	**1.8 J**
t-Butyl Alcohol	**220**
Tetrachloroethene	**130**
Toluene	**14**
Trichloroethene	**34**
Trichlorofluoromethane	**5.3 J**

SV-1	7/24/18	7/24/2018 DUP
VOCs		
1,1,1-Trichloroethane	**3**	**3.3**
1,1,2,2-Tetrachloroethane	ND	**2.9**
1,2,4-Trimethylbenzene	**40**	**57**
1,3,5-Trimethylbenzene	**13**	**17**
1,3-Butadiene	**18 J**	**10 J**
2,2,4-Trimethylpentane	**14 J**	**5.6 J**
2-Butanone (MEK)	**82**	**100**
2-Hexanone	**19**	**21**
4-Ethyltoluene	**12**	**16**
4-Methyl-2-Pentanone	**5.3**	ND
Acetone	**2200 ET**	**2100 ET**
Benzene	**28 J**	**18 J**
Butane	**44**	**27**
Carbon disulfide	**4.5**	**ND**
Chloroform	**2.9**	**3.3**
Cyclohexane	**9.4**	**4.1**
Ethylbenzene	**47 J**	**34 J**
Isopropanol	**2.9**	**2.6**
m+p-Xylene	**140**	**110**
Methylene chloride	ND	**6.1**
N-Butylbenzene	**3**	**3.2**
n-Heptane	**32 J**	**16 J**
n-Hexane	**35 J**	**17 J**
N-Propylbenzene	**10**	**11**
o-Xylene	**52**	**45**
Styrene	**2.4**	**2.4**
Tetrachloroethene	**31**	**62**
Toluene	**150 J**	**76 J**
Trichloroethene	**150**	**230**
Trichlorofluoromethane	**39**	**40**
Xylenes, Total	**190**	**160**

SV-7	4/30/19
VOCs	
1,1,1-Trichloroethane	**0.73 J**
1,1-Dichloroethene	**0.55**
2-Butanone (MEK)	**46**
Acetone	**84**
Benzene	**0.8**
Butane	**3.3**
Carbon disulfide	**1.5 J**
Carbon tetrachloride	**0.45**
Chlorodifluoromethane	**1.6 J**
Chloroform	**5.4**
cis-1,2-Dichloroethene	**550 D**
Dichlorodifluoromethane	**3.8**
Ethylbenzene	**2.3**
1,1,2-Trichloro-1,2,2-Trifluoroethane	**0.43 J**
2,2,4-Trimethylpentane	**0.47 J**
m+p-Xylene	**10**
Methylene chloride	**0.85 J**
n-Hexane	**0.61 J**
o-Xylene	**1.4**
t-Butyl Alcohol	**27**
Tetrachloroethene	**7**
Toluene	**1.6**
trans-1,2-Dichloroethene	**2.8**
Trichloroethene	**130**
Trichlorofluoromethane	**4**
Vinyl chloride	**0.88**

SV-10	4/30/19
VOCs	
1,1,1-Trichloroethane	**0.57 J**
1,2,4-Trimethylbenzene	**0.46 J**
1,3-Butadiene	**0.30 J**
2-Butanone (MEK)	**130 D**
2-Hexanone	**7.4**
Acetone	**130 D**
Benzene	**0.67**
Butane	**8.5**
Carbon disulfide	**2.9**
Carbon tetrachloride	**0.37**
Chloroform	**3.3**
Dichlorodifluoromethane	**2.5**
Ethylbenzene	**2.4**
1,1,2-Trichloro-1,2,2-Trifluoroethane	**0.47 J**
2,2,4-Trimethylpentane	**0.60 J**
Isopropanol	**8.6 J**
m+p-Xylene	**8.8**
n-Heptane	**4.6**
n-Hexane	**3.2**
o-Xylene	**1.7**
t-Butyl Alcohol	**65**
Tetrachloroethene	**3.6**
Toluene	**2.1**
Trichloroethene	**470 D**
Trichlorofluoromethane	**4.1**

SV-8	4/30/19
VOCs	
2-Butanone (MEK)	**160**
2-Hexanone	**6**
Acetone	**280 D**
Benzene	**0.70 J**
Butane	**6.7**
Carbon disulfide	**3.1**
Carbon tetrachloride	**0.54**
Chloroform	**3.1**
cis-1,2-Dichloroethene	**1.4**
Dichlorodifluoromethane	**2.4 J**
Ethylbenzene	**1.9**
Freon 113	**0.49 J**
m+p-Xylene	**7.7**
n-Heptane	**1.4 J**
n-Hexane	**1.6**
o-Xylene	**0.92 J**
t-Butyl Alcohol	**48**
Tetrachloroethene	**3.9**
Toluene	**2.8**
Trichloroethene	**680 D**
Trichlorofluoromethane	**4.3**

SV-11	5/7/19
VOCs	
1,3-Butadiene	**6.8 J**
2-Butanone (MEK)	**1600 B**
2-Hexanone	**220**
Acetone	**3300**
Butane	**60**
t-Butyl Alcohol	**440 J**
Tetrachloroethene	**15 J**
Trichloroethene	**1700**

SV-2	7/24/18
VOCs	
1,1,1-Trichloroethane	**3.1**
1,2,4-Trimethylbenzene	**37**
1,3,5-Trimethylbenzene	**12**
1,3-Butadiene	**4.2**
2,2,4-Trimethylpentane	**11**
2-Butanone (MEK)	**60**
4-Ethyltoluene	**12**
Acetone	**1800 ET**
Benzene	**40**
Butane	**24**
Carbon disulfide	**9.1**
Chloroform	**3**
Cyclohexane	**7.3**
Ethylbenzene	**42**
Isopropylbenzene	**3**
m+p-Xylene	**130**
n-Heptane	**51**
n-Hexane	**30**
N-Propylbenzene	**9.3**
o-Xylene	**50**
Tetrachloroethene	**320**
Toluene	**120**
Trichloroethene	**210**
Trichlorofluoromethane	**21**
Xylenes, Total	**180**

SV-9	4/30/19	4/30/19 DUP
VOCs		
1,3-Butadiene	**0.79 J**	**0.95 J**
2-Butanone (MEK)	**91**	**100**
Acetone	**160**	**160**
Benzene	**0.85 J**	ND
Butane	**11**	**9.3**
Carbon disulfide	**2.5 J**	**3.1 J**
Carbon tetrachloride	**0.38 J**	ND
Chloroform	**9.9**	**12**
Cyclohexane	**0.48 J**	ND
Dichlorodifluoromethane	**3.2 J**	ND
Ethylbenzene	**3.2**	**3.1 J**
1,1,2-Trichloro-1,2,2-Trifluoroethane	**0.61 J**	ND
2,2,4-Trimethylpentane	**0.86 J**	ND
m+p-Xylene	**12**	**11**
Methylene chloride	**1.9 J**	ND
n-Heptane	**1.9**	ND
n-Hexane	**2.5**	ND
o-Xylene	**2.3**	**2.0 J**
t-Butyl Alcohol	**54**	**38 J**
Tetrachloroethene	**5.5**	**10**
Toluene	**2.2**	**2.4 J**
Trichloroethene	**730 D**	**1800 D**
Trichlorofluoromethane	**2.6**	**2.8 J**

SV-3	7/24/18
VOCs	
Acetone	**2200 T**
Butane	**100**
Cis-1,2-Dichloroethylene	**74**
Tetrachloroethene	**13000**
Toluene	**100**
Trichloroethene	**4600**

SV-6	4/30/19
VOCs	
1,1,1-Trichloroethane	**1.3**
1,3-Butadiene	**0.67**
2-Butanone (MEK)	**120**
2-Hexanone	**5.3**
Acetone	**320 D**
Benzene	**0.48 J**
Butane	**5.4**
Carbon disulfide	**2.6**
Carbon tetrachloride	**0.20 J**
Chloroform	**5**
cis-1,2-Dichloroethene	**2.8**
Dichlorodifluoromethane	**2.8**
Ethylbenzene	**1.6**
Freon 113	**0.42 J**
Isopropanol	**5.9 J**
m+p-Xylene	**4.8**
n-Heptane	**1.1**
n-Hexane	**1.2**
o-Xylene	**0.55 J**
t-Butyl Alcohol	**41**
Tetrachloroethene	**7.3**
Toluene	**1.5**
Trichloroethene	**56**
Trichlorofluoromethane	**8.3**

LEGEND

- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL BORING, TEMPORARY MONITORING WELL, AND SOIL VAPOR POINT COMPLETED IN 2018
- LOCATION OF SOIL BORING AND COMPLETED IN 2019
- LOCATION OF MONITORING WELL COMPLETED IN 2019
- LOCATION OF SOIL BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF SOIL VAPOR POINT COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING COMPLETED IN 2019
- LOCATION OF WASTE CHARACTERIZATION BORING AND SOIL VAPOR POINT COMPLETED IN 2019
- SITE BOUNDARY

NOTES

1. CONCENTRATIONS IN MICROGRAMS PER CUBIC METER (µg/m^3)
2. BOLD DATA INDICATES A DETECTION

ND - NO DETECTION
B - THE ANALYTE WAS FOUND IN AN ASSOCIATED BLANK AS WELL AS IN THE SAMPLE
D - A SECONDARY ANALYSIS AFTER DILUTION DUE TO EXCEEDANCE OF THE CALIBRATION RANGE IN THE ORIGINAL SAMPLE
E - INDICATES VALUE EXCEEDED CALIBRATION RANGE
J - ESTIMATED VALUE
T - INDICATES THAT A QUALITY CONTROL PARAMETER HAS EXCEEDED LABORATORY LIMITS
VOCS - VOLATILE ORGANIC COMPOUNDS

30 0 30'

Title:

SUMMARY OF DETECTIONS IN SOIL VAPOR

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 07/26/19
Prepared by: M.S.R.	Scale: AS SHOWN
Project Mgr: L.C.	Project: 3002.0004Y000
File: 3002.0004Y115.5.mxd	

FIGURE 6

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LEGEND

- BCP SITE BOUNDARY
- RX–2 — LOCATION AND DESIGNATION OF SOIL BORING
- RX–5/SV–1 — LOCATION AND DESIGNATION OF SOIL BORING/SOIL VAPOR SAMPLE POINT
- RX–1/MW–1 — LOCATION AND DESIGNATION OF SOIL BORING/SOIL VAPOR SAMPLE POINT AND MONITORING WELL
- MW–8 — LOCATION AND DESIGNATION OF MONITORING WELL
- SV–9 — LOCATION AND DESIGNATION OF SOIL VAPOR SAMPLE POINT
- WC–4 — LOCATION AND DESIGNATION OF WASTE CHARACTERIZATION BORING
- WC–2/SV–8 — LOCATION AND DESIGNATION OF WASTE CHARACTERIZATION BORING/SOIL VAPOR SAMPLE POINT
- PROPOSED LIMIT OF EXCAVATION 14–20 FT BLS
- PROPOSED LIMIT OF EXCAVATION/BACKFILL 32 FT BLS
- FT BLS — FEET BELOW LAND SURFACE
- BCP — BROWNFIELDS CLEANUP PROGRAM

NOTES

SITE PLAN ADAPTED FROM "100% CONTRACT DOCUMENTS – SUPPORT OF EXCAVATION DRAWINGS" PROVIDED BY DATTNER ARCHITECTS.

N

30' 0 30'

Title:

REMEDIAL ALTERNATIVE 1: TRACK 1 UNRESTRICTED USE CLEANUP

CHESTNUT COMMONS ATLANTIC AVENUE SITE
BLOCK 4142, LOT 34, BROOKLYN, NEW YORK
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: A.F.	Date: 03JUL19	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	7
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.01.DWG		

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LEGEND

- BCP SITE BOUNDARY
- RX–2 — LOCATION AND DESIGNATION OF SOIL BORING
- RX–5/SV–1 — LOCATION AND DESIGNATION OF SOIL BORING/SOIL VAPOR SAMPLE POINT
- RX–1/MW–1 — LOCATION AND DESIGNATION OF SOIL BORING/SOIL VAPOR SAMPLE POINT AND MONITORING WELL
- MW–8 — LOCATION AND DESIGNATION OF MONITORING WELL
- SV–9 — LOCATION AND DESIGNATION OF SOIL VAPOR SAMPLE POINT
- WC–4 — LOCATION AND DESIGNATION OF WASTE CHARACTERIZATION BORING
- WC–2/SV–8 — LOCATION AND DESIGNATION OF WASTE CHARACTERIZATION BORING/SOIL VAPOR SAMPLE POINT
- PROPOSED LIMITS OF EXCAVATION TO A MINIMUM OF APPROXIMATELY 15 FT BLS. SITE COVER SYSTEM COMPRISED OF CONCRETE BUILDING FOUNDATIONS WITH DEMARCATION LAYER OF 20–MIL THICK VAPOR BARRIER OR WATERPROOFING
- FT BLS — FEET BELOW LAND SURFACE
- BCP — BROWNFIELDS CLEANUP PROGRAM

NOTES

SITE PLAN ADAPTED FROM "100% CONTRACT DOCUMENTS – SUPPORT OF EXCAVATION DRAWINGS" PROVIDED BY DATTNER ARCHITECTS.

N

30' 0 30'

Title:

REMEDIAL ALTERNATIVE 2: TRACK 2 RESTRICTED RESIDENTIAL USE CLEANUP

CHESTNUT COMMONS ATLANTIC AVENUE SITE
BLOCK 4142, LOT 34, BROOKLYN, NEW YORK
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: A.F.	Date: 03JUL19	FIGURE
Prepared by: G.M.	Scale: AS SHOWN	8
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.01.DWG		

V:\CAD\PROJECTS\3002Y\0004Y\115\3002.0004Y115.01.DWG

LEGEND

200’ 0 200’

IN-BOUND ROUTE

1. Turn right onto Chestnut Street from Atlantic Avenue.
2. Turn left onto Dinsmore Place.
3. Enter site on left.

OUT-BOUND ROUTE

1. Exit site and make left onto Dinsmore Place.
2. Turn left onto Logan Street.
3. Turn right onto Atlantic Avenue.

N

Title:

TRUCK ROUTE MAP

CHESTNUT COMMONS ATLANTIC AVENUE SITE
BLOCK 4142, LOT 34, BROOKLYN, NEW YORK
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 09JULY19
Prepared by: B.H.C.	Scale: AS SHOWN
Project Mgr: L.C.	Project: 3002.0004Y000
File: 3002.0004Y115.02.CDR	

FIGURE 9

\3002Y\0004Y\115\3002.0004Y115.02.CDR

DINSMORE PLACE

CHESTNUT STREET

ATLANTIC AVENUE

WC-1

WC-5

WC-6

WC-2

WC-3

WC-7

WC-4

WC-8

N

LEGEND

- LOCATION OF PRE-EXCAVATION END-POINT SAMPLE COLLECTED DURING 2019 RI
- APPROXIMATE LOCATION OF PROPOSED POST-EXCAVATION END-POINT SAMPLES
- SITE BOUNDARY

30 0 30'

Title:

END-POINT SOIL SAMPLE LOCATIONS

CHESTNUT COMMONS ATLANTIC AVE. SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS, LLC

ROUX

Compiled by: E.B.	Date: 12/10/19	FIGURE
Prepared by: M.S.R.	Scale: AS SHOWN	10
Project Mgr: L.C.	Project: 3002.0004Y000	
File: 3002.0004Y115.7.mxd		

V:\GIS\Projects\3002\0004Y\115\3002.0004Y115.7.mxd

APPENDICES

A. Metes and Bounds
B. Soil Boring and Well Construction Logs
C. Groundwater Sampling Forms
D. Soil Vapor Sampling Forms
E. Analytical Data from the Remedial Investigation
F. Data Usability Summary Report for Remedial Investigation Data
G. Certified Sanborn Maps
H. *In Situ* Soil Waste Characterization Report
I. Health and Safety Plan
J. Quality Assurance Project Plan/Field Sampling Plan
K. Citizen Participation Plan
L. Resumes of Key Personnel
M. Vapor Barrier System Specifications
N. Sub-Slab Depressurization System Specifications

APPENDIX A

Metes and Bounds

APPENDIX B

Soil Boring and Well Construction Logs

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE
RX-1/MW-1	**Not Measured**	**Not Measured**
PROJECT NO./NAME		LOCATION
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**
APPROVED BY	LOGGED BY	**Brooklyn, New York**
J. Taylor	**C. Stowell**	
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA
Trinity Environmental / Joe Sakellis		

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/25/18-7/25/18**

LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL
Not Measured	**Not Measured**	**Cuttings**

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine SAND and SILT, little coarse Gravel and Cobble, trace brick and glass (FILL); moist.		0.0	4' recovery. Collect groundwater sample MW-1 for VOCs, SVOCs, Pesticides, PCBs and TAL Metals. Collect grab sample RX-1_0-2 from 0' to 2' bls for VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
5		Dark brown, fine to medium SAND, some Silt and fine to coarse Gravel, little Cobble, trace brick and glass (FILL); moist.			5
		BRICK (FILL).			5' recovery.
		Light brown, fine to coarse SAND, trace fine gravel; moist.		0.0	
10					10
					5' recovery.
				0.0	
15					Collect grab sample RX-1_13-15 from 13' to 15' bls for VOCs, SVOCs, Pesticides, PCBs and TAL Metals. 15
					5' recovery.
				0.0	
20					20
					5' recovery.
				0.0	
25					25
		Light brown, fine to coarse SAND, little fine Gravel; moist.			5' recovery.
				0.0	
30					30
		Light brown, fine to coarse SAND, some fine Gravel, little Cobble and medium to coarse Gravel; wet.			5' recovery.
				0.0	
35					End of boring at 35' bls. 35

BORING/FEET MHANY CHESTNUT COMMONS.GPJ ROUX.GDT 8/15/19

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-10/MW-2	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/24/18-7/24/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark brown, fine to coarse SAND, some fine to coarse Gravel, trace brick (FILL); moist.			3' recovery.
				0.0	Collect grab sample RX-10_0-2 from 0' to 2' bls for VOCs, SVOCs, Pesticides, PCBs and TAL Metals. Collect groundwater sample MW-2 for VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
5					5
		Brown, fine to medium SAND, some Silt, little fine to coarse Gravel and Cobble, trace brick (FILL); moist.			4' recovery.
				0.0	
		Light brown, fine to coarse SAND, trace fine gravel; moist.			
10					10
					5' recovery.
				0.0	
				0.0	Collect grab sample RX-10_13-15 from 13' to 15' bls for VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
15					15
					5' recovery.
				0.0	
20					20
					5' recovery.
				0.0	
				0.0	
25					25
					5' recovery.
				0.0	
30					30
		Dark brown, fine to coarse SAND, some fine to coarse Gravel; moist.			5' recovery.
		Light brown, fine to coarse SAND, trace fine gravel; moist.			
				0.0	
35					End of boring at 35' bls. 35

BORING/FEET MHANY CHESTNUT COMMONS.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-12/MW-3	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/24/18-7/24/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to medium SAND, some fine to coarse Gravel, little Silt (FILL); moist.			4.5' recovery.
				0.0	Collect grab sample RX-12_0-2 from 0' to 2' bls for VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
				0.0	Collect groundwater sample MW-3 for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
		Grey, fine SAND and SILT (FILL); moist.			
		Grey, COBBLE, some fine to coarse Sand and Gravel, little Brick (FILL); moist.		0.0	
5					5
					3' recovery.
				0.0	
		Dark brown, fine to medium SAND, some coarse Sand and fine Gravel, little Silt and Cobble; moist.			
10					10
					4.5' recovery.
				0.0	
		Brown, fine to medium SAND, little fine Gravel; moist.			Collect grab sample RX-12_13-15 from 13' to 15' bls for VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
		Light brown, fine to coarse SAND; moist.		0.0	
15					End of boring at 15' bls. 15

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-14/SV-3	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/24/18-7/24/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark brown, fine to medium SAND, some Silt and fine to coarse Gravel, little Cobble, trace glass, brick, debris (FILL); moist.			5' recovery.
					Collect soil vapor sample SV-3 for VOCs.
				0.0	
5					5
					4' recovery.
		Light brown, fine to medium SAND, some coarse Sand and fine Gravel; moist.		0.0	
10					10
		Light brown, fine to coarse SAND, little fine Gravel; moist.			5' recovery.
				0.0	Collect grab sample RX-14_13-15 for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
					End of boring at 15' bls.
15					15

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-3	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/25/18-7/25/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark brown, fine to medium SAND and fine GRAVEL, trace medium to coarse gravel and brick (FILL); moist.			3' recovery.
					Collect grab sample RX-3_0-2 from 0' to 2' bls for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
				0.0	Collect grab sample RX-3 (3-5) from 3' to 5' bls for for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
5					5
		Brown, SILT, some fine to medium Sand; moist.			4' recovery.
		Light brown, fine to coarse SAND; moist.		0.0	
10					10
					5' recovery.
				0.0	
					Collect grab sample RX-3_13-15 from 13' to 15' bls for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
					End of boring at 15' bls.
15					15

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-5/SV-1	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/24/18-7/24/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace glass, brick (FILL); moist.			4' recovery.
					Collect soil vapor sample SV-1 for VOCs.
				0	
		Grey, COBBLE, some fine to coarse Sand (FILL); dry.			
		Brown, fine to coarse SAND, some fine to coarse Gravel, little Silt, trace glass, brick (FILL); moist.		0	
5		Grey, COBBLE, little fine to coarse Sand (FILL); dry.			4' recovery. 5
		Brown to grey, fine to coarse SAND, some fine to coarse Gravel, little Cobble, trace brick (FILL); moist.		0	
		Light brown, fine SAND, some Silt, trace cobble; moist.			
		Light brown, coarse SAND, some fine to medium Sand, little fine Gravel; moist.		0	
10					10
		LIght brown, medium to coarse SAND, some fine Gravel, little fine Sand; moist.			4.5' recovery.
				0	
					Collect sample RX-5_13-15 from 13' to 15' bls for for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
15					End of boring at 15' bls. 15

BORING/FEET MHANY CHESTNUT COMMONS.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-6	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/25/18-7/25/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to coarse SAND, some fine to coarse Gravel and Cobble, little Silt, trace brick (FILL); moist.			4' recovery.
					Collect grab sample RX-6_0-2 from 0' to 2' bls for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
				0.0	
5					5
					2.5' recovery.
				0.0	
		BRICK (FILL).			
		Brown, fine to coarse SAND, some fine to coarse Gravel and Cobble, little Silt, trace brick (FILL); moist.			
10					10
					2.5' recovery.
				0.0	Collect grab sample RX-6_13-15 from 13' to 15' bls for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
15					End of boring at 15' bls. 15

BORING/FEET MHANY CHESTNUT COMMONS.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-9/SV-2	**Not Measured**	**Not Measured**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons Atlantic Ave.		**Block 4142 Lot 34**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**C. Stowell**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
Trinity Environmental / Joe Sakellis				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**7720DT / Geoprobe**	**2" Macro-Core**	**7/24/18-7/24/18**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
Not Measured	**Not Measured**	**Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to medium SAND, some Silt, little coarse Sand and fine Gravel, trace brick (FILL); moist.			3' recovery.
				0.0	Collect grab sample RX-9_0-2 and soil vapor sample SV-2 for VOCs.
		Dark brown, SILT, some fine to medium Sand, little fine Gravel (FILL); moist.	G		
				8.8	Collect grab sample RX-9_3-5 for for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
				23.2	
5					5
		Brown, fine to coarse SAND, some fine to coarse Gravel, little Brick (FILL); moist.			2.5' recovery.
		Grey, COBBLE, some fine to coarse Gravel, little fine to coarse Sand; dry.			
		Dark brown, fine to medium SAND, little fine Gravel; moist.			
10					10
		Dark brown, fine to medium SAND, some fine to coarse Gravel, little Silt and Cobble; moist.			2.5' recovery. Refusal at 10.5' bls, moved boring 4' east; continue drilling.
				0.0	
		Brown, fine to coarse SAND, some fine Gravel, little Silt, trace cobble; moist.			Collect grab sample RX-9_13-15 from 13' to 15' bls for analysis of VOCs, SVOCs, Pesticides, PCBs and TAL Metals.
				0.0	
15					End of boring at 15' bls. 15

BORING/FEET MHANY CHESTNUT COMMONS.GPJ ROUX.GDT 8/15/19

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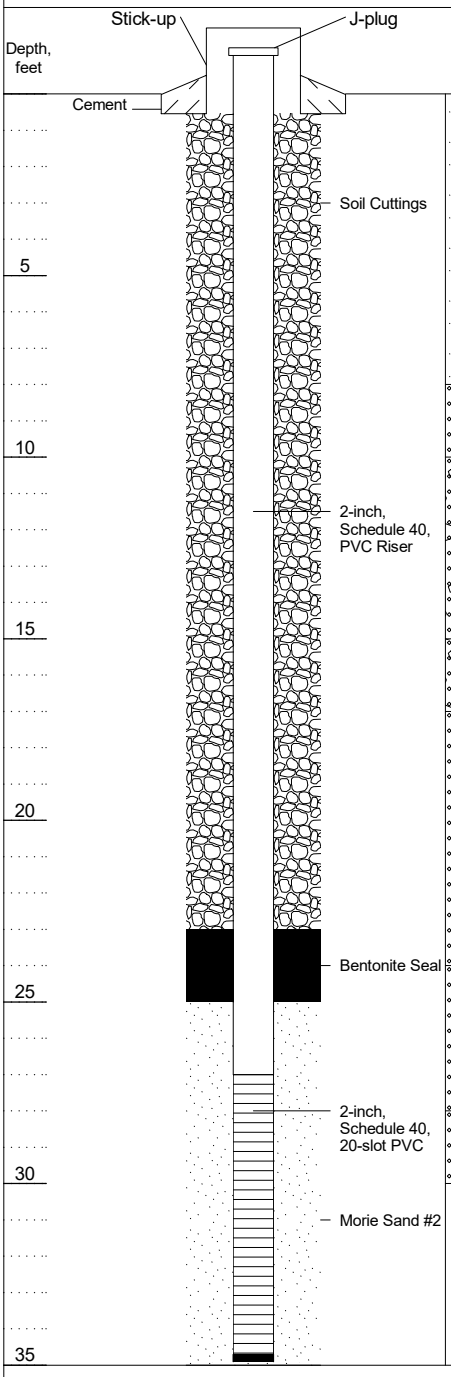
WELL CONSTRUCTION LOG

WELL NO.	LATITUDE	LONGITUDE
MW-4	**187536.436**	**1018862.892**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **E. Butler**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT / R. Allegrezza**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/15/19-4/17/19**

CASING MAT./DIA.: **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **8.0** ft DIA. **2-inch** SLOT SIZE **20-Slot**



Depth, feet	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0	Brown, fine to coarse SAND, some Gravel, Brick, and Concrete (FILL); moist.	G	0.2	Collect soil sample MW-4 (0-2) for RI list of parameters.
5			0.2	Hand cleared to 5 ft bls.
	Brown, fine to coarse SAND, some Silt, little gravel; moist.		0.4	
10	Brown, fine to coarse SAND, little gravel and silt; moist.		0.1	
15	Brown, fine to coarse SAND, some Gravel; moist.		0.1	
	Brown, fine to coarse SAND, little Silt; moist.		0.2	
20			0.1	
25	Brown, fine to medium SAND, little Silt; moist.		0.1	
			0.1	Collect soil sample MW-4 (26-28) for RI list of parameters. Collect soil sample DUP041719 for RI list of parameters. Water observed at 28 ft bls.
30	Brown, fine to medium SAND, little Silt; wet.			End of soil boring at 30 ft bls.
35				

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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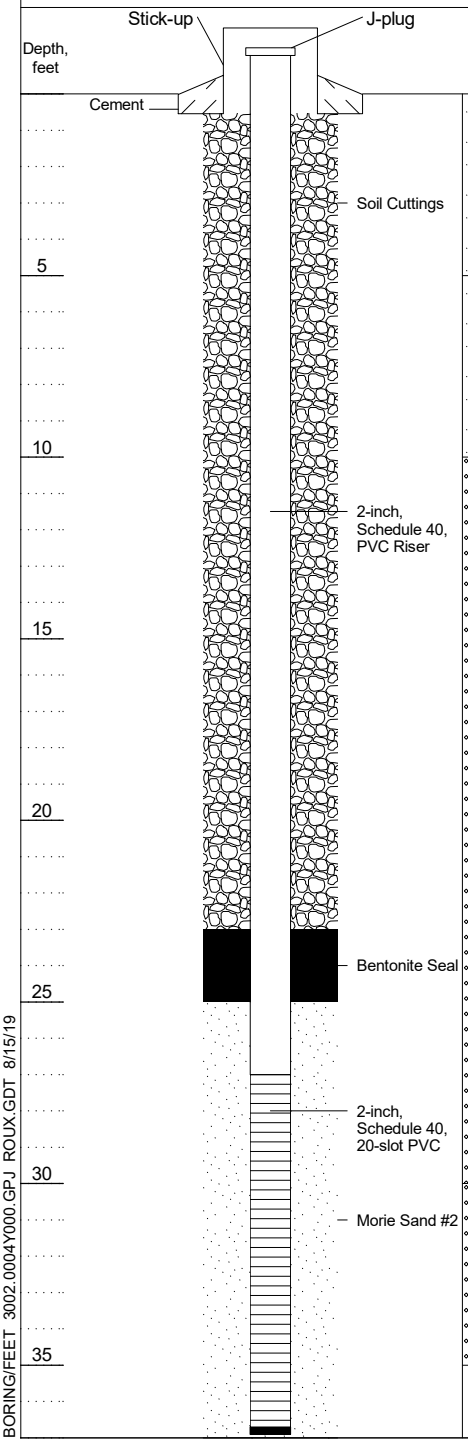
WELL CONSTRUCTION LOG

WELL NO.	LATITUDE	LONGITUDE
MW-5	**187482.798**	**1018830.953**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **L. D'Orsa**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT /**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/16/19**

CASING MAT./DIA.: **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown to dark brown, fine to medium SAND, some Brick, Asphalt, and Concrete (FILL); moist.	G	0.0	Collect soil sample MW-5 (0-2) for RI list of parameters.
5		Light to dark Brown, fine to medium SAND, some Asphalt and Concrete (FILL); moist.		0.0	Hand cleared to 5 ft bls.
10		Light Brown, fine to medium SAND; moist.		0.1	
15				0.0	
20				0.0	
25				0.0	
30		Dark brown, fine to medium SAND; wet.		0.0	Collect soil sample MW-5 (28-30) for RI list of parameters. Water observed at 31 ft bls.
35					End of soil logging at 35 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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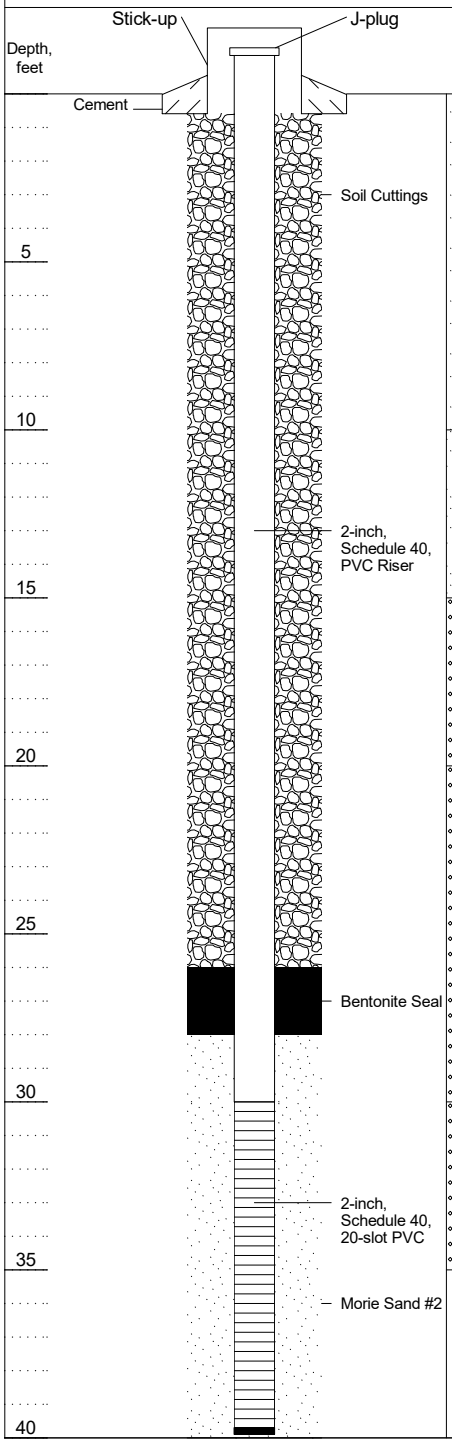
WELL CONSTRUCTION LOG

WELL NO.	LATITUDE	LONGITUDE
MW-6	**187400.609**	**1018780.811**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **L. D'Orsa**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT / R. Allegrezza**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/15/19-4/18/19**

CASING MAT./DIA.: **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Light to dark brown, fine to coarse SAND, some Asphalt, Brick, and Concrete (FILL), trace gravel; moist.	G	0.0	
5				0.0	Hand cleared to 5 ft bls.
10		Light brown, coarse SAND; moist.		8.8	
15		Brown, fine to coarse SAND; moist.		11.4	
20		Light brown, coarse to fine SAND; moist.		6.9	
25				19.0	
30		Light brown, fine to coarse SAND, trace gravel; wet.		0.0	Collect soil sample MW-6 (30-32) for RI list of parameters. Water observed at 34 ft bls.
35					End of soil logging at 35 ft bls.
40					

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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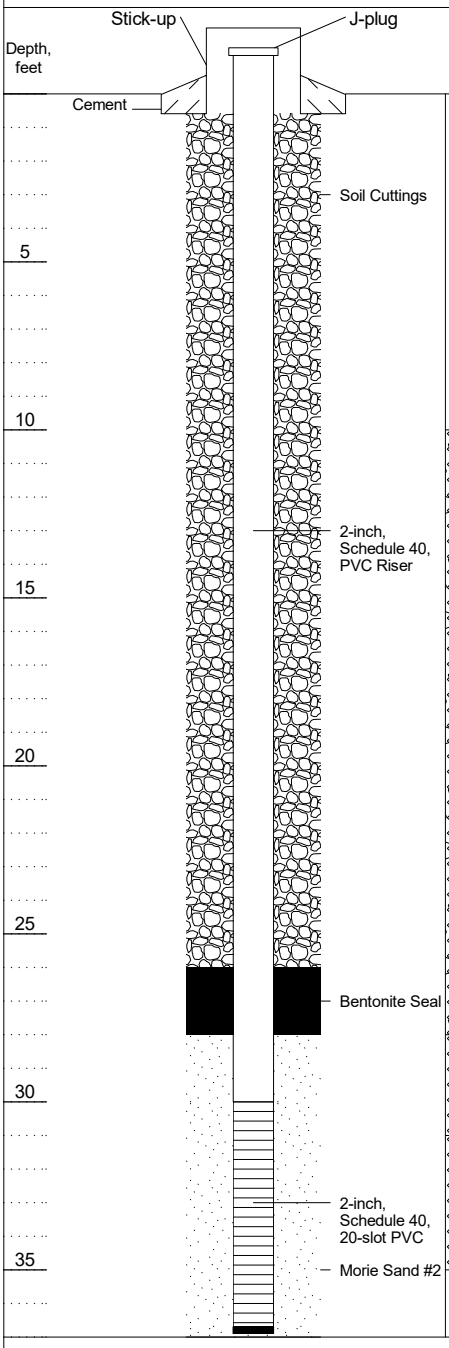
WELL CONSTRUCTION LOG

WELL NO.	LATITUDE	LONGITUDE
MW-7	**187401.853**	**1018854.163**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **E. Butler**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT / R. Allegrezza**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/11/19-4/16/19**

CASING MAT./DIA.: **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **7.0** ft DIA. **2-inch** SLOT SIZE **20-Slot**



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to coarse SAND, some Gravel, Brick, and Cocnrete (FILL); moist.	G	0.7	Collect soil sample MW-7 (0-2) for RI list of parameters.
5					Hand cleared to 5 ft bls.
10		Brown, fine to coarse SAND, little Gravel; moist.		0.2	
15				0.2	
20				0.7	
25				0.4	
				0.2	
30		Brown, fine to medium SAND, little Silt; moist.		0.2	
		Brown, fine to medium SAND, little Silt; wet.		0.2	Collect soil sample MW-7 (30-32) for RI list of parameters. Water observed at 32 ft bls.
35					End of soil logging at 37 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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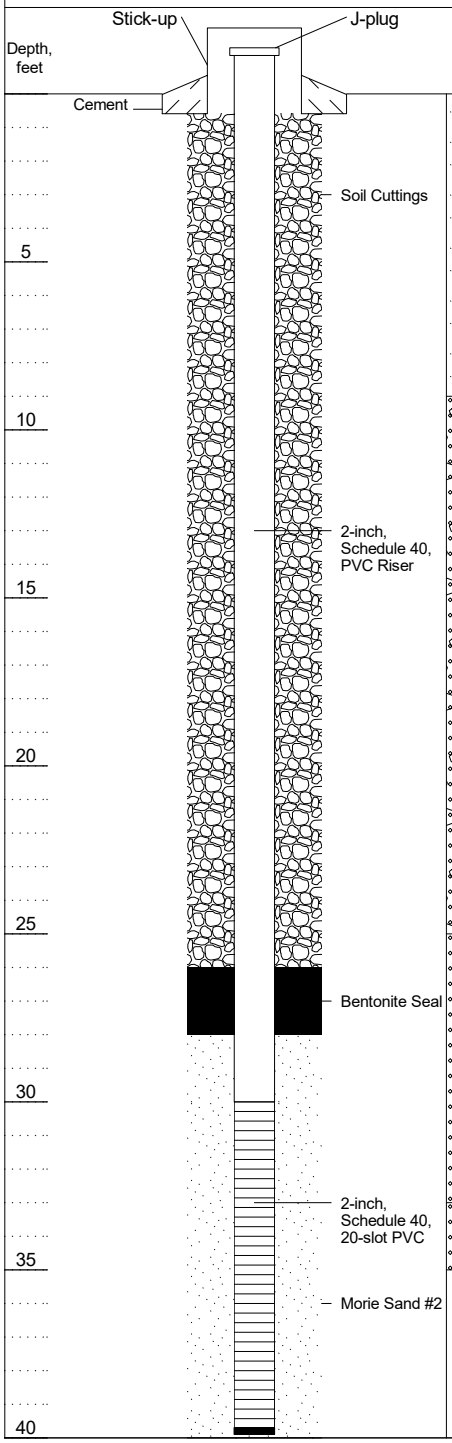
WELL CONSTRUCTION LOG

WELL NO.	LATITUDE	LONGITUDE
MW-8	**187358.266**	**1018863.308**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **E. Butler**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT / R. Allegrezza**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/11/19-4/16/19**

CASING MAT./DIA.: **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to coarse SAND, some Gravel and Asphalt (FILL); moist.	G	0.0	Collect soil sample MW-8 (0-2) for RI list of parameters.
5				0.0	Hand cleared to 5 ft bls.
10		Brown, fine to coarse SAND, little Gravel; moist.		0.0	
15				0.0	
20				0.0	
25		Brown, fine to medium SAND; moist.		0.0	
30				0.0	Collect soil sample MW-8 (30-32) for RI list of parameters.
35		Brown, fine to medium SAND; wet.			Water observed at 33 ft bls.
40					End of soil logging at 35 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-15/SV-4	**187527.829**	**1018747.897**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT /				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/15/19-4/17/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
35.01(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, coarse SAND, some Gravel and Brick (FILL); moist.		0.0	Collect soil sample RX-15 (0-2) for RI list of parameters.
		Light brown, coarse SAND; moist.			
					Hand cleared to 5 ft bls.
5		Light brown, fine to coarse SAND, some fine to medium Gravel; moist.		0.0	
10		Light brown, coarse SAND, fine Gravel; moist.		0.1	
15		Light brown, fine to coarse SAND, some fine to medium Gravel; moist.		0.1	
20				0.1	Soil vapor screen installed at 20 ft bls.
25				0.1	Collect soil sample RX-15 (24-26) (in triplicate for MS/MSD) for RI list of parameters.
		Light brown, fine to coarse SAND, some fine to medium Gravel; wet.			Water observed at 27 ft bls.
30					End of boring at 30 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
RX-16/SV-11	**187333.802**	**1018783.025**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**E. Butler**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/11/19-4/15/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
39.59(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Brown, fine to coarse SAND, some Gravel, Brick, and Concrete (FILL); moist.		0.0	Collect soil sample RX-16 (0-2) for RI list of parameters.
				G	
5				0.0	Hand cleared to 5 ft bls.
10				0.0	
		Brown, fine to coarse SAND, little Gravel and Silt; moist.		0.0	
15				0.0	
20				0.0	
25				0.0	
		Brown, fine to medium SAND; moist.		0.0	Soil vapor screen installed at 30 ft bls. Collect soil sample RX-16 (30-32) for RI list of parameters.
30		Brown, fine to medium SAND; wet.			Water observed at 32 ft bls.
35					End of boring at 35 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
SV-10	**187407.332**	**1018776.547**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / T.				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/16/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
40.41(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to medium SAND, some Gravel (FILL); moist.		0.0	
5		Brown to light brown, coarse SAND, some Brick, Concrete, and Asphalt (FILL); moist.		0.0	Hand cleared to 5 ft bls.
10		Light brown, coarse SAND, trace asphalt, brick, and concrete (FILL); moist.		0.4	
15		Light brown, coarse to fine SAND; moist.		0.1	
20		Light brown, coarse to fine SAND, some Gravel; moist.		3.8	
25					Soil vapor screen installed at 25 ft bls. End of boring at 25 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
SV-5	**187535.724**	**1018877.758**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**E. Butler**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/15/19-4/17/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
36.25(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to coarse SAND, some Gravel, Brick, and Asphalt (FILL); moist.		22.9	
5		Brown, fine to coarse SAND, trace gravel; moist.		0.3	Hand cleared to 5 ft bls.
10				1.4	
15				0.1	
20				0.1	
25		Brown, fine to medium SAND, little Silt; wet.		0.0	Soil vapor screen installed at 25 ft bls.
				0.1	End of boring at 25 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
SV-6	**187473.856**	**1018831.662**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / T.				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/16/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
38.02(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
5		Brown, fine to medium SAND, some Brick, Asphalt, and Concrete, trace gravel (FILL); moist.	G	0.0	
10		Light brown to dark brown, fine to coarse SAND, some fine to medium Gravel, Brick, Asphalt, and Concrete (FILL); moist.		0.0	Hand cleared to 5 ft bls.
15		Light to dark brown, fine to medium SAND, some Brick, Concrete, and Asphalt, trace gravel (FILL); moist.		0.7	
20		Light brown, coarse SAND, trace gravel; moist.		0.1	
25		Light brown, fine to medium SAND; moist.		0.1	Soil vapor screen installed at 25 ft bls. End of boring at 25 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE
SV-7	**187455.965**	**1018892.131**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **L. D'Orsa**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT / T.**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/16/19**

LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL
36.74(FT.)	**Not Measured**	**Soil Cuttings**

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Light to dark brown, fine to medium SAND, some Clay, Brick, and Asphalt (FILL); moist.		0.1	
5		Light brown, fine to medium SAND, some Gravel; moist.		0.1	Hand cleared to 5 ft bls.
10		Light brown, fine to coarse SAND, trace gravel; moist.		0.0	
15				0.0	
20				0.1	
25					Soil vapor screen installed at 25 ft bls. End of boring at 25 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
SV-9	**187363.335**	**1018866.492**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / T.				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/17/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
39.02(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to medium SAND, some medium Gravel, Brick, and Concrete (FILL); moist.		0.0	
5		Brown, fine to medium SAND, some fine to medium Gravel, Brick, Asphalt, Concrete (FILL); moist.		0.0	Hand cleared to 5 ft bls.
10		Light brown, fine SAND, trace gravel; moist.		0.1	
15		Light brown, coarse SAND, some fine to medium Gravel; moist.		0.0	
20		Light brown, fine to coarse SAND; moist.		0.1	Soil vapor screen installed at 25 ft bls.
25					End of boring at 25 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-1	**187514.047**	**1018778.531**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/18/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
38.68(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Dark brown, fine to medium SAND, some fine to medium Gravel, Brick, Asphalt, and Concrete (FILL); moist.		5.8	Collect soil sample WC-1 (0-6) for WC list of parameters.
5		Brown, fine to medium SAND, some Brick, Asphalt, and Gravel (FILL); moist.		0.0	Hand cleared to 5 ft bls. Collect soil sample WC-1 (6-12) for WC list of parameters.
10		Light to dark brown, fine to coarse SAND; moist.		5.7	Collect soil sample WC-1 (12-18) for WC list of parameters.
15		Light brown, fine to coarse SAND, some fine Gravel; moist.		5.0	Collect soil sample WC-1 (18-20) for RI list of parameters.
20					End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-2	**187450.849**	**1018794.054**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/10/19-4/18/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
38.48(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark brown, fine to medium SAND, some Gravel, trace brick and concrete (FILL); wet.		0.0	Collect soil sample WC-2 (0-6) for WC list of parameters.
5		Dark brown, fine to medium SAND, some Gravel; moist.		20.2	Hand cleared to 5 ft bls. Collect soil sample WC-2 (6-12) for WC list of parameters.
10		Dark brown, fine to medium SAND, some fine to medium Gravel; moist.		92.2	Collect soil sample WC-2 (12-18) for WC list of parameters.
15		Light brown, coarse SAND; moist.		12.7	Collect soil sample WC-2 (18-20) for RI list of parameters.
20					End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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Fax: (631) 232-9898

SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE
WC-3/SV-8	**187397.481**	**1018802.021**

PROJECT NO./NAME	LOCATION
3002.0004Y000 / Chestnut Commons	**110 Dinsmore Place**
APPROVED BY: **J. Taylor** / LOGGED BY: **L. D'Orsa**	**Brooklyn, New York**
DRILLING CONTRACTOR/DRILLER: **ADT / R. Allegrezza**	GEOGRAPHIC AREA

DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/10/19-4/18/19**

LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL
39.90(FT.)	**Not Measured**	**Soil Cuttings**

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Brown, fine to medium SAND, some fine to medium Gravel, Asphalt, and Concrete (FILL); moist.	G	0.0	Collect soil sample WC-3 (0-6) for WC list of parameters.
5		Brown, fine to medium SAND, some Asphalt and Concrete (FILL); moist.		0.2	Hand cleared to 5 ft bls. Collect soil sample WC-3 (6-12) for WC list of parameters.
10		Light to dark brown, fine to coarse SAND, some Brick, Asphalt, and Concrete, trace Gravel (FILL); moist.		0.3	Collect soil sample WC-3 (12-18) for WC list of parameters.
15				0.0	Collect soil sample WC-3 (0-6) for RI list of parameters.
20		Light to dark brown, fine to coarse SAND, trace Gravel; moist.		0.0	Soil vapor screen installed at 25 ft bls.
25					End of boring at 25 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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Environmental Consulting & Management

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Islandia, NY 11749
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Fax: (631) 232-9898

SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-4	**187354.946**	**1018813.288**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/10/19-4/19/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
40.56(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark brown, fine to medium SAND, some fine to medium Gravel, Concrete, Asphalt, and Brick (FILL); moist.		0.0	Collect soil sample WC-4 (0-6) for WC list of parameters.
5				0.0	Hand cleared to 5 ft bls.
					Collect soil sample WC-4 (6-12) for WC list of parameters.
10		Light to dark brown, fine SAND, some Clay, Brick, and Concrete (FILL); moist.		0.0	
					Collect soil sample WC-4 (12-18) for WC list of parameters. Collect soil sample DUP041919 for WC list of parameters.
15		Light to dark brown, fine to coarse SAND, some Clay and fine to medium Gravel; moist.		0.0	
					Collect soil sample WC-4 (18-20) for RI list of parameters.
20					End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-5	**187530.551**	**1018845.064**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/19/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
36.43(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark to light brown, coarse to medium SAND, some fine to medium Gravel, Asphalt, and Brick (FILL); moist.		9.1	Collect soil sample WC-5 (0-6) for WC list of parameters.
5		Light brown, coarse SAND, some medium Gravel; moist.		0.0	Hand cleared to 5 ft bls. Collect soil sample WC-5 (6-12) for WC list of parameters.
10				0.0	
15		Light brown, fine to coarse SAND; moist.		0.0	Collect soil sample WC-5 (12-18) for WC list of parameters.
20					Collect soil sample WC-5 (18-20) for RI list of parameters. End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-6	**187467.759**	**1018855.243**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/19/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
37.38(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Dark brown, fine to medium SAND, some Gravel and Clay, some Asphalt and Concrete (FILL); moist.		0.0	
			G		Collect soil sample WC-6 (0-6) for WC list of parameters.
5		Reddish brown, fine to coarse SAND, some Clay, Asphalt, and Concrete (FILL); moist.		0.0	Hand cleared to 5 ft bls.
					Collect soil sample WC-6 (6-12) for WC list of parameters.
10		Light brown, coarse SAND; moist.		0.0	
					Collect soil sample WC-6 (12-18) for WC list of parameters.
15		Light brown, fine to coarse SAND; moist.		0.0	
					Collect soil sample WC-6 (18-20) for RI list of parameters.
20					End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-7	**187409.584**	**1018867.8**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/11/19-4/19/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
38.63(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Dark brown, fine to medium SAND, some fine to medium Gravel, Clay, Brick, and Asphalt (FILL); moist.		0.0	Collect soil sample WC-7 (0-6) for WC list of parameters.
5		Light brown, fine to medium SAND, some fine to medium Gravel, Brick, Asphalt, and Concrete (FILL); moist.		0.0	Hand cleared to 5 ft bls. Collect soil sample WC-7 (6-12) for WC list of parameters.
10		Light brown, fine to coarse SAND, some fine Gravel; moist.		0.0	Collect soil sample WC-7 (12-18) (in triplicate for MS/MSD) for WC list of parameters.
15				0.0	Collect soil sample WC-7 (18-20) for RI list of parameters.
20					End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

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SOIL BORING LOG

WELL NO.	LATITUDE	LONGITUDE		
WC-8	**187364.366**	**1018882.067**		
PROJECT NO./NAME		LOCATION		
3002.0004Y000 / Chestnut Commons		**110 Dinsmore Place**		
APPROVED BY	LOGGED BY	**Brooklyn, New York**		
J. Taylor	**L. D'Orsa**			
DRILLING CONTRACTOR/DRILLER		GEOGRAPHIC AREA		
ADT / R. Allegrezza				
DRILL BIT DIAMETER/TYPE	BOREHOLE DIAMETER	DRILLING EQUIPMENT/METHOD	SAMPLING METHOD	START-FINISH DATE
2-in. / Drive Sampler	**2-inches**	**6620DT / Geoprobe**	**2" Macro-Core**	**4/12/19-4/19/19**
LAND SURFACE ELEVATION	DEPTH TO WATER	BACKFILL		
39.26(FT.)	**Not Measured**	**Soil Cuttings**		

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
0		Dark brown, fine to medium SAND, some Clay, Gravel, Brick, Asphalt, and Concrete (FILL); moist.	G	0.0	Collect soil sample WC-8 (0-6) for WC list of parameters.
5		Dark to light brown, fine to coarse SAND, some fine Gravel, Asphalt, Concrete, and Brick (FILL); moist.		0.0	Hand cleared to 5 ft bls. Collect soil sample WC-8 (6-12) for WC list of parameters.
10		Light brown, coarse SAND, some fine Gravel, Brick, and Asphalt (FILL); moist.		0.0	Collect soil sample WC-8 (12-18) for WC list of parameters. Collect soil sample DUP041919 for WC list of parameters.
15		Light brown, fine to coarse SAND; moist.		0.0	Collect soil sample WC-8 (18-20) for RI list of parameters.
20					End of boring at 20 ft bls.

BORING/FEET 3002.0004Y000.GPJ ROUX.GDT 8/15/19

APPENDIX C

Groundwater Sampling Forms

Well Sampling Data Form

Client: AMHANY **Project Number:** 3002.004.000

Site Location: Chestnut Commons, Brooklyn, NY

Well No: MW-4 Weather: 50°F

Date: 4-30-19 Purge Water Disposal: Drum

Sampled By: LD Well Diameter / Type: 2" stick up

Depth of Well (ft): 36.80' Water Column (ft): 9.82

Depth to Water(ft): 26.98' Volume of Water in Well (gal) 1.60

Depth to Product (ft): - Volume of Water to Remove (gal): 2.7

well diameter:	1 in	2 in	4 in	6 in	8 in
gallons per foot:	0.041	0.163	0.653	1.469	2.611

Start Purging: 0923 Purge Rate: 300 mL/min

End Purging: 1240 Volume of Water Removed (gal): 0.5

Method of Purge: Peri Method of Sampling: low-flow

Physical Appearance/ Comments: Clear, no odor

Samples Collected: TCL+30/TAL + PFAS (DUP-043019A+MS/MSD)
(analyses / no. bottles)

+MS/MSD+DUP-043019B

Time: 1020 Laboratory : Test America

Field Measurements:

Time	DTW ft	Flow Rate ml/min	ORP mV (+/- 10 mV)	Conductivity mS/m - S/m (w/in 3%)	Turbidity NTU (w/in %10)	pH SU (+/- 0.1)	Temperature C° - F° (w/in 3%)	Dissolved O_2 mg/L (w/in 10%)
0930	27.03	300mL/min	331	0.118	8.0	4.75	13.02	7.63
0935	27.03	300mL/min	309	0.109	0.0	4.90	11.81	6.22
0940								
1005	27.03	300mL/min	300	0.204	3.4	5.44	11.64	8.06
1010	27.03	300mL/min	318	0.199	1.4	5.18	11.13	6.68
1015	27.03	300mL/min	321	0.196	1.0	5.16	11.26	6.33
1016	27.03	300mL/min	322	0.194	0.9	5.17	11.30	6.40

DM

Well Sampling Data Form

Client: Chestnut commons | MHANY **Project Number:** 3002-00044000

Site Location: Brooklyn, NY

Well No: MW-5 Weather: 60°F, Cloudy

Date: 4-30-19 Purge Water Disposal: drum

Sampled By: LD Well Diameter / Type: 2" Stick up

Depth of Well (ft): 38.40' Water Column (ft): 9.92

Depth to Water(ft): ~~28.~~ 28.48' Volume of Water in Well (gal) 1.62

Depth to Product (ft): — Volume of Water to Remove (gal): 0.9

well diameter:	1 in	2 in	4 in	6 in	8 in
gallons per foot:	0.041	0.163	0.653	1.469	2.611

Start Purging: 1255 Purge Rate: 300 mL/min

End Purging: 1400 Volume of Water Removed (gal): 0.5

Method of Purge: peri Method of Sampling: low-flow

Physical Appearance/ Comments: Clear, no odor

Samples Collected: (analyses / no. bottles) TCL+30 | TAL | PFAS

Time: 1320 Laboratory: Test America

Field Measurements:

Time	DTW ft	Flow Rate ml/min	ORP mV (+/- 10 mV)	Conductivity mS/m - S/m (w/in 3%)	Turbidity NTU (w/in %10)	pH SU (+/- 0.1)	Temperature C° - F° (w/in 3%)	Dissolved O_2 mg/L (w/in 10%)
1300	28.48	300	283	0.977	0.0	6.08	14.51	8.53
1305	28.48	300	277	0.984	0.0	6.12	14.31	5.08
1310	28.48	300	275	0.984	0.0	6.13	14.40	4.83
1313	28.48	300	273	0.987	0.0	6.15	14.44	4.46
1316	28.48	300	271	0.989	0.0	6.16	14.5	4.42

OM

Well Sampling Data Form

Client: Chestnut Commons/MHANY **Project Number:** 3002.0004.000

Site Location: Brooklyn, NY

Well No: MW-6 Weather: 60°F, Cloudy

Date: 4-30-19 Purge Water Disposal: Drum

Sampled By: AD Well Diameter / Type: 2" SS Flush

Depth of Well (ft): 38.90 Water Column (ft): 7.55

Depth to Water(ft): 31.35 Volume of Water in Well (gal) 1.23

Depth to Product (ft): - Volume of Water to Remove (gal): 0.9

well diameter:	1 in	2 in	4 in	6 in	8 in
gallons per foot:	0.041	0.163	0.653	1.469	2.611

Start Purging: 1635 Purge Rate: 300

End Purging: 1735 Volume of Water Removed (gal): 0.5

Method of Purge: Bladder Pump Method of Sampling: low-flow

Physical Appearance/ Comments: Cloudy, no odor

Samples Collected: (analyses / no. bottles) TCL+30/TAL+PFAS

Time: 1710 Laboratory: Test America

Field Measurements:

Time	DTW ft	Flow Rate ml/min	ORP mV (+/- 10 mV)	Conductivity mS/m - S/m (w/in 3%)	Turbidity NTU (w/in %10)	pH SU (+/- 0.1)	Temperature C° - F° (w/in 3%)	Dissolved O_2 mg/L (w/in 10%)	
1645	31.35	300	209	0.944	6.55	6.87	18.45	4.73	
1650	31.35	300	209	0.943	300	6.87	18.40	4.72	
1655	31.35	300	207	0.942	215	6.89	18.36	4.68	→ Horiba cleaned
1700	31.35	300	188	0.942	85	6.89	18.36	8.51	
1703	31.35	300	191	0.942	83	6.89	18.42	8.49	
1706	31.35	300	193	0.941	84	6.89	18.43	8.48	
				DM					

Well Sampling Data Form

Client: Chestnut Owners / MHANY **Project Number:** 3002.0004800

Site Location: Brooklyn, NY

Well No: MW-7
Date: 4-30-19
Sampled By: LD

Weather: 60's F, Sunny
Purge Water Disposal: Drum
Well Diameter / Type: 2" stickup

Depth of Well (ft): 37.10
Depth to Water(ft): 29.70
Depth to Product (ft): —

Water Column (ft): 7.40
Volume of Water in Well (gal) 1.21
Volume of Water to Remove (gal): 0.9

well diameter:	1 in	2 in	4 in	6 in	8 in
gallons per foot:	0.041	0.163	0.653	1.469	2.611

Start Purging: 1420
End Purging: 1630
Method of Purge: Peri

Purge Rate: 300mL/min
Volume of Water Removed (gal): 0.5
Method of Sampling: low-flow

Physical Appearance/ Comments: Clear, no odor

Samples Collected: (analyses / no. bottles) TCL +30 TAL, PFAS

Time: 1450 Laboratory: TestAmerica

Field Measurements:

Time	DTW ft	Flow Rate ml/min	ORP mV (+/- 10 mV)	Conductivity mS/m - S/m (w/in 3%)	Turbidity NTU (w/in %10)	pH SU (+/- 0.1)	Temperature C° - F° (w/in 3%)	Dissolved O_2 mg/L (w/in 10%)
1420	29.70	300	214	0.442	2.2	6.47	17.71	5.92
1433	29.70	300	240	0.429	0.0	6.05	17.46	3.72
1440	29.70	300	258	0.431	0.5	5.99	17.58	3.56
1443	29.70	300	262	0.430	0.5	5.96	17.39	3.50

DM

Well Sampling Data Form

Client: Chestnut Commons / MHANY **Project Number:** 3002.0004Y00

Site Location: Brooklyn, NY

Well No: MW-8 Weather: 60°F, Cloudy

Date: 4-30-19 Purge Water Disposal: Drum

Sampled By: LD Well Diameter / Type: 2" Stickup

Depth of Well (ft): 39.81 Water Column (ft): 9.66

Depth to Water(ft): 30.15 Volume of Water in Well (gal) 1.57

Depth to Product (ft): - Volume of Water to Remove (gal): 0.9 gal

well diameter:	1 in	2 in	4 in	6 in	8 in
gallons per foot:	0.041	0.163	0.653	1.469	2.611

Start Purging: 1745 Purge Rate: 300 mL/min

End Purging: 1830 Volume of Water Removed (gal): 0.5

Method of Purge: Peri Method of Sampling: low-flow

Physical Appearance/ Comments: Slightly cloudy

Samples Collected: (analyses / no. bottles) TCL+ 30/TAL+PFAS

Time: 1805 Laboratory : Test America

Field Measurements:

Time	DTW ft	Flow Rate ml/min	ORP mV (+/- 10 mV)	Conductivity mS/m - S/m (w/in 3%)	Turbidity NTU (w/in %10)	pH SU (+/- 0.1)	Temperature C° - F° (w/in 3%)	Dissolved O_2 mg/L (w/in 10%)
1748	30.15	300	162	0.330	68.9	7.66	20.21	3.78
1753	30.15	300	186	0.322	68.0	7.10	19.99	3.87
1758	30.15	300	200	0.314	71.6	6.47	19.27	3.74
1803	30.15	300	198	0.314	71.9	6.41	19.10	3.73

DM

APPENDIX D

Soil Vapor Sampling Forms

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn, NY

SV-4

Date: 4-30-19 **Time:** 0740

Weather : Rain, 50°F

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orso, D. Mirarchino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

—

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: —

Sampling Depth: — inches below land surface

Sealed at land surface : —

Purge Rate: 200 cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 12500 ppm

Helium Rate from sample tubing: 0 ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

Starting Pressure: -30.0 in. of Hg

Starting Time: 0740 **Date:** 4-30-19

Ending Time: 1605 **Date:**

Ending Pressure: -10.0 in. of Hg

Summa Canister Identification #: 5632

Flow Regulator ID # 4738

Sample ID # SV-4 **Time** 1605

Analysis TO-15

Laboratory TestAmerica

Comments

—

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn NY

SV-5

Date: 4-30-19 **Time:** 0750

Weather : Rain, 50°F

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orsa, D. Miserendino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

-

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: -

Sampling Depth: - inches below land surface

Sealed at land surface : -

Purge Rate: 200 cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 75000 ppm

Helium Rate from sample tubing: 0 ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

Starting Pressure: -28.0 in. of Hg

Starting Time: 0750 **Date:** 4-30-19

Ending Time: 1630 **Date:**

Ending Pressure: -6.0 in. of Hg

Summa Canister Identification #: 4780

Flow Regulator ID # 3222

Sample ID # SV-5 **Time** 1650

Analysis TO-15

Laboratory Test America

Comments

-

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn, NY

SV-6

Date: 4-30-19 **Time:** 0757

Weather : 50°F, Overcast

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orsa, D. Minervino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

–

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: –

Sampling Depth: – inches below land surface

Sealed at land surface : –

Purge Rate: 200cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 25 ppm

Helium Rate from sample tubing: 0ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

Starting Pressure: -30.0 in. of Hg

Starting Time: 0757 **Date:** 4-30-19

Ending Time: 1648 **Date:**

Ending Pressure: -9 in. of Hg

Summa Canister Identification #: 4133

Flow Regulator ID # 3787

Sample ID # SV-6 **Time** 1648

Analysis TO-15

Laboratory Test America

Comments

–

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn NY

SV-7

Date: 4-30-19 **Time:** 0805

Weather : 55°F Overcast

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. O'Dea, D. Miserendino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

~

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: ~

Sampling Depth: ~ inches below land surface

Sealed at land surface : ~

Purge Rate: 200 cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 725 ppm

Helium Rate from sample tubing: 0 ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

Starting Pressure: -31.0 in. of Hg

Starting Time: 0805 **Date:** 4-30-19

Ending Time: 1647 **Date:**

Ending Pressure: -4 in. of Hg

Summa Canister Identification #: 4349

Flow Regulator ID # 5176

Sample ID # SV-7 **Time** 1647

Analysis TO-15

Laboratory Test America

Comments

-

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn, NY

SV4

Date: 4-30-19 **Time:** 0821

Weather : 55°F, Cloudy

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orsa, D. Mirerandino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

~

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: —

Sampling Depth: — inches below land surface

Sealed at land surface : —

Purge Rate: 200 cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 187.5 ppm

Helium Rate from sample tubing: 0 ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

Starting Pressure: -30.0 in. of Hg

Starting Time: 0821 **Date:** 4-30-19

Ending Time: 1645 **Date:**

Ending Pressure: -2.6 in. of Hg

Summa Canister Identification #: 5447

Flow Regulator ID # 4993

Sample ID # SV-8 **Time** 1645

Analysis TO-15

Laboratory TestAmerica

Comments

→

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn, NY

SV-9 + DUP-043019

Date: 4-30-19 **Time:** 0938

Weather : 55°F Overcast

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orsa, D. Miserendino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

~

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: ~

Sampling Depth: ~ inches below land surface

Sealed at land surface : ~

Purge Rate: 200cc/min Must be less than 0.2 L/min

Purge Time: 5minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 1250ppm

Helium Rate from sample tubing: 0ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

SV-9/DUP-043019

Starting Pressure: -30/-30 in. of Hg

Starting Time: 0938 **Date:** 4-30-19

Ending Time: 1713 **Date:**

Ending Pressure: -9/-5 in. of Hg

Summa Canister Identification #: 4235

Flow Regulator ID # 4532

Sample ID # SV-9 **Time** 1713

Analysis TO-15

Laboratory TestAmerica

Comments

~

Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn, NY

SV-10

Date: 4-30-19 **Time:** 0820

Weather : 55°F, Overcast

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orsa, D. Mierendino

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

–

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: –

Sampling Depth: – inches below land surface

Sealed at land surface : –

Purge Rate: 200cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 800ppm

Helium Rate from sample tubing: 0ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ?

Starting Pressure: -27.0 in. of Hg

Starting Time: 0820 **Date:** 4-30-19

Ending Time: 1525 **Date:**

Ending Pressure: -1.0 in. of Hg

Summa Canister Identification #: 5135

Flow Regulator ID # 4061

Sample ID # SV-10 **Time** 1525

Analysis TO-15

Laboratory TestAmerica

Comments

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Soil Vapor Sampling Form

Site Name: Chestnut Commons

Location: Brooklyn, NY

SV-11 VOID

Date: 4-30-19 **Time:** 0828

Weather : 53°F Overcast

Temperature (Start/End): _____ Humidity (Start/End): _____

Wind Magnitude (Start/End): _____ Wind Direction (Start/End): _____

Barometric Pressure (Start/End): _____ Precipitation: _____

Sampling Team: L. D'Orso, D. Miranda

Sampling Location: Brooklyn, NY

Site Condition (i.e. any adjacent questionable facilities, vent pipes, tanks, etc. and type of basement present)

—

Prior to commencing the GeoProbe activity, ensure that all the rods were properly deconed and a new disposable tip is present at the end of the rods.

Calibrate the Helium detection meter

Utility Clearance Completed: —

Sampling Depth: — inches below land surface

Sealed at land surface : —

Purge Rate: 200 cc/min Must be less than 0.2 L/min

Purge Time: 5 minutes Assuming 0.17"tubing internal dia. purge 15sec./every 10ft of tubing

Helium Rate at enclosure: 10.75 ppm

Helium Rate from sample tubing: 0 ppm Is this rate <10% of the rate at the enclosure

If the Helium readings have a greater ratio than 10% the seals should be rechecked and the tracer gas should be reapplied.

Once the tracer gas screening procedures are completed and no short-circuiting is determined to be present at the location the soil vapor sample can be collected in a lab certified clean summa canister at a rate less than 0.2 L/min.

Finishing pressure should be within 0.5 - 4 in. of Hg

Is the Summa Canister Certified Clean and within the proper holding time ? VOID, lab did not analyze

Starting Pressure: -29.0 in. of Hg

Starting Time: 0828

Ending Time: 1155

Ending Pressure: -2.0 in. of Hg

Date: 4-30-19

Date:

Summa Canister Identification #: 5721

Flow Regulator ID # 3856

Sample ID # SV-11 **Time** 1156

Analysis

Laboratory

Comments

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APPENDIX E

Analytical Data from the Remedial Investigation
(Provided in Separate File)

APPENDIX F

Data Usability Summary Report for Remedial Investigation Data

Data Validation Services

120 Cobble Creek Road P.O. Box 208
North Creek, NY 12853

Phone 518-251-4429
harry@frontiernet.net

June 25, 2019

Levi Curnette
Roux Environmental Engineering and Geology, D. P. C.
209 Shafter St
Islandia, NY 11747

RE: Validation of the MHANY Chestnut Commons Site Analytical Laboratory Data
Data Usability Summary Report (DUSR)
Eurofins TestAmerica SDG Nos. 200-44507, 200-48574, 200-48575, 200-48692, 460-161119, 460-161216, 460-161238, , 460-179682, 460-1779773, 460-179851, 460-179861, 460-179972, 460-179974, 460-180074, 460-180076, and 460-180788

Dear Mr. Curnette:

Review has been completed for the data packages generated by Eurofins TestAmerica that pertain to samples collected between 07/24/18 and 05/07/19 at the MHANY Chestnut Commons site. Thirty nine soil samples, eight aqueous samples, two soil field duplicates, and two aqueous field duplicates were processed for TCL and 6 NYCRR Part 375 CP-51 volatiles, TCL semivolatiles, TCL Pesticides, Aroclor PCBs, TAL metals, and total cyanide. Twenty three of the soil samples, one of the soil field duplicates and all of the aqueous samples/field duplicates were also processed for TCL herbicides and hexavalent chromium. The aqueous samples were also processed for 1,4-dioxane by SIM. Twenty four soil samples and a field duplicate were processed for TCL and 6 NYCRR Part 375 CP-51 volatiles, TCL semivolatiles, TCL Pesticides, Aroclor PCBs, TCL herbicides, TAL metals, hexavalent chromium, trivalent chromium, total cyanide, TCLP RCRA metals, NJEPH, paint filter, reactive cyanide, reactive sulfide, pH/corrosivity, and burn rate. Five aqueous samples and an aqueous field duplicate were processed for per- and poly fluorinated alkyl substances (PFAS). Eleven 6 L summa canisters and two field duplicates were processed for volatile analytes. Field and trip blanks were also processed. The analytical methodologies are those of the USEPA SW846 and a modified USEPA method 537.

The data packages submitted by the laboratory contain full deliverables for validation, and this usability report is generated from review of the QC summary form information, with full review of sample raw data and limited review of associated QC raw data. The reported QC summary forms and sample raw data have been reviewed for application of validation qualifiers, with guidance from the USEPA national and regional validation documents, and in consideration for the specific requirements of the analytical methodology. The following items were reviewed:

* Data Completeness
* Case Narrative
* Custody Documentation

* Holding Times
* Surrogate, Isotopic Dilution, and Internal Standard Recoveries
* Method/Preparation Blanks
* Matrix Spike Recoveries/Duplicate Correlations
* Blind Field Duplicate Correlations
* Laboratory Control Sample (LCS)
* Instrumental Tunes
* Initial and Continuing Calibration Standards
* Serial Dilution Evaluation
* Method Compliance
* Sample Result Verification

Those items listed above which show deficiencies are discussed within the text of this narrative. All of the other items were determined to be acceptable for the DUSR level review, as discussed in NYS DER-10 Appendix B Section 2.0 (c). Documentation of the outlying parameters cited in this report can be found in the laboratory data package.

In summary, most results for the samples are usable either as reported or with minor qualification. Results for two phenolic analytes in three soil samples and two other semivolatile analytes in one sample are rejected due to laboratory processing and a matrix effect, respectively.

Data completeness, accuracy, precision, representativeness, reproducibility, sensitivity, and comparability are acceptable.

The laboratory modifications to the USEPA method 537 are significant, including acceptance ranges, consistent in many respects to the advances in the available monitoring compounds. Validation actions are based on the laboratory procedures, in consideration that the laboratory undergoes NYS DOH certifications and NYS SOP review.

Copies of the client sample identifications are attached to this text. Also included in this report are the client EDDs with recommended qualifiers/edits applied in red.

Chain-of-Custody/Sample Receipt

Processing of MW-6(30-32) was cancelled by the client.

Suffixes were added to the client identifications of the field blanks FB041919, in order to distinguish between the two.

Blind Field Duplicate

Blind field duplicate evaluations were performed on SV-1, SV-9, MW-4(26-28), WC-5(12-18), WC-7(12-18) (limited number of analytes), MW-1, MW-4, and RX-5-13-15. Correlations are within validation guidelines, with the following exceptions, the results for which are qualified as estimated in the parent sample and its duplicate:

- Trichloroethene in SV-9
- Butane, 1,3-butadiene, n-hexane, cyclohexane, 2,2,4-trimethylpentane, benzene, n-heptane, toluene, and tetrachloroethene
- Calcium, chromium, and lead in MW-4(26-28)
- Trivalent chromium in WC-7(12-18)

- Total chromium, trivalent chromium, and lead in WC-5(12-18)
- Total sodium in MW-4
- Total aluminum and iron in MW-1

TCL Volatile Analyses by EPA 8260C

The following detections are considered contamination and edited to non-detection due to presence in the associated blanks:

- m,p-xylene flagged as "B" in samples reported in SDG 460-179682
- acetone in samples reported in SDG 460-179851 and 460-179861
- methylene chloride in all samples

All results for WC-7(6-12) are qualified as estimated, with a low bias, due to the use of a bulk jar containers. The Encore data for this sample were not reportable for an undisclosed reason.

Calibration standards showed acceptable responses, with the following exceptions, results for which are qualified as estimated in the indicated associated samples:

- 1,1,2-Trichloro-1,2,2-trifluoroethane, cyclohexane, carbon tetrachloride, and methylcyclohexane (26%D to 62%D) in FB041519
- Vinyl chloride (22%D) in samples MW-8(0-2), MW-8(30-32), RX-16(0-2), RX-16(30-32), MW-6(0-2), RX-15(0-2), and MW-4(0-2)
- Dichlorodifluoromethane and bromomethane (22%D to 56%D) in FB041719
- tert-Butylbenzene, sec-butylbenzene, 1,2,4-trichlorobenzene, and 1,2,3-trichlorobenzene (22%D to 25%D) in WC-1 (18-20)
- Bromomethane, trans-1,3-dichloropropene, and 1,1,2,2-tetrachloroethane (23%D to 33%D) in samples FB-043019B, Trip Blank, and MW-7
- Bromoform (23%D) in samples RX-5_13-15, RX-9_0-2, RX-9_13-15, RX-14_13-15, DUP072418, and RX-12_0-2
- Bromomethane (28%D and 33%D) in FB41919A and all samples reported with SDG 460-161238-1

The matrix spikes of MW-7(30-32), RX-15(24-26), WC-5(12-18), MW-4, and MW-2. Recoveries and duplicate correlations are within validation guidelines, with the exception of the following, results for which are qualified as estimated in the indicated parent sample:

Parent Sample	Analyte	Outlying % Recoveries
MW-7(30-32)	1,1,2,2-tetrachloroethane	69,68
	chloromethane	52,56
	dichlorodifluoromethane	58,60
	n-butylbenzene	73,69
	trichloroethene	52,54
	vinyl chloride	60,63
RX-15 (24-26)	1,2,3-trichlorobenzene	69,67
	1,2,4-trichlorobenzene	71,67
	1,2-dichlorobenzene	79,74
	tert-butylbenzene	76,75
MW-4	dichlorofluoromethane	39,39
	trichlorofluoromethane	68,69

The field and trip blanks associated with the aqueous samples collected in July 2018 were highly contaminated with acetone and 2-butanone, and contained low level concentrations of three other volatile analytes; the field blank also contained a low level of diethyl phthalate. The source of the contamination, which is consistent in the two blanks, is not apparent, as the associated samples do not contain those compounds. Field sample reported results are unaffected.

Due to outlying LCS recoveries, the following analytes are qualified as estimated in the indicated associated samples:

Affected Samples	Analyte	Outlying % Recoveries
Samples reported in 460-179682	1,1,2-trichloro-1,2,2-trifluoroethane	57,56
	dichlorodifluoromethane	33,32
	methylcyclohexane	59,58
	trichlorofluoromethane	68,66
Samples reported in 460-179773	dichlorodifluoromethane	68
Samples reported in 460-179974	sec-butylbenzene	75,72
	tert-butylbenzene	74,71
FB041919A	1,1,2-trichloro-1,2,2-trifluoroethane	50,52
	cyclohexane	53,55
	dichlorodifluoromethane	42,44
	methylcyclohexane	55,57

TCL Semivolatile Analyses and 1,4-Dioxane by EPA8270D (Full Scan and SIM)

MW-4(0-2) shows a matrix effect on the response of an internal standard that produced a recovery of only 6%. This internal standard is associated with eight analytes, two of which report no detection. The results of those two compounds, benzo(k)fluoranthene and di-n-octylphthalate, are rejected in that parent sample. The results for the other six analytes, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(g,h,i)perylene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene are reported as detections, and have been qualified as estimated. However, there is a possibility that the detected concentration values of those compounds in MW-4(0-2) are significantly elevated, and some of them show instrument responses below those of the MDL levels. Those results should be used with great caution, and be considered of borderline usability in that parent sample.

Calibration standards show responses within validation action levels, with the exception of that for 4-nitroaniline (48%D) in the calibration associated with all samples reported in SDG 460-179773. The results for that compound in those samples have been qualified as estimated.

2,4-Dinitrophenol and 4,6-dinitro-2-methylphenol failed to recover in the LCS associated with the soil samples reported in SDG 460-179974. Therefore, the results for those two analytes in those field samples are rejected, and not usable. The samples had time to be reextracted within holding time, and should have been. Results for the following analytes are qualified as estimated in the indicated samples due to low recoveries in the associated LCSs:

Affected Samples	Analyte	Outlying % Recoveries	Outlying %RPD
Samples reported in 460-179773	pentachlorophenol		
Samples reported in 460-179861	atrazine	47	
Samples reported in 460-179974	2-nitrophenol	58	
	butyl benzyl phthalate	53	
	hexachlorocyclopentadiene	28	
FB041919A	caprolactam	48	47

The matrix spikes of RX-5_13-15, RX-1_13-15, MW-7(30-32), RX-15(24-26), WC-5(12-18), MW-4, and MW-2. Recoveries and duplicate correlations for those six parent samples are within validation guidelines, with the exception of the following, results for which are qualified as estimated in the indicated parent samples:

Parent Sample	Analyte	Outlying % Recoveries	Outlying % RPD's
MW-7(30-32)	2,4-dinitrophenol	29,24	
	4,6-dinitro-2-methylphenol	47,39	
	acetophenone	59,57	
	benzaldehyde	46,47	
	hexachlorocyclopentadiene	39,38	
	hexachloroethane	53,53	
	isophorone	63,62	
	nitrobenzene	65,64	
	n-nitrosodi-n-propylamine	54,51	
RX-15 (24-26)	2,4-dinitrophenol	34,41	
	hexachloroethane	59,59	
WC-5 (12-18)	2,4-dinitrophenol	49,52	
RX-5_13-15	2,4-dinitrophenol	24,0	
	4,6-dinitro-2-methylphenol	56,64	
	4-chlorophenyl phenyl ether	61,64	
	hexachlorobutadiene	49,56	
	pentachlorophenol	55,55	
RX-1_13-15	2,4-dinitrophenol	35,45	
	2-methylphenol	50,71	35
	acetophenone	41	40
	bis (2-chloroethyl) ether	43,60	
	hexachloroethane	41,58	35
	isophorone	56,67	
	nitrobenzene	44	45
	n-nitroso-di-n-propylamine	42	42
MW-2	3,3'-dichlorobenzidine	66,44	41

Tentatively Identified Compounds were reported for some of the samples. Those flagged by the laboratory as "A" are extraction artifacts and are removed from consideration as sample components.

The data package for 460-179773-1 did not include many of the summary forms. They were located in the package 460-179773-2.

Surrogate recoveries for WC-3(12-18) were misentered as being 0% on the QC summary Form 2; they are actually acceptable.

TCL Pesticide, TCL Herbicides, and Aroclor PCBs by EPA 8081B, 8151, and 8082A

Many of the detected pesticide and some of the Aroclor results exhibit elevated dual column quantitative correlations, and are qualified to reflect the uncertainty in identification and/or quantitation. The values have been either qualified as estimated ("J"), qualified as tentative in identification and estimated in value ("NJ"), or edited to non-detection ("U"), depending on the degree of variance. In some instances, the adjusted reporting limits are elevated over the original method reporting limits.

The pesticide, herbicides, and Aroclor 1016/1260 matrix spikes of MW-7(30-32), RX-15(24-26), WC-5(12-18), MW-4, of pesticide and Aroclor 1016/1260 matrix spikes of WC-5(18-20) and MW-2, and herbicides matrix spikes of MW-6 (30-32) and WC-4(0-6) show acceptable recoveries and correlations, with exceptions as shown in the following table. The results for those compounds in that parent sample are qualified as estimated:

Parent Sample	Analyte	Outlying % Recoveries
RX-15(24-26)	Endosulfan sulfate	46, 43
	Endrin aldehyde	41, 40
	Endrin ketone	51, 51
MW-2	Aroclor 1260	76, 79

Holding times were met, surrogate recoveries are compliant, and blanks show no contamination affecting reported results. Calibration standards are compliant.

TAL Metals Analyses by EPA 6010D, 6020, 7470, and 7471B

Results for the filtered fraction of the samples and field blanks are qualified as estimated due to delayed filtration and subsequent preservation.

The following results are considered external contamination and edited to reflect non-detection due to presence in the associated method blanks:

- antimony in MW-6, MW-7, RX-16(0-2), and MW-4(0-2)
- silver in samples reported in SDG 460-179972 and 460-180074

Total and dissolved fraction concentrations correlate well, with the exception of that for manganese in MW-2. The results for that element in both fractions of that sample have been qualified as estimated in value.

Matrix spikes/duplicate evaluations for metals were performed for TAL metals on MW-7(30-32), RX-15(24-26), MW-6 (30-32), WC-5(18-20), MW-4 (total and dissolved), and MW-2 (total and dissolved), and for TCLP metals on WC-5(12-18), They show recoveries and correlations within

validation guidelines, with the following exceptions, results for which are qualified as estimated in the indicated parent samples:

Parent Sample	Element	Outlying % Recoveries	Outlying % RPD
MW-7(30-32)	antimony	66	
	calcium	130	
	lead	129	
	magnesium	139	
	chromium		62
RX-15(24-26),	antimony	57	
	barium	-2	43
	calcium	-29	42
	lead	6	41
	nickel	52	
	iron		38
	chromium		37
MW-6 (30-32)	antimony	58	
	chromium	153	
WC-5 (12-18)	antimony	71	
	calcium	60	
	chromium	70	
	magnesium	71	
WC-5 (18-20)	antimony	67	
	barium	132	
	lead	142	
	magnesium	133	

The ICP serial dilution evaluations of MW-7(30-32), RX-15(24-26), MW-6 (30-32), WC-5(12-18), WC-5(12-18) (TAL and TCLP), WC-5(18-20), MW-4 (total and dissolved) and MW-2 (total and dissolved) show acceptable correlations.

Instrument performance was compliant.

PFAS by Modified EPA Method 537

PFAS compounds are identified by their common acronyms in this report. The EDDs reference both the technical names and the acronyms.

The results for PFOA in MW-5 and MW-6 have been qualified as estimated in value due to low recoveries in the associated internal standards:

Matrix spikes of MW-4 show recoveries and correlations within validation guidelines.

Calibration standard recoveries are compliant and blanks show no contamination.

Some of the samples were processed at initial dilution due to target analyte concentrations. This results in elevated reporting limits.

Volatile Analyses by EPA TO-15

Holding times were met, surrogate and internal standard responses are compliant, and instrument tunes meet fragmentation requirements. Method and canister blanks show no contamination affecting sample reported results.

Initial calibration linearity and calibration verification responses are within validation guidelines.

Results of analytes initially reported with the laboratory "E" flag are derived from the dilution analyses of the samples, or qualified as estimated if no dilution was performed.

The detected results for acetone in samples reported in SDG 200-44507 that are not flagged "E" are qualified as estimated, with a high bias, due to elevated recovery in the associated LCS.

Some of the samples were processed at initial dilution due to target analyte concentrations. This results in elevated reporting limits.

Total Cyanide, Reactive Cyanide, Reactive Sulfide, pH/Corrosivity, Burn Rate, Paint Filter, and NJEPH Analyses

The results for NJEPH in the field blanks are qualified as estimated due to delayed preservation.

Total cyanide matrix spikes of RX-5_13-15, RX-3_13-15, RX-16(30-32), RX-15(24-26), WC-5(12-18), WC-7(12-18), WC-5(18-20), MW-4, and MW-2 show recoveries and correlations within validation guidelines, with the exception of elevated recoveries (116% and 132%) in RX-6_13-15. The result for cyanide in that sample has been qualified as estimated.

Insoluble and soluble hexavalent chromium matrix spikes of MW-8(30-32), RX-16(30-32), RX-15(24-26), WC-5(12-18), and WC-7(12-18), of soluble hexavalent chromium matrix spikes of WC-1(18-20), and of hexavalent chromium of MW-4, show recoveries and correlations within validation guidelines.

Matrix spikes of petroleum hydrocarbons on WC-5(12-18) and of sulfide on WC-5(12-18) and WC-7(12-18) show recoveries and correlations within validation guidelines.

The laboratory duplicate of pH/corrosivity of WC-3(12-18) is acceptable.

Please do not hesitate to contact me if questions or comments arise during your review of this report.

Very truly yours,

Judy Harry

Attachments: Validation Qualifier Definitions
Sample Identifications
Qualified Laboratory EQuIS EDDs

VALIDATION DATA QUALIFIER DEFINITIONS

U	The analyte was analyzed for, but was not detected above the level of the associated reported quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
J-	The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased low.
J+	The analyte was positively identified; the associated numerical value is an estimated quantity that may be biased high.
UJ	The analyte was analyzed for, but was not detected. The associated reported quantitation limit is approximate and may be inaccurate or imprecise.
NJ	The detection is tentative in identification and estimated in value. Although there is presumptive evidence of the analyte, the result should be used with caution as a potential false positive and/or elevated quantitative value.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control limits. The analyte may or may not be present.
EMPC	The results do not meet all criteria for a confirmed identification. The quantitative value represents the Estimated Maximum Possible Concentration of the analyte in the sample.

Client and Laboratory Sample IDs

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

TestAmerica Job ID: 200-44507-1
SDG: 200-44507-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
200-44507-1	SV-1	Air	07/24/18 13:24	07/26/18 10:20
200-44507-2	SV-2	Air	07/24/18 14:38	07/26/18 10:20
200-44507-3	SV-3	Air	07/24/18 14:40	07/26/18 10:20
200-44507-4	DUP 072418	Air	07/24/18 15:25	07/26/18 10:20

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

TestAmerica Job ID: 460-161119-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-161119-1	RX-5_13-15	Solid	07/24/18 09:10	07/24/18 19:00
460-161119-2	RX-9_0-2	Solid	07/24/18 10:00	07/24/18 19:00
460-161119-3	RX-9_3-5	Solid	07/24/18 10:05	07/24/18 19:00
460-161119-4	RX-9_13-15	Solid	07/24/18 10:10	07/24/18 19:00
460-161119-5	RX-14_13-15	Solid	07/24/18 10:50	07/24/18 19:00
460-161119-6	DUP072418	Solid	07/24/18 12:00	07/24/18 19:00
460-161119-7	RX-12_0-2	Solid	07/24/18 12:10	07/24/18 19:00
460-161119-8	RX-12_13-15	Solid	07/24/18 12:20	07/24/18 19:00
460-161119-9	RX-10_0-2	Solid	07/24/18 13:20	07/24/18 19:00
460-161119-10	RX-10_13-15	Solid	07/24/18 13:25	07/24/18 19:00

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

TestAmerica Job ID: 460-161216-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-161216-1	RX-6_0-2	Solid	07/25/18 09:00	07/25/18 19:00
460-161216-2	RX-6_13-15	Solid	07/25/18 09:10	07/25/18 19:00
460-161216-3	RX-3_0-2	Solid	07/25/18 09:50	07/25/18 19:00
460-161216-4	RX-3_13-15	Solid	07/25/18 10:00	07/25/18 19:00
460-161216-5	RX-1_0-2	Solid	07/25/18 10:20	07/25/18 19:00
460-161216-6	RX-1_13-15	Solid	07/25/18 10:30	07/25/18 19:00

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

TestAmerica Job ID: 460-161238-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-161238-1	MW-3	Water	07/25/18 11:00	07/25/18 19:00
460-161238-2	MW-2	Water	07/25/18 11:15	07/25/18 19:00
460-161238-3	MW-1	Water	07/25/18 11:30	07/25/18 19:00
460-161238-4	DUP072518	Water	07/25/18 12:00	07/25/18 19:00
460-161238-5	FB072518	Water	07/25/18 12:30	07/25/18 19:00
460-161238-6	Trip Blank	Water	07/25/18 12:30	07/25/18 19:00

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 200-48574-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received	Assest ID
200-48574-1	MW-4	Water	04/30/19 10:20	05/02/19 13:01	
200-48574-2	MW-5	Water	04/30/19 13:20	05/02/19 13:01	
200-48574-3	MW-7	Water	04/30/19 14:50	05/02/19 13:01	
200-48574-4	MW-6	Water	04/30/19 17:10	05/02/19 13:01	
200-48574-5	MW-8	Water	04/30/19 17:40	05/02/19 13:01	
200-48574-6	FB-043019A	Water	04/30/19 10:45	05/02/19 13:01	
200-48574-7	DUP-043019A	Water	04/30/19 12:00	05/02/19 13:01	

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: Chestnut Commons

Job ID: 200-48575-1
SDG: 200-48575-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
200-48575-1	SV-4	Air	04/30/19 16:05	05/02/19 13:01
200-48575-2	SV-5	Air	04/30/19 16:50	05/02/19 13:01
200-48575-3	SV-6	Air	04/30/19 16:48	05/02/19 13:01
200-48575-4	SV-7	Air	04/30/19 16:47	05/02/19 13:01
200-48575-5	SV-8	Air	04/30/19 16:45	05/02/19 13:01
200-48575-6	SV-9	Air	04/30/19 17:13	05/02/19 13:01
200-48575-7	DUP-043019	Air	04/30/19 17:13	05/02/19 13:01
200-48575-8	SV-10	Air	04/30/19 15:25	05/02/19 13:01

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179773-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179773-2	MW-7(0-2)	Solid	04/16/19 10:20	04/16/19 19:30
460-179773-3	MW-7(30-32)	Solid	04/16/19 11:15	04/16/19 19:30
460-179773-4	MW-5(0-2)	Solid	04/16/19 13:00	04/16/19 19:30
460-179773-5	MW-5(28-30)	Solid	04/16/19 13:50	04/16/19 19:30

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179773-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179773-2	MW-7(0-2)	Solid	04/16/19 10:20	04/16/19 19:30
460-179773-3	MW-7(30-32)	Solid	04/16/19 11:15	04/16/19 19:30
460-179773-4	MW-5(0-2)	Solid	04/16/19 13:00	04/16/19 19:30
460-179773-5	MW-5(28-30)	Solid	04/16/19 13:50	04/16/19 19:30

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179682-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179682-1	MW-8(0-2)	Solid	04/15/19 08:50	04/15/19 19:00
460-179682-2	MW-8(30-32)	Solid	04/15/19 09:50	04/15/19 19:00
460-179682-3	RX-16(0-2)	Solid	04/15/19 12:25	04/15/19 19:00
460-179682-4	RX-16(30-32)	Solid	04/15/19 13:35	04/15/19 19:00
460-179682-5	MW-6(0-2)	Solid	04/15/19 09:15	04/15/19 19:00
460-179682-6	RX-15(0-2)	Solid	04/15/19 12:30	04/15/19 19:00
460-179682-7	MW-4(0-2)	Solid	04/15/19 08:45	04/15/19 19:00
460-179682-8	FB 041519	Water	04/15/19 14:20	04/15/19 19:00

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179851-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179851-1	MW-4 (26-28)	Solid	04/17/19 11:20	04/17/19 19:00
460-179851-2	DUP041719	Solid	04/17/19 12:00	04/17/19 19:00
460-179851-3	RX-15 (24-26)	Solid	04/17/19 14:00	04/17/19 19:00
460-179851-4	FB041719	Water	04/17/19 14:45	04/17/19 19:00
460-179851-5	WC-3(18-20)	Solid	04/17/19 11:55	04/17/19 19:00

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179861-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179861-1	WC-3(0-6)	Solid	04/17/19 11:00	04/17/19 19:00
460-179861-2	WC-3(6-12)	Solid	04/17/19 11:15	04/17/19 19:00
460-179861-3	WC-3(12-18)	Solid	04/17/19 11:30	04/17/19 19:00

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179972-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179972-1	WC-2(0-6)	Solid	04/18/19 14:45	04/19/19 06:30
460-179972-2	WC-2(6-12)	Solid	04/18/19 15:00	04/19/19 06:30
460-179972-3	WC-2(12-18)	Solid	04/18/19 15:10	04/19/19 06:30
460-179972-4	WC-1(0-6)	Solid	04/18/19 15:40	04/19/19 06:30
460-179972-5	WC-1(6-12)	Solid	04/18/19 15:50	04/19/19 06:30
460-179972-6	WC-1(12-18)	Solid	04/18/19 16:00	04/19/19 06:30

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-179974-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-179974-1	MW-6(30-32)	Solid	04/18/19 09:15	04/18/19 19:40
460-179974-2	WC-2 (18-20	Solid	04/18/19 15:20	04/18/19 19:40
460-179974-3	WC-1(18-20)	Solid	04/18/19 16:07	04/18/19 19:40

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-180074-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-180074-1	WC-5(0-6)	Solid	04/19/19 07:40	04/19/19 19:20
460-180074-2	WC-5(6-12)	Solid	04/19/19 07:50	04/19/19 19:20
460-180074-3	WC-5(12-18)	Solid	04/19/19 07:55	04/19/19 19:20
460-180074-4	WC-6(0-6)	Solid	04/19/19 08:20	04/19/19 19:20
460-180074-5	WC-6(6-12)	Solid	04/19/19 08:25	04/19/19 19:20
460-180074-6	WC-6(12-18)	Solid	04/19/19 08:30	04/19/19 19:20
460-180074-7	WC-7(0-6)	Solid	04/19/19 09:50	04/19/19 19:20
460-180074-8	WC-7(6-12)	Solid	04/19/19 10:05	04/19/19 19:20
460-180074-9	WC-7(12-18)	Solid	04/19/19 10:10	04/19/19 19:20
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460-180074-15	WC-4(12-18)	Solid	04/19/19 11:45	04/19/19 19:20
460-180074-16	DUP041919A	Solid	04/19/19 12:15	04/19/19 19:20
460-180074-17	DUP041919B	Solid	04/19/19 13:00	04/19/19 19:20
460-180074-18	FB041919A	Water	04/19/19 08:30	04/19/19 19:20
460-180074-19	FB041919B	Water	04/19/19 15:00	04/19/19 19:20

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-180076-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-180076-1	WC-5(18-20)	Solid	04/19/19 08:02	04/19/19 19:20
460-180076-2	WC-6(18-20)	Solid	04/19/19 08:35	04/19/19 19:20
460-180076-3	WC-7(18-20)	Solid	04/19/19 10:15	04/19/19 19:20
460-180076-4	WC-8(18-20)	Solid	04/19/19 11:10	04/19/19 19:20
460-180076-5	WC-4(18-20)	Solid	04/19/19 11:55	04/19/19 19:20

Sample Summary

Client: Roux Environmental Eng & Geology DPC
Project/Site: MHANY Chestnut Commons

Job ID: 460-180788-1

Lab Sample ID	Client Sample ID	Matrix	Collected	Received
460-180788-1	MW-4	Water	04/30/19 10:20	04/30/19 20:20
460-180788-2	MW-5	Water	04/30/19 13:20	04/30/19 20:20
460-180788-3	MW-7	Water	04/30/19 14:50	04/30/19 20:20
460-180788-4	MW-6	Water	04/30/19 17:10	04/30/19 20:20
460-180788-5	MW-8	Water	04/30/19 17:40	04/30/19 20:20
460-180788-6	DUP-043019B	Water	04/30/19 13:00	04/30/19 20:20
460-180788-7	FB-043019B	Water	04/30/19 16:10	04/30/19 20:20
460-180788-8	Trip Blank	Water	04/30/19 00:00	04/30/19 20:20

APPENDIX G

Certified Sanborn Maps

Dinsmore

3249 Atlantic Avenue

Brooklyn, NY 11208

Inquiry Number: 4858628.1

February 21, 2017

Certified Sanborn® Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

02/21/17

Site Name:

Dinsmore
3249 Atlantic Avenue
Brooklyn, NY 11208
EDR Inquiry # 4858628.1

Client Name:

Roux Associates
209 Shafter Street
Islandia, NY 11749
Contact: Frank Cherena

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The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # BA9C-4227-8DD6

PO # NA

Project Dinsmore

Maps Provided:

2007	1994	1979
2006	1993	1977
2005	1991	1968
2004	1989	1965
2003	1988	1951
2002	1987	1928
2001	1982	1908
1995	1980	1887

Sanborn® Library search results

Certification #: BA9C-4227-8DD6

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- ☑ Library of Congress
- ☑ University Publications of America
- ☑ EDR Private Collection

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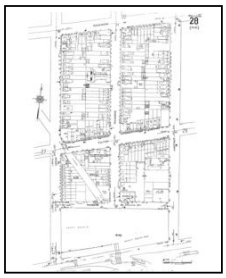
Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

2007 Source Sheets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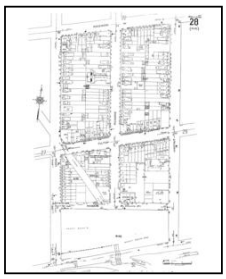
2007

Volume 8, Sheet 29
2007

Volume 8, Sheet 31
2007

Volume 8, Sheet 32
2007

2006 Source Sheets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Volume 8, Sheet 31
2006

Volume 8, Sheet 32
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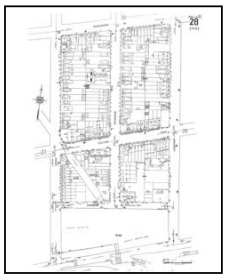
2005 Source Sheets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2005

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2005

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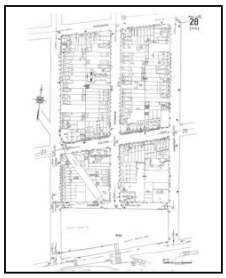
2004 Source Sheets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2004

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2004

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2004

Sanborn Sheet Key

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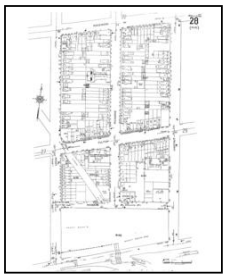
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2003

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2003

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2003

2002 Source Sheets

Volume 8, Sheet 28
2002

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2002

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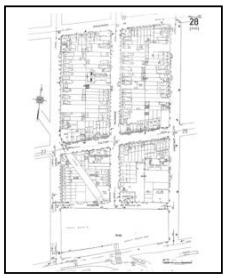
2002

2001 Source Sheets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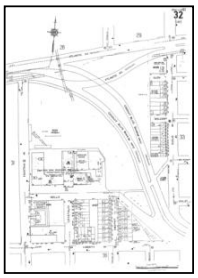
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2001

1995 Source Sheets

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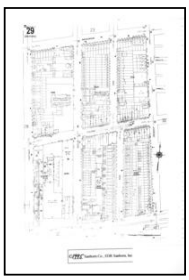
1995


Volume 8, Sheet 29
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Sanborn Sheet Key

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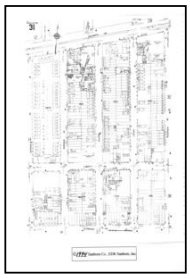
1994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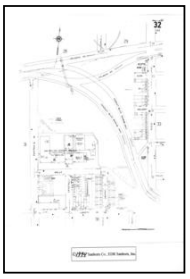
1994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1994

1993 Source Sheets

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Volume 8, Sheet 29
1993

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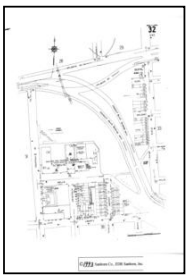
1993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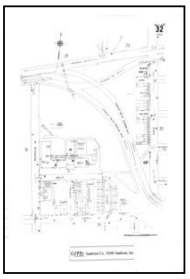
1993

1991 Source Sheets

Volume 8, Sheet 28
1991

Volume 8, Sheet 29
1991

Volume 8, Sheet 31
1991


Volume 8, Sheet 32
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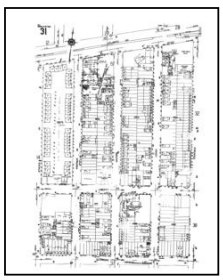
1989 Source Sheets


Volume 8, Sheet 31
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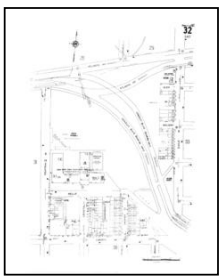
Volume 8, Sheet 32
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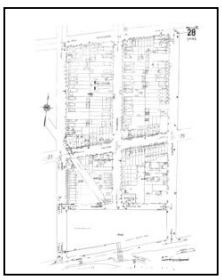
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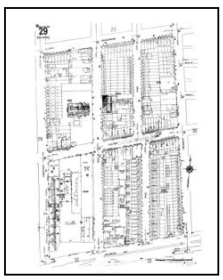
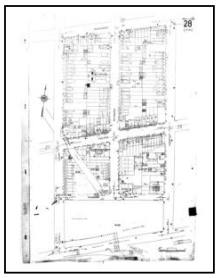

Volume 8, Sheet 29
1989

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1988 Source Sheets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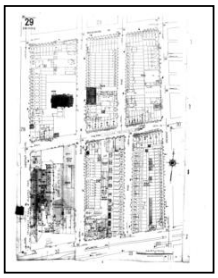
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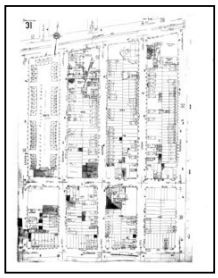
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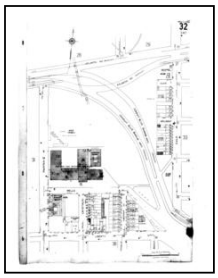
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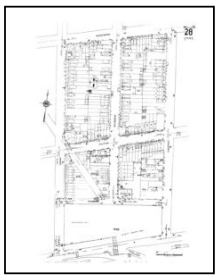
1987 Source Sheets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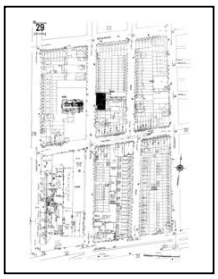
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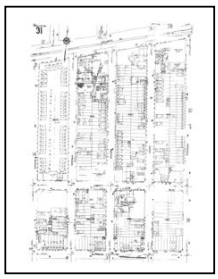
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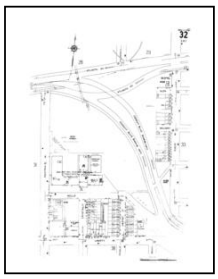
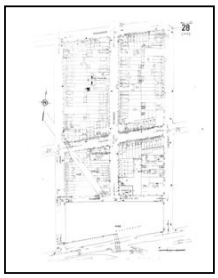

Volume 8, Sheet 32
1987

1982 Source Sheets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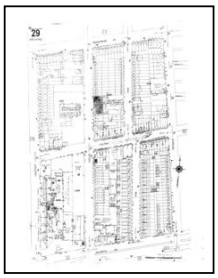
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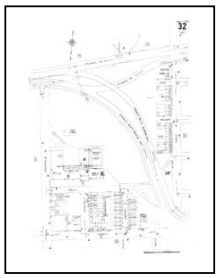
Volume 8, Sheet 32
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1980 Source Sheets

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1980

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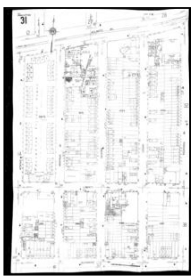
1980


Volume 8, Sheet 31
1980

Volume 8, Sheet 32
1980

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

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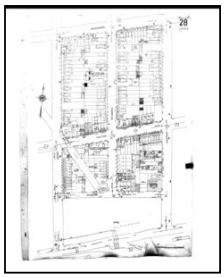
Volume 8, Sheet 28
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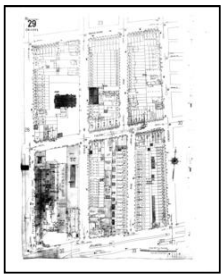
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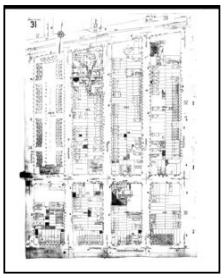
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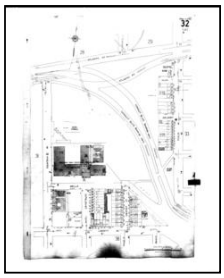
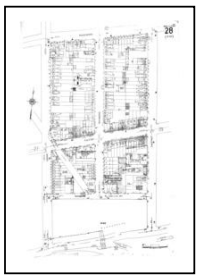

Volume 8, Sheet 32
1979

1977 Source Sheets


Volume 8, Sheet 28
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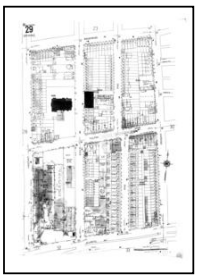
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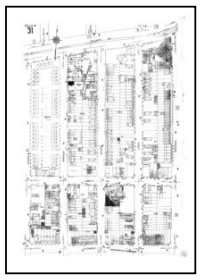
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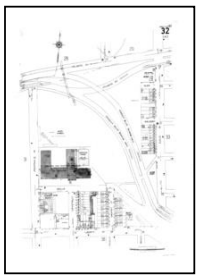
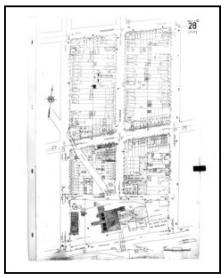

Volume 8, Sheet 32
1977

1968 Source Sheets


Volume 8, Sheet 28
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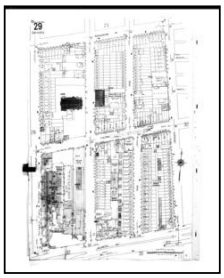
Volume 8, Sheet 29
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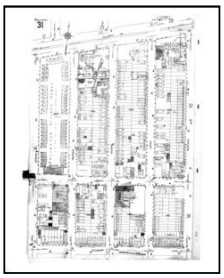
Volume 8, Sheet 31
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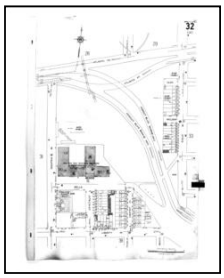
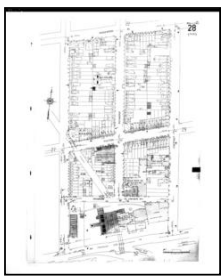

Volume 8, Sheet 32
1968

1965 Source Sheets


Volume 8, Sheet 28
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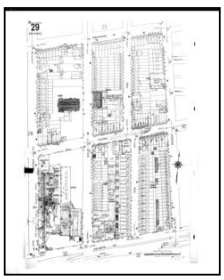
Volume 8, Sheet 29
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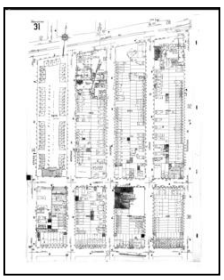
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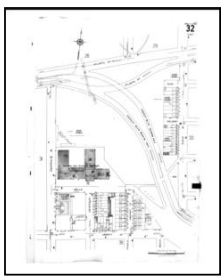
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1965

Sanborn Sheet Key

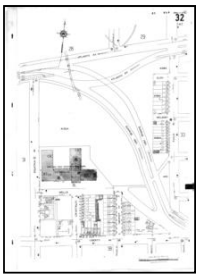
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.

1951 Source Sheets

Volume 8, Sheet 28
1951

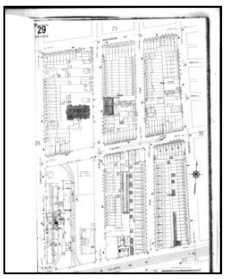
Volume 8, Sheet 29
1951

Volume 8, Sheet 31
1951


Volume 8, Sheet 32
1951

1928 Source Sheets

Volume 8, Sheet 28
1928


Volume 8, Sheet 29
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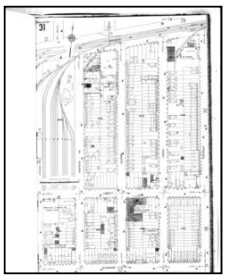
Volume 8, Sheet 31
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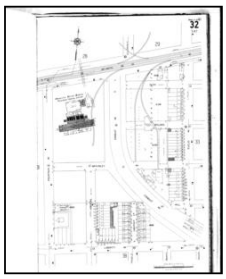
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1908 Source Sheets

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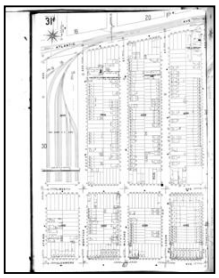
1908


Volume 8, Sheet 31
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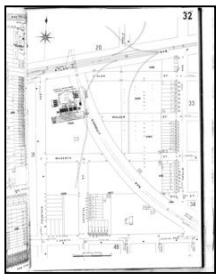
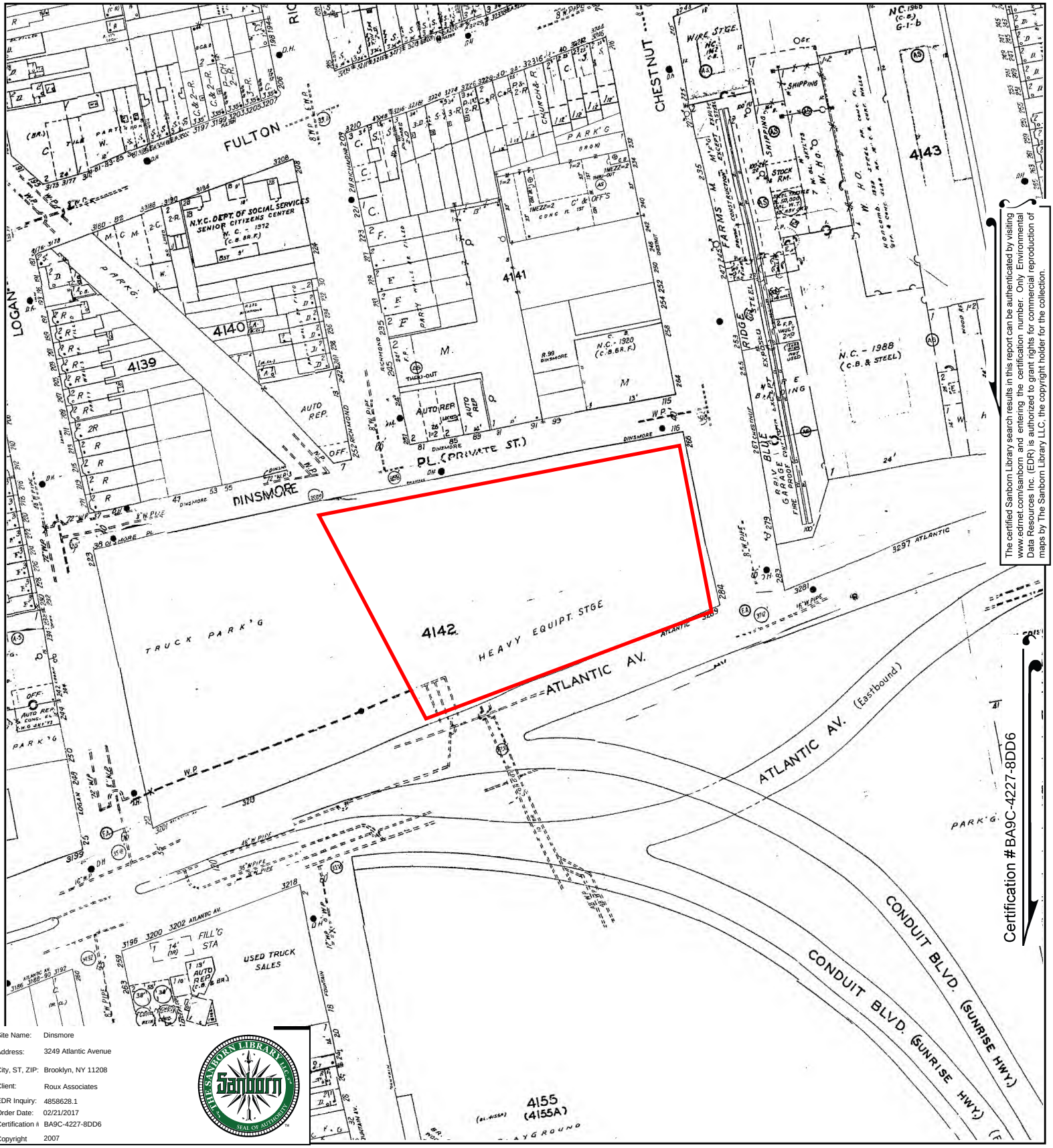

Volume 8, Sheet 32
1908

1887 Source Sheets

Volume 8, Sheet 219
1887

Volume 8, Sheet 219
1887



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City, ST, ZIP:	Brooklyn, NY 11208
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Order Date:	02/21/2017
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Copyright	2007

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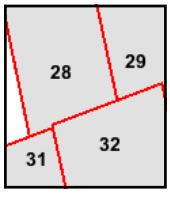

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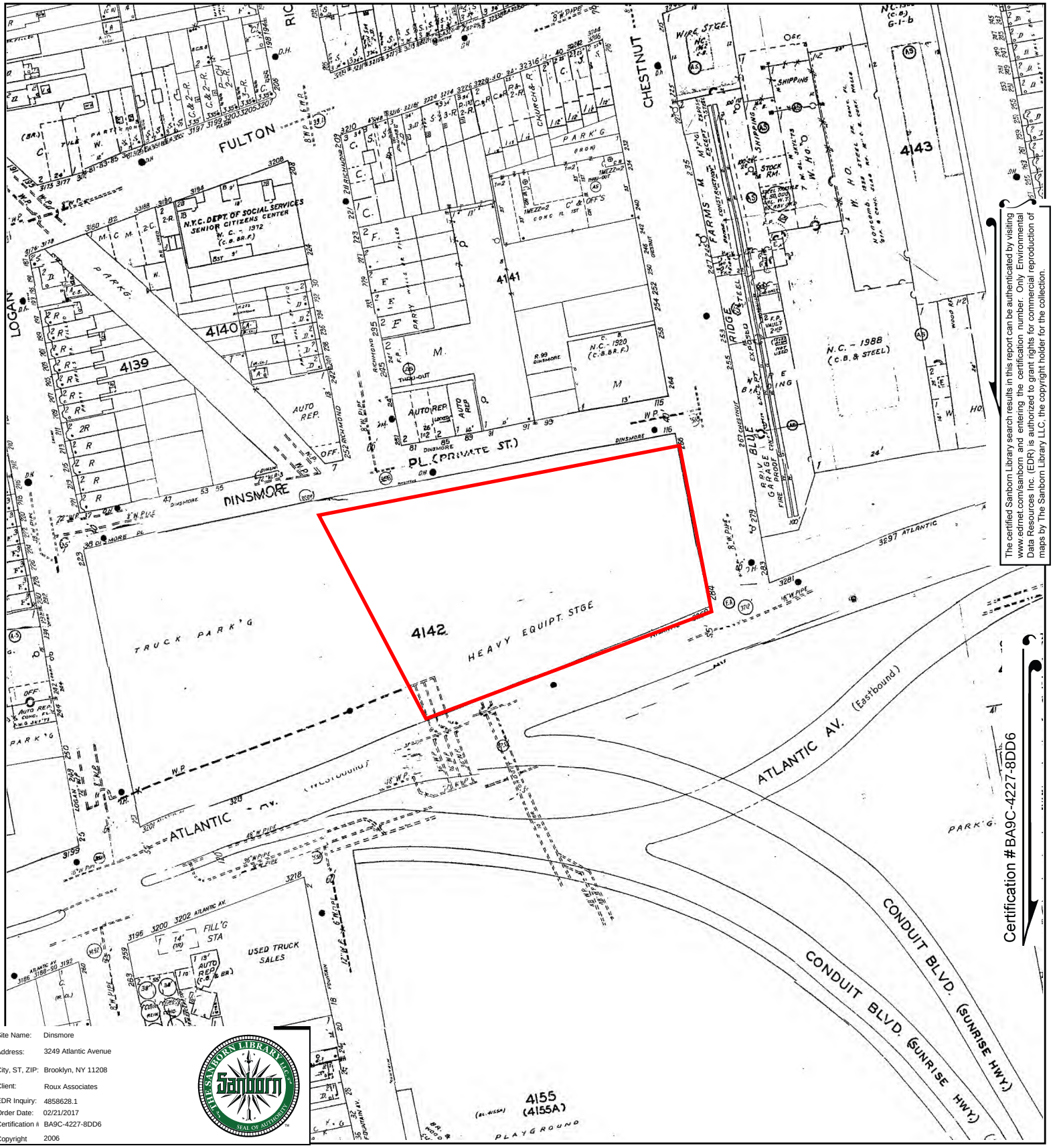
Volume 8, Sheet 31
Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

N

Certified Sanborn® Map

2006



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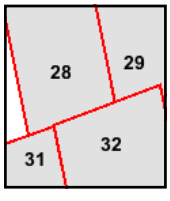

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Volume 8, Sheet 31
Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

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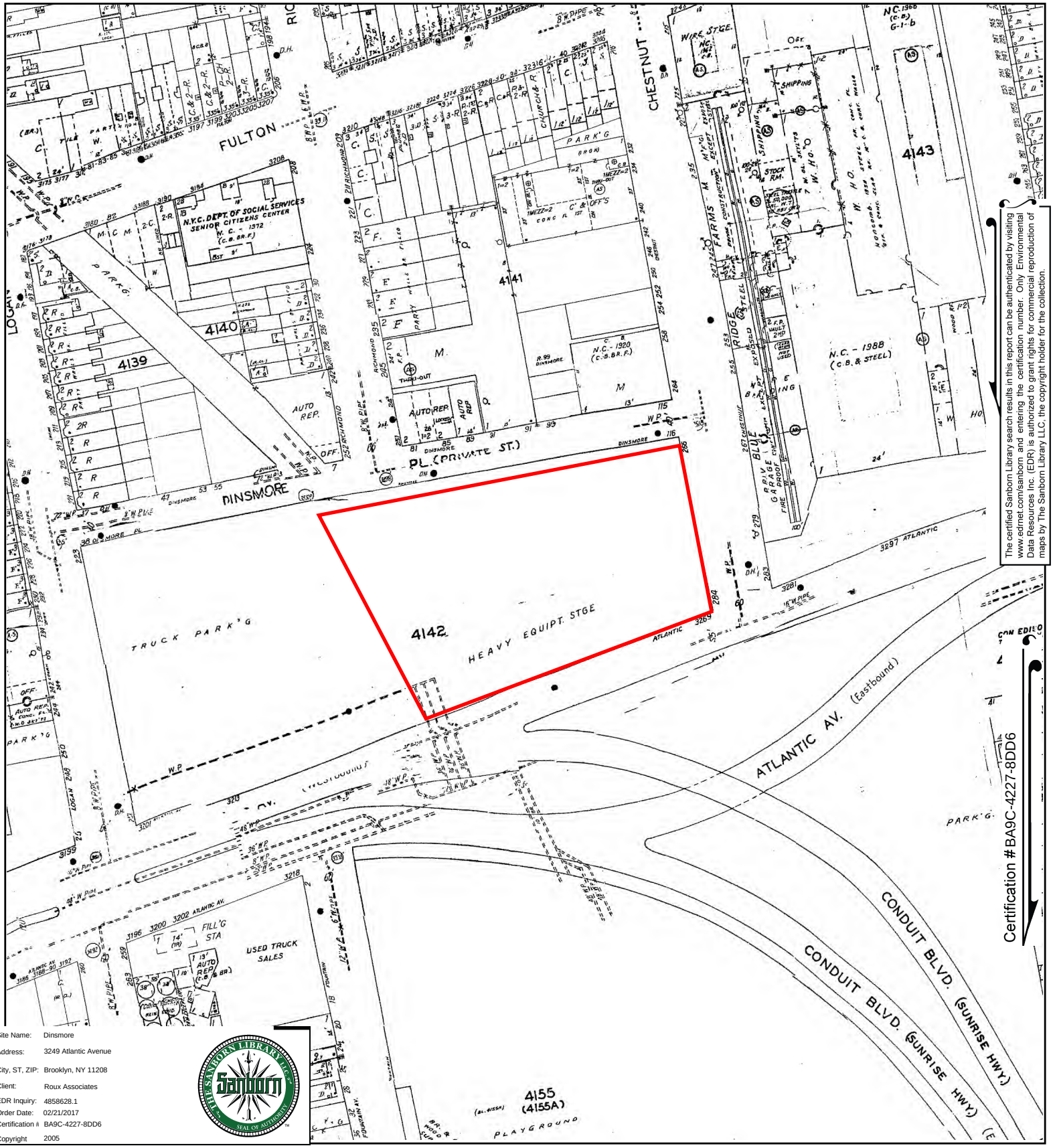

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Order Date:	02/21/2017
Certification #:	BA9C-4227-8DD6
Copyright	2005

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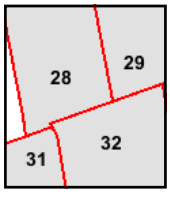

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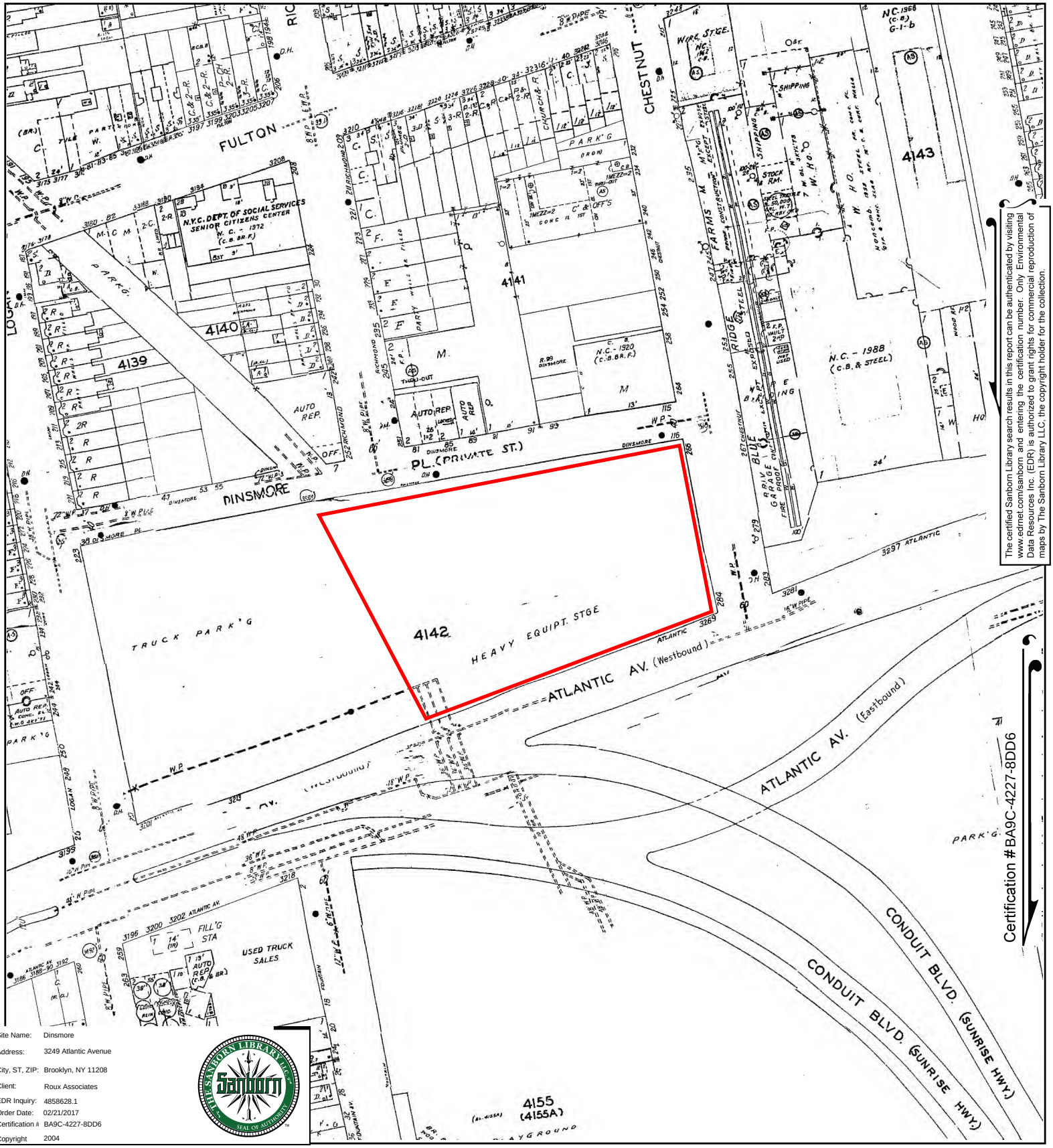
Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

N

Certified Sanborn® Map

2004



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EDR Inquiry:	4858628.1
Order Date:	02/21/2017
Certification #:	BA9C-4227-8DD6
Copyright	2004

This Certified Sanborn Map combines the following sheets.
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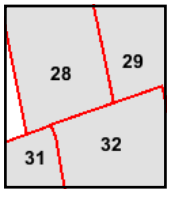

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Volume 8, Sheet 31
Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

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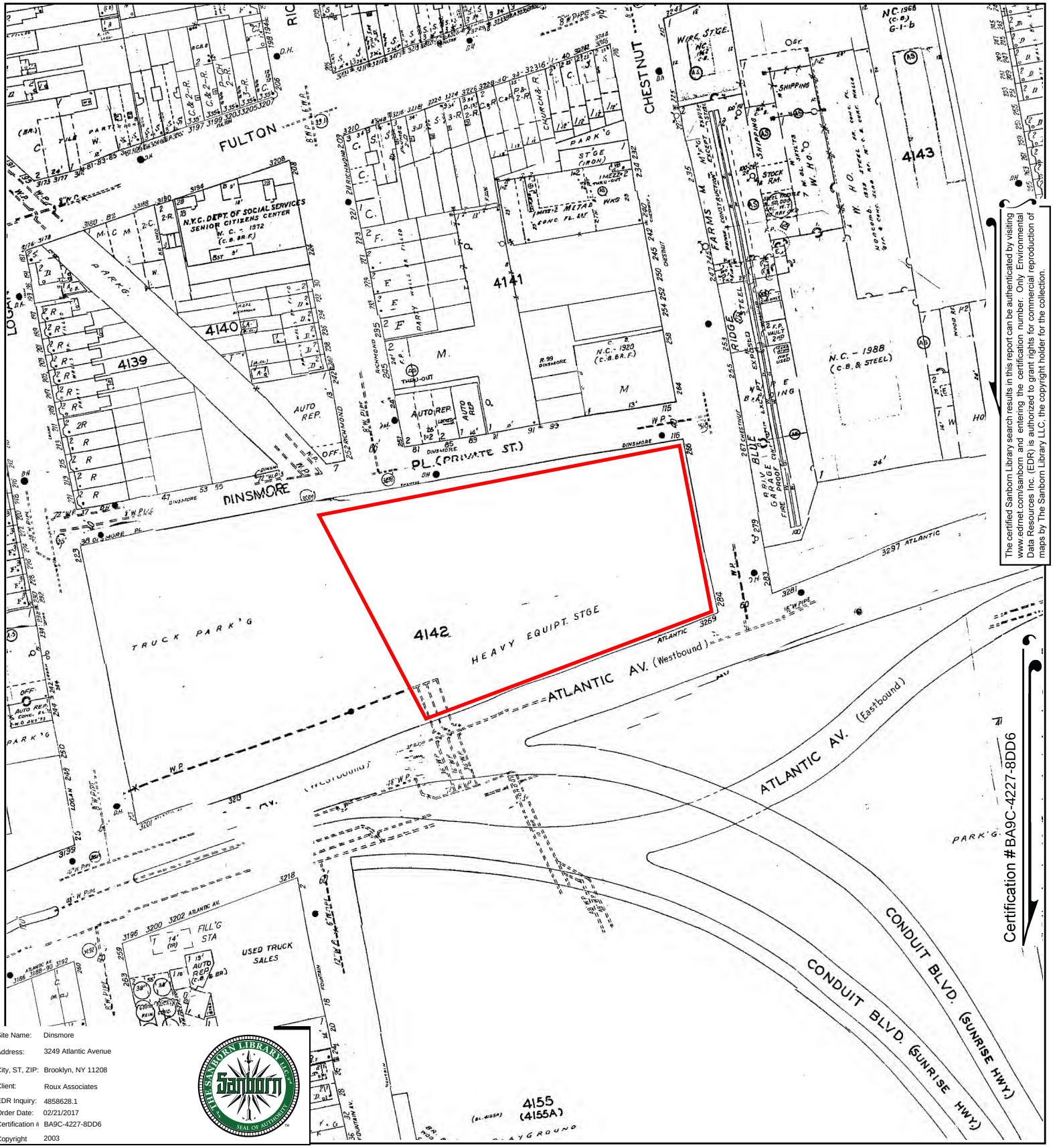

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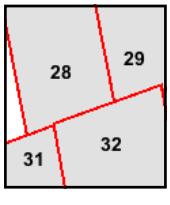

Volume 8, Sheet 32
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Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

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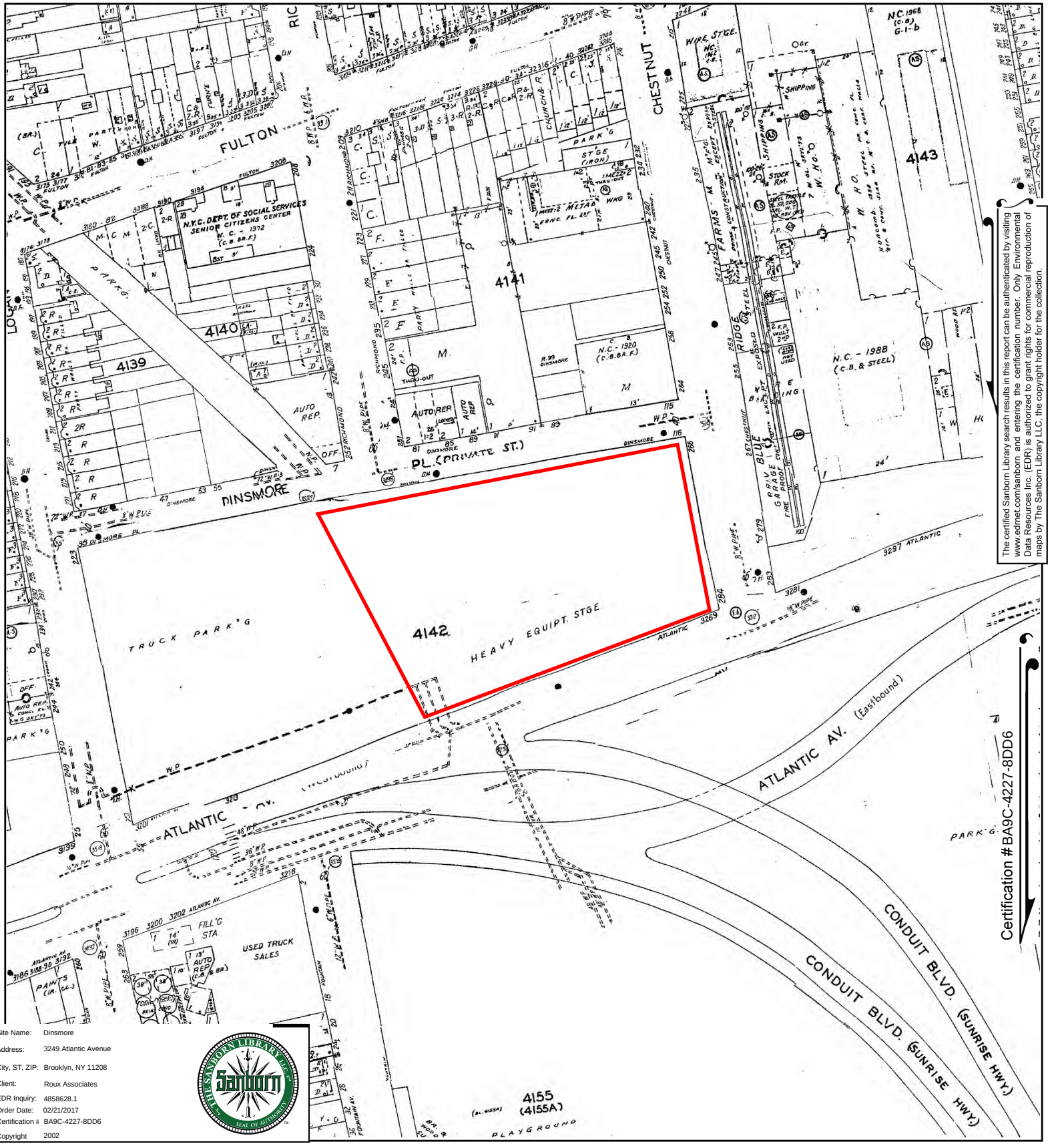

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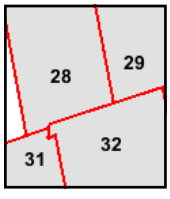

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Volume 8, Sheet 29
Volume 8, Sheet 28

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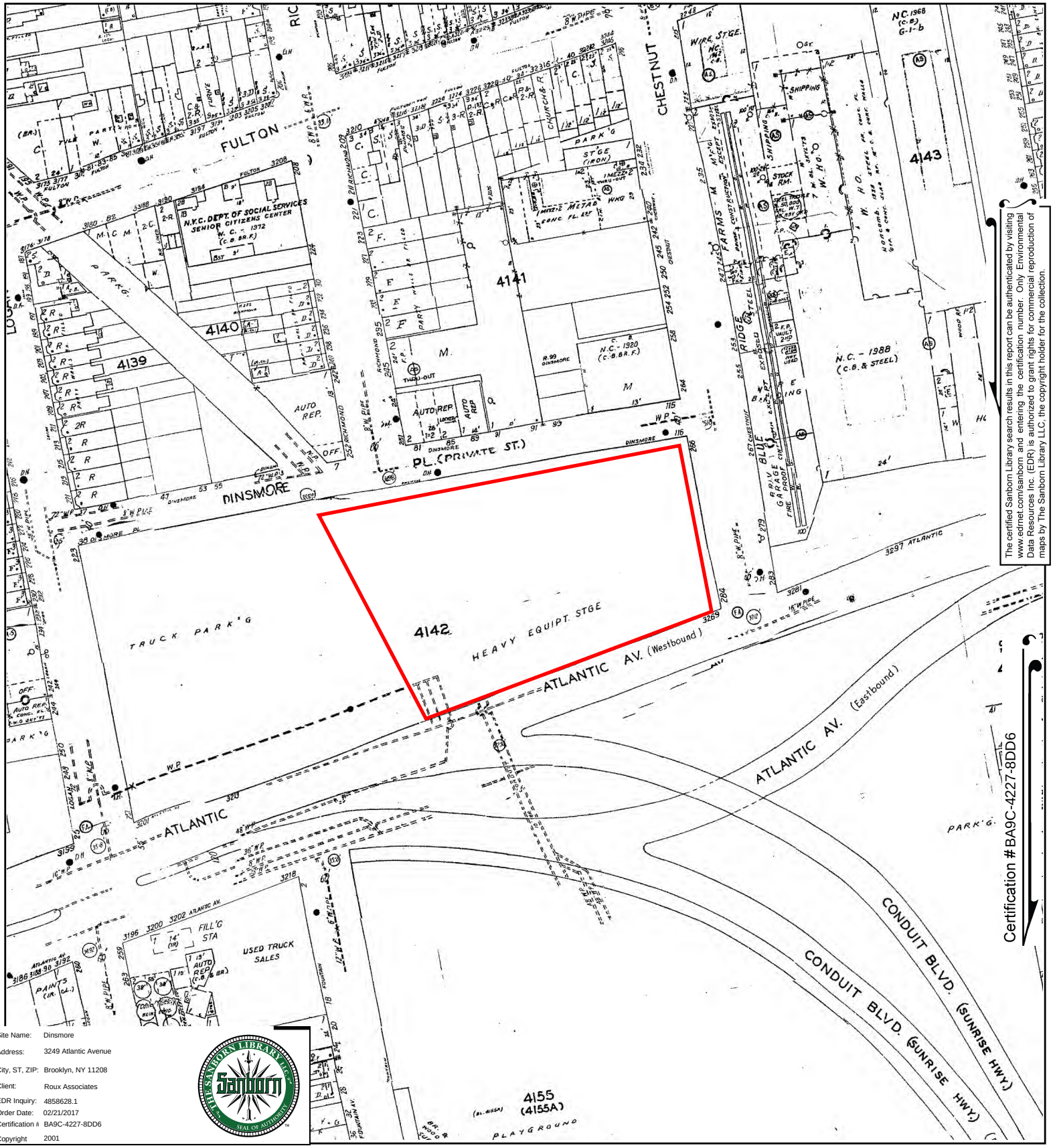

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Copyright	2001

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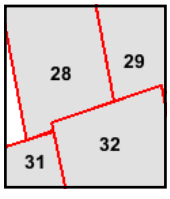

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Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

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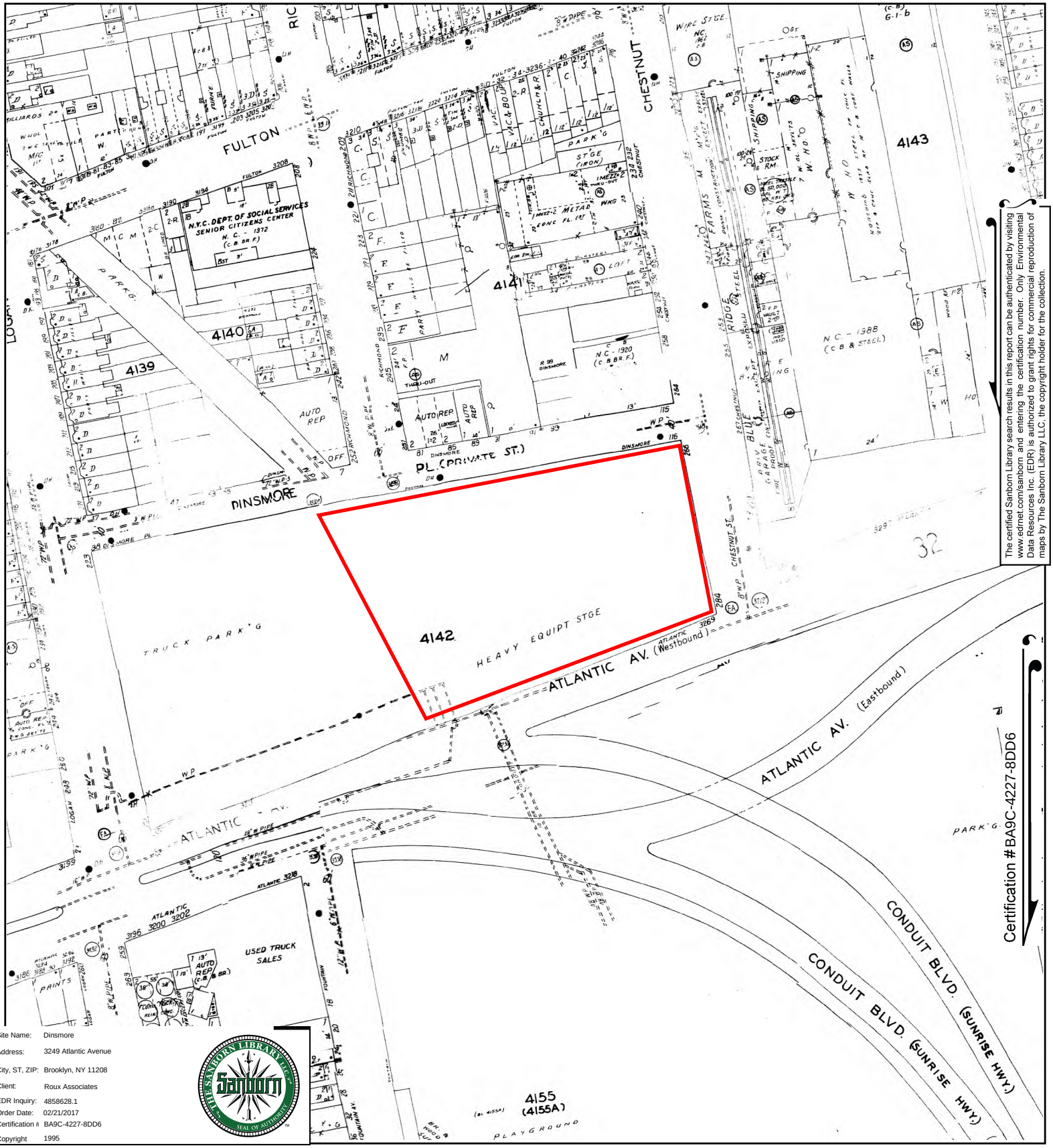
Certified Sanborn® Map

1995



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Copyright	1995

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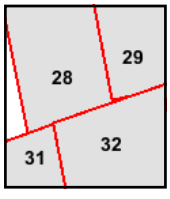

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Volume 8, Sheet 28

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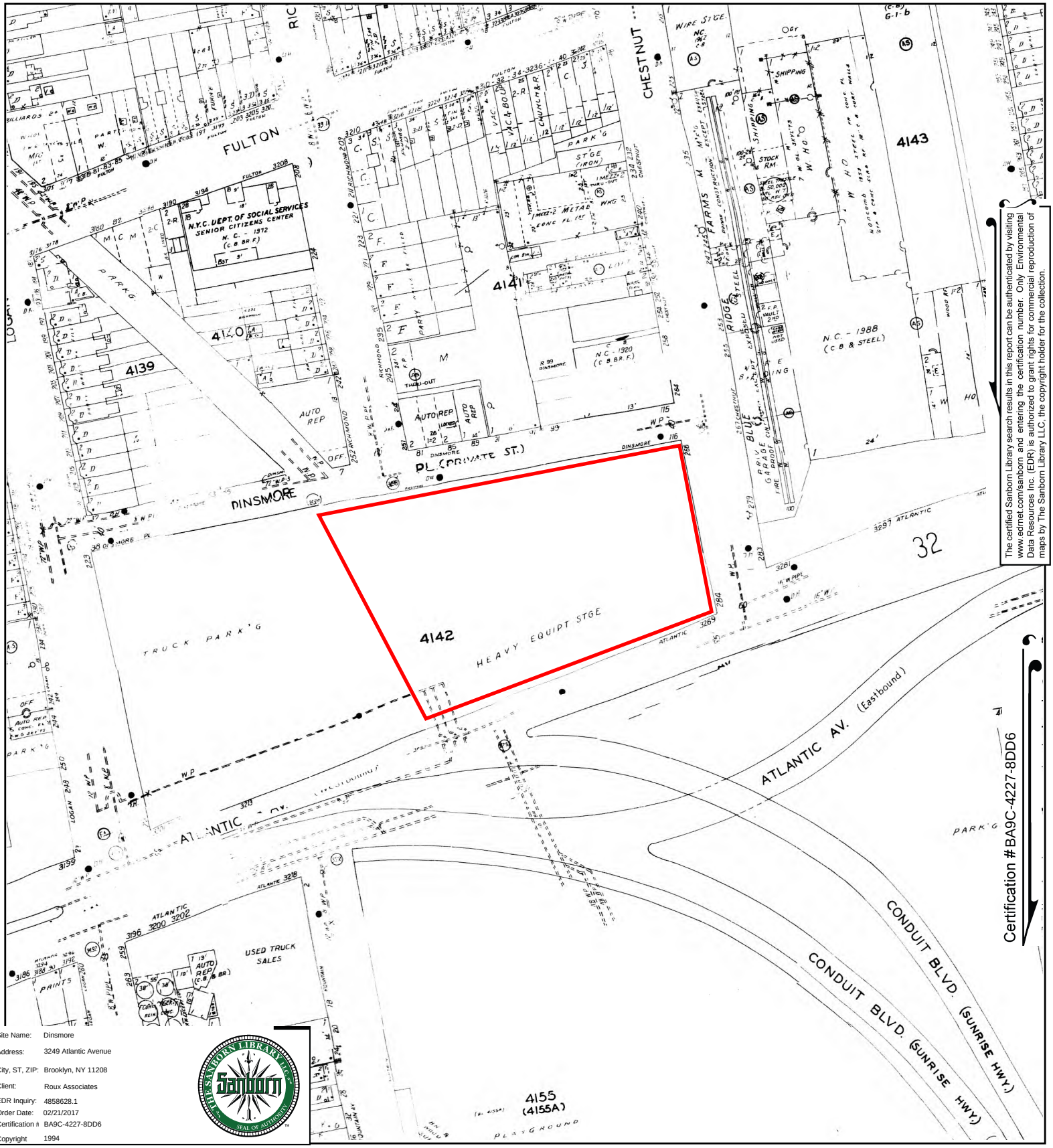

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Copyright	1994

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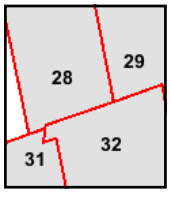

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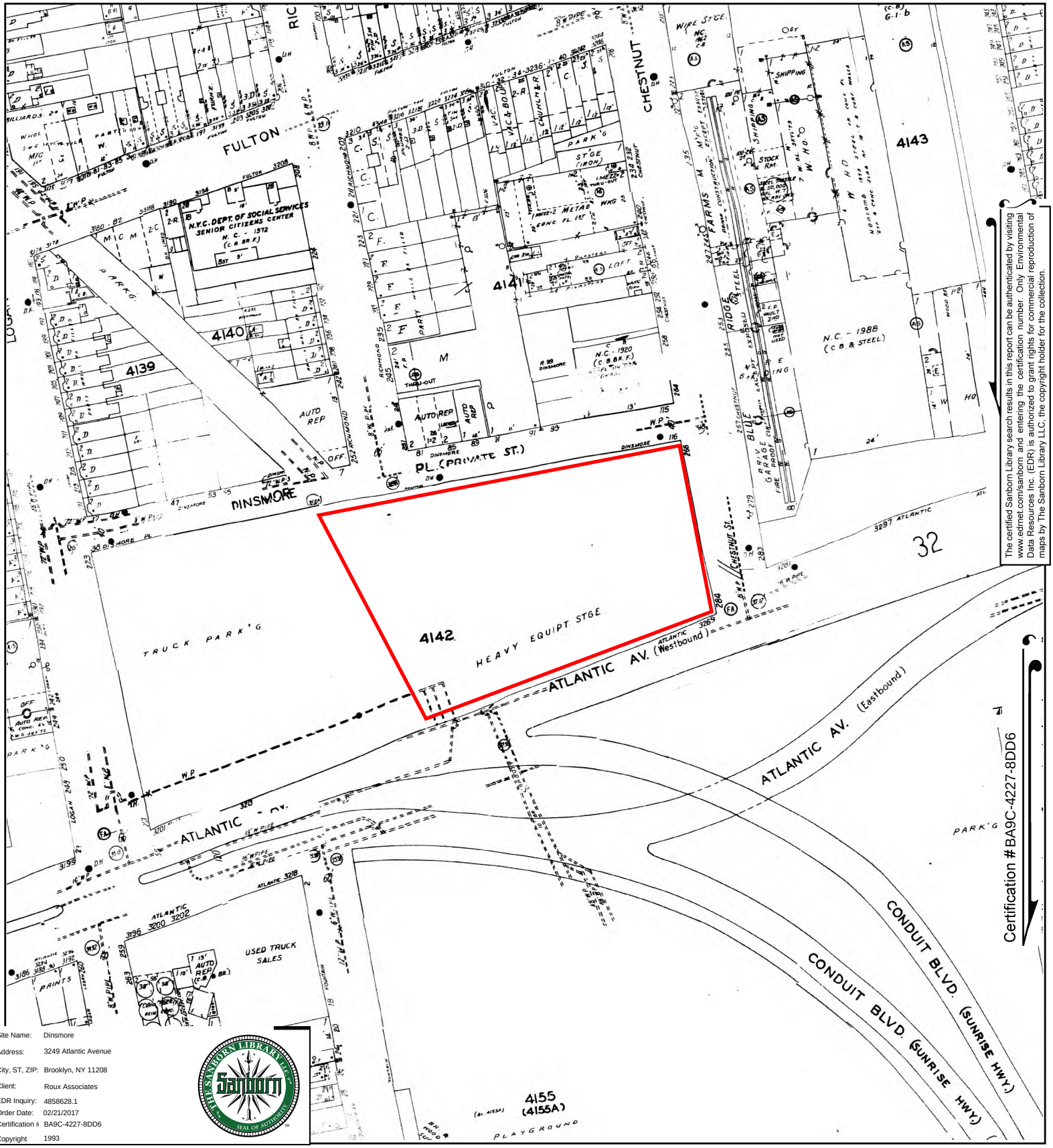
Volume 8, Sheet 29
Volume 8, Sheet 28

0 Feet 150 300 600

N

Certified Sanborn® Map

1993



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Copyright	1993

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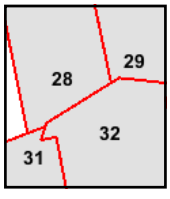

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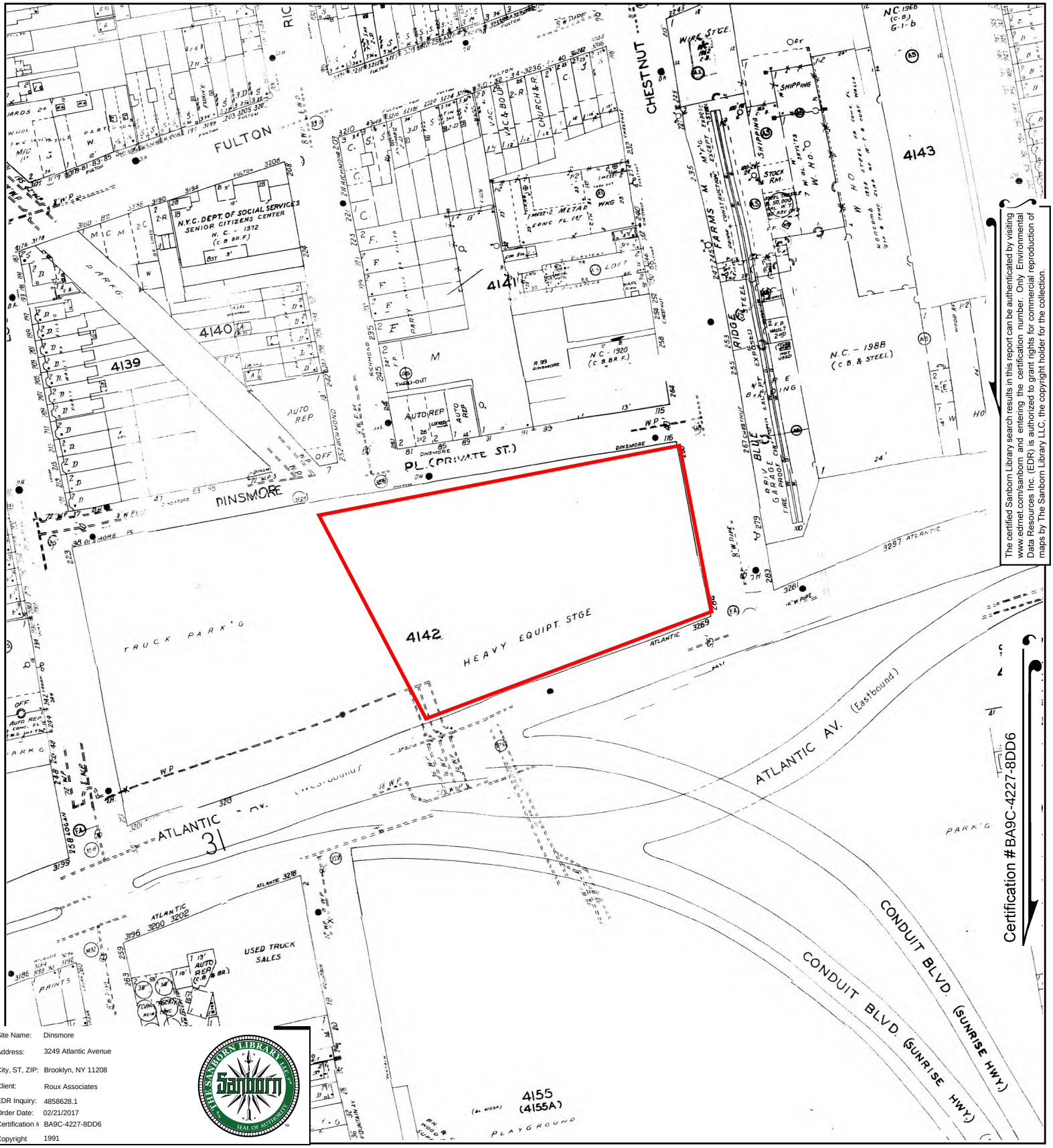
Volume 8, Sheet 28

0 Feet 150 300 600

N

Certified Sanborn® Map

1991



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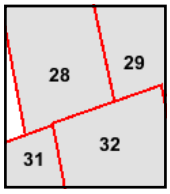

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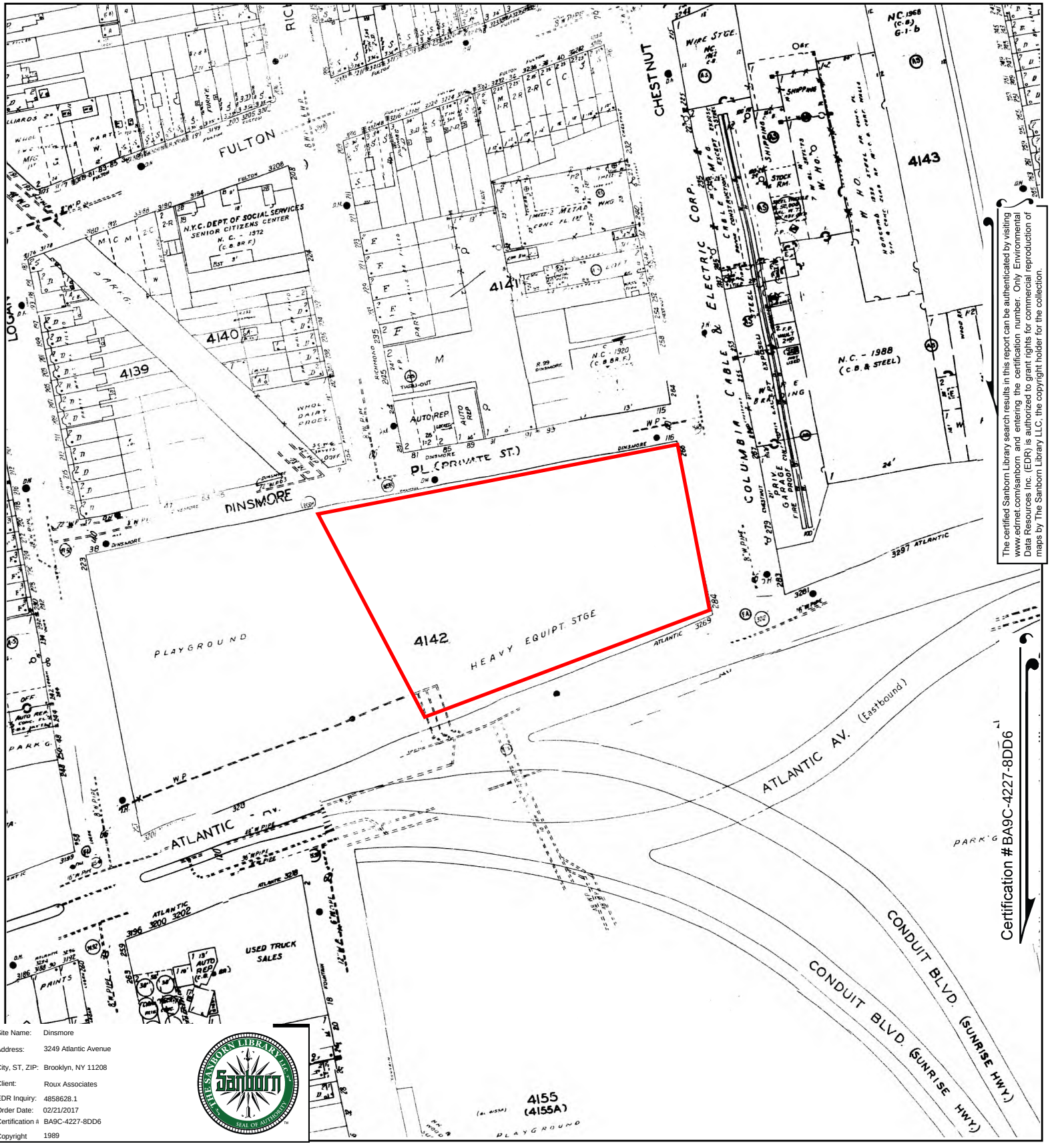
Volume 8, Sheet 28

0 Feet 150 300 600

N

Certified Sanborn® Map

1989



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Copyright	1989

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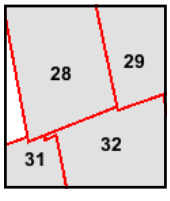

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Volume 8, Sheet 32
Volume 8, Sheet 31

0 Feet 150 300 600

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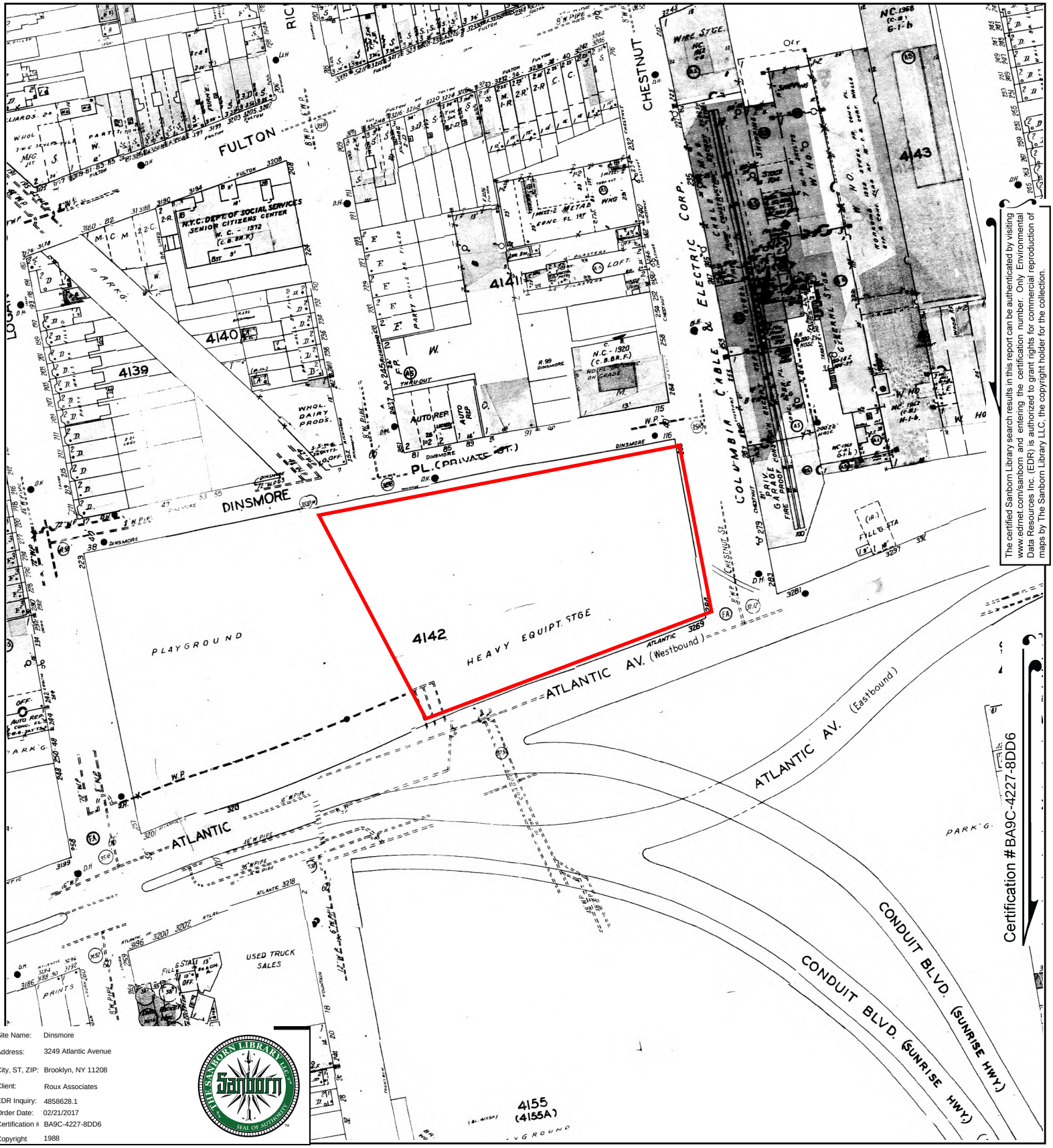
Certified Sanborn® Map

1988



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Copyright	1988

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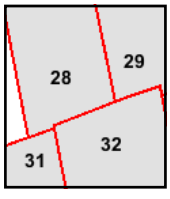

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Volume 8, Sheet 29
Volume 8, Sheet 28

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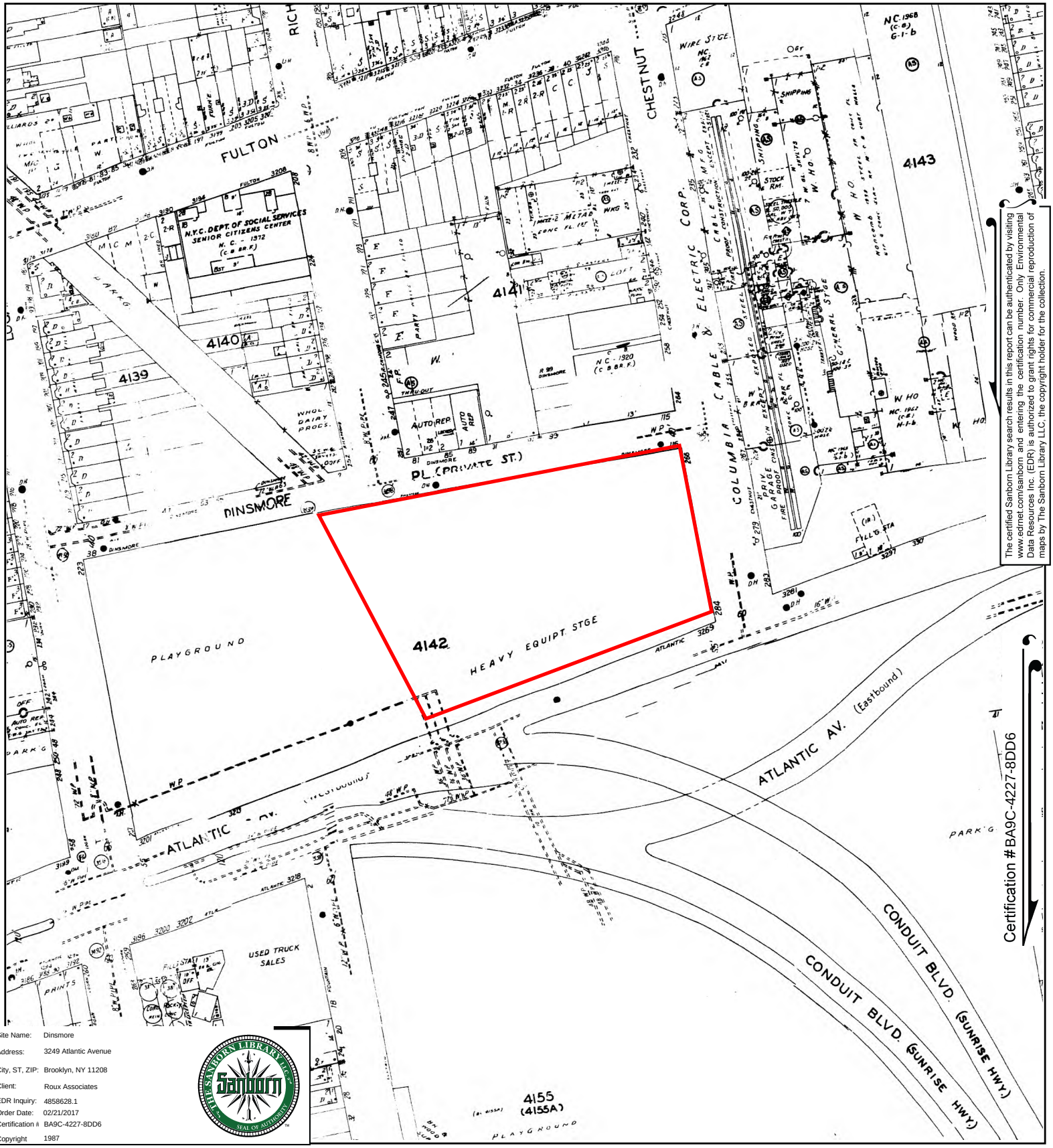

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Copyright	1987

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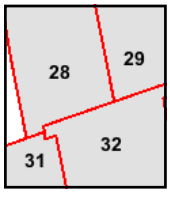

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Volume 8, Sheet 29
Volume 8, Sheet 28

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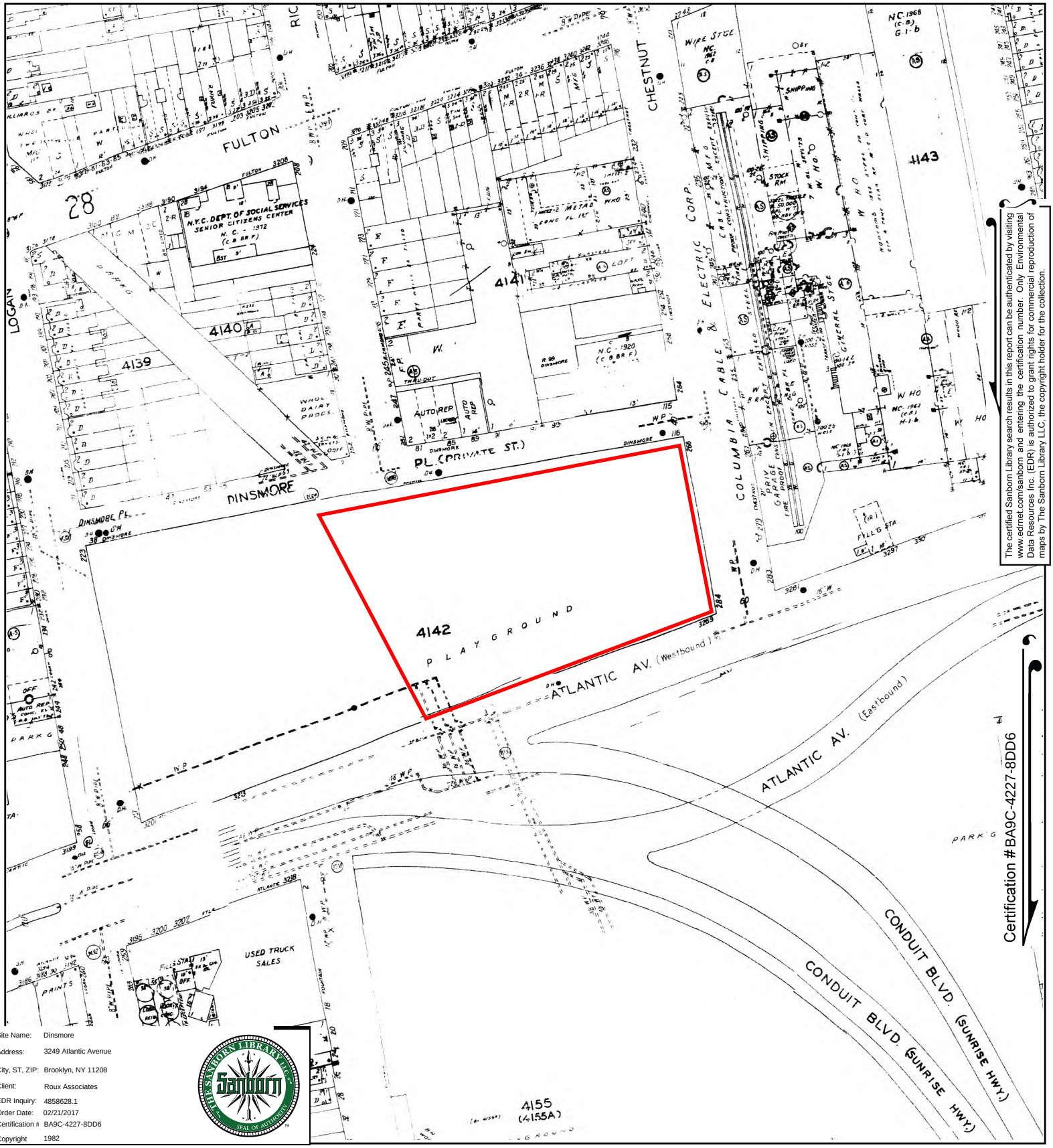

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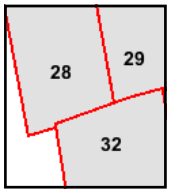

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Volume 8, Sheet 28

0 Feet 150 300 600

N

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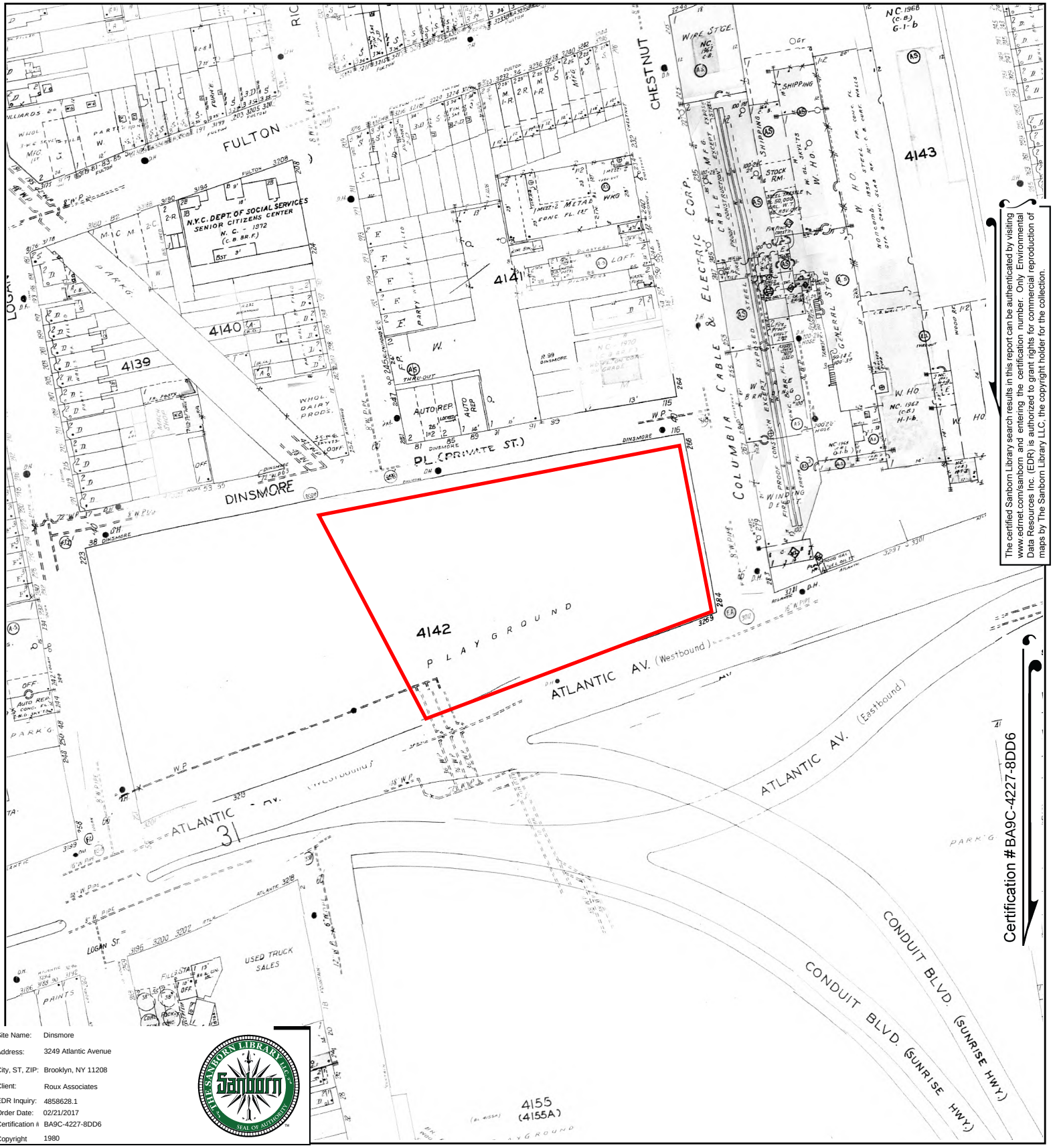
1980



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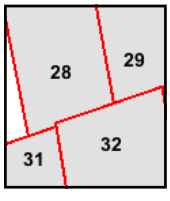

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Volume 8, Sheet 31
Volume 8, Sheet 29
Volume 8, Sheet 28

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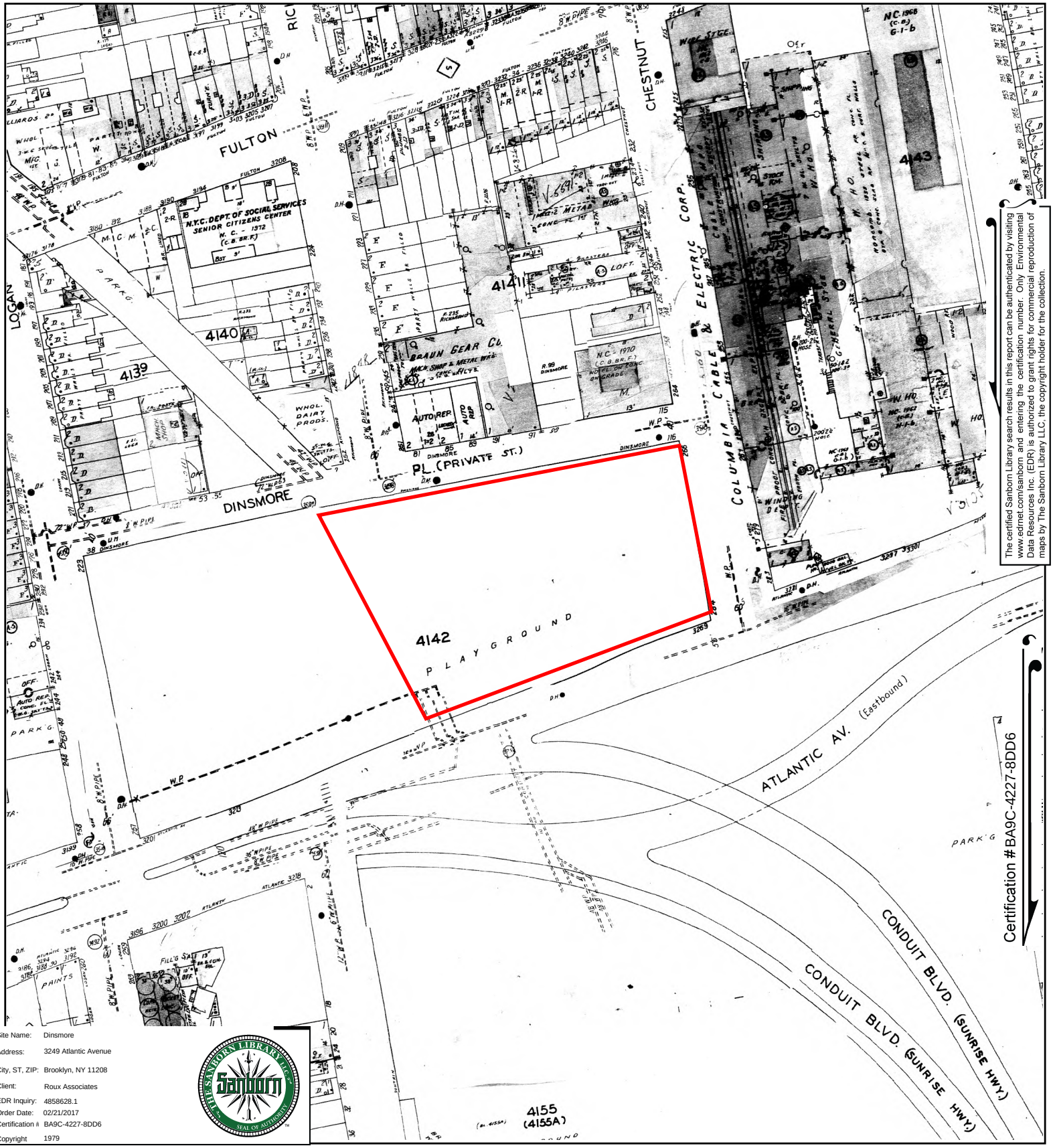

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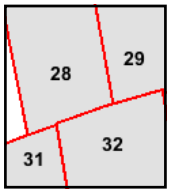

Volume 8, Sheet 32
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Volume 8, Sheet 28

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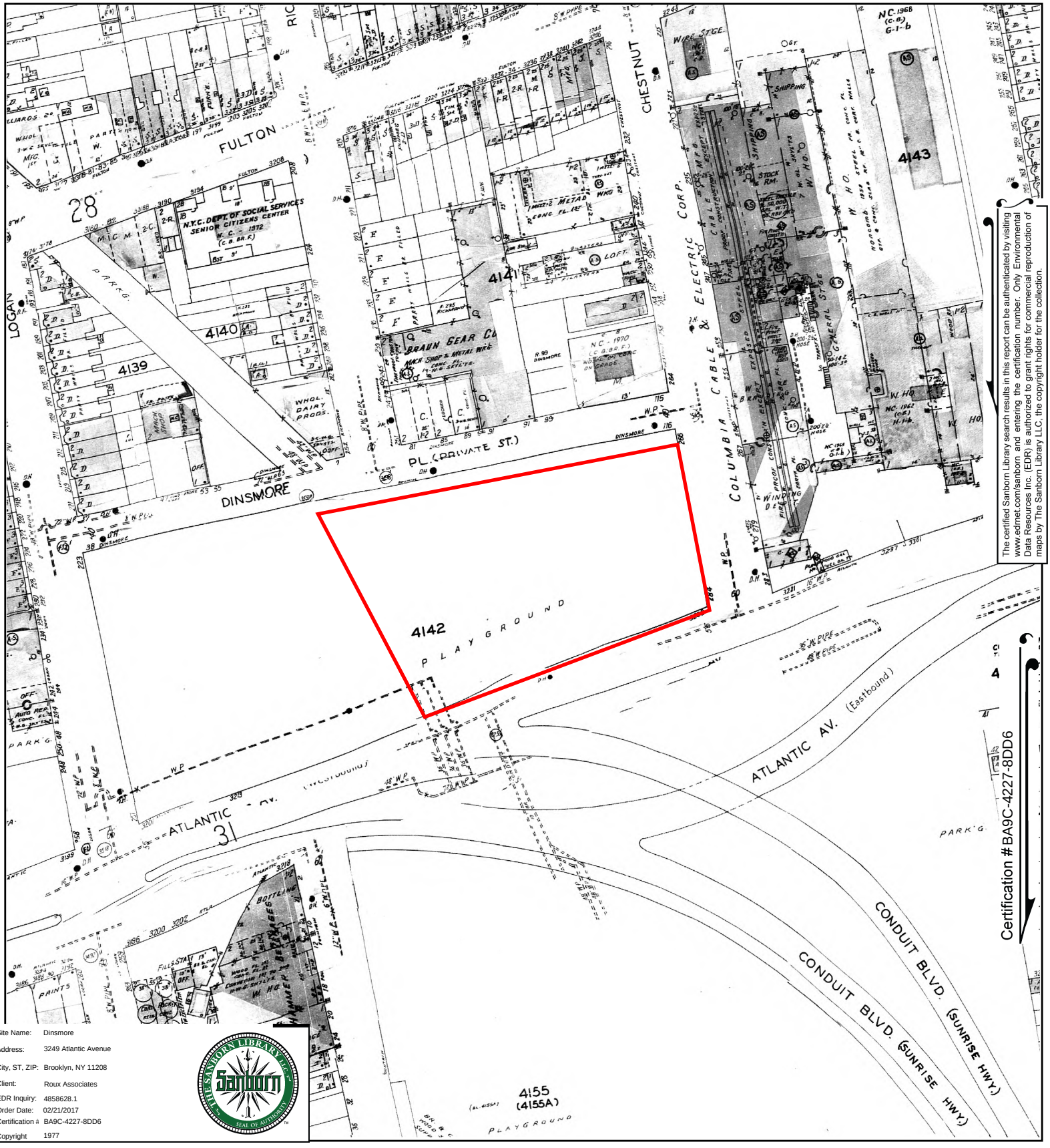

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Copyright	1977

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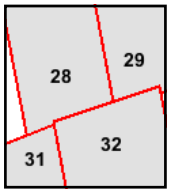

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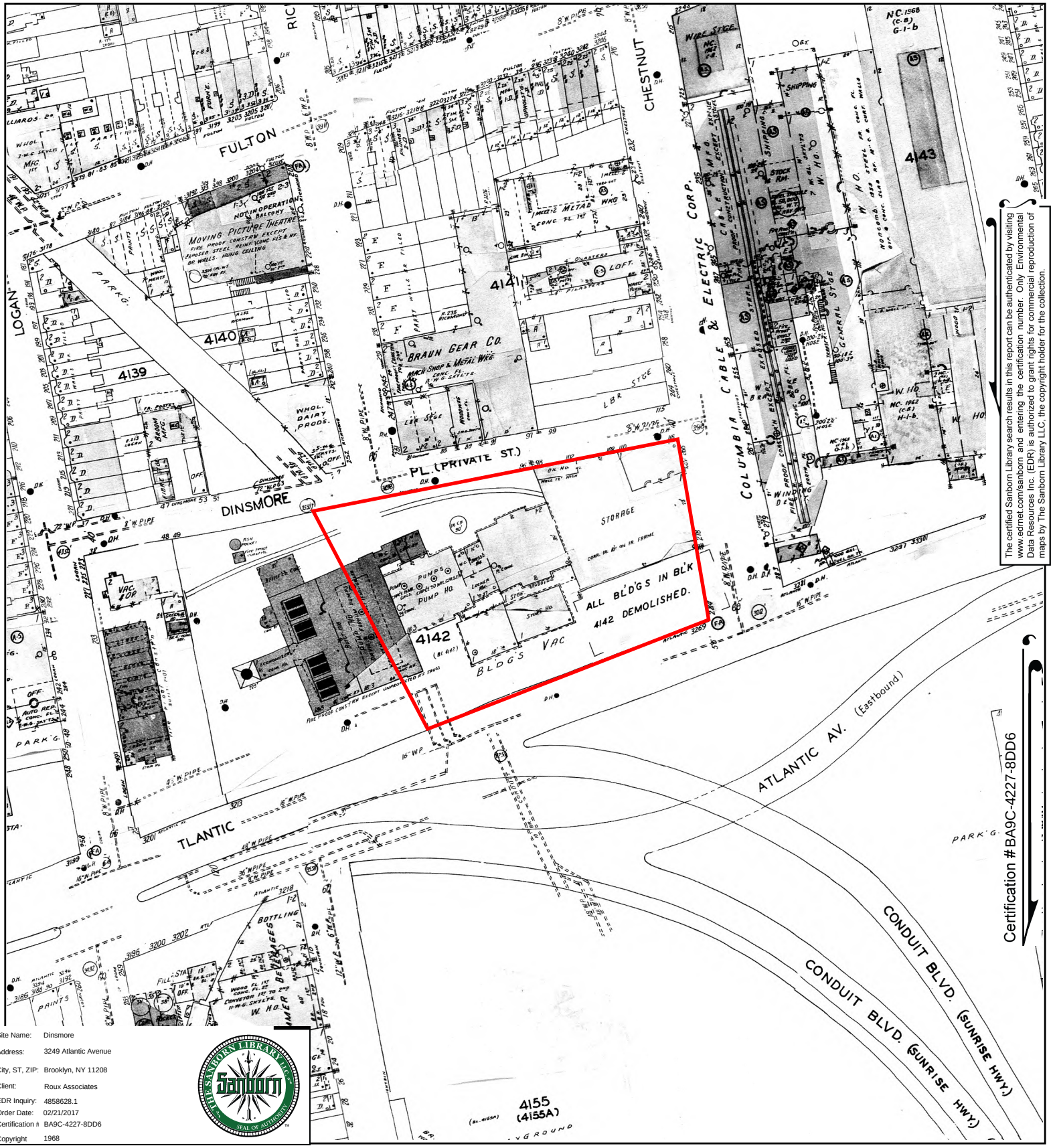
N

Certified Sanborn® Map

1968



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Copyright	1968

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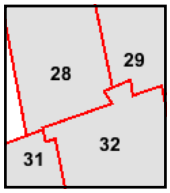

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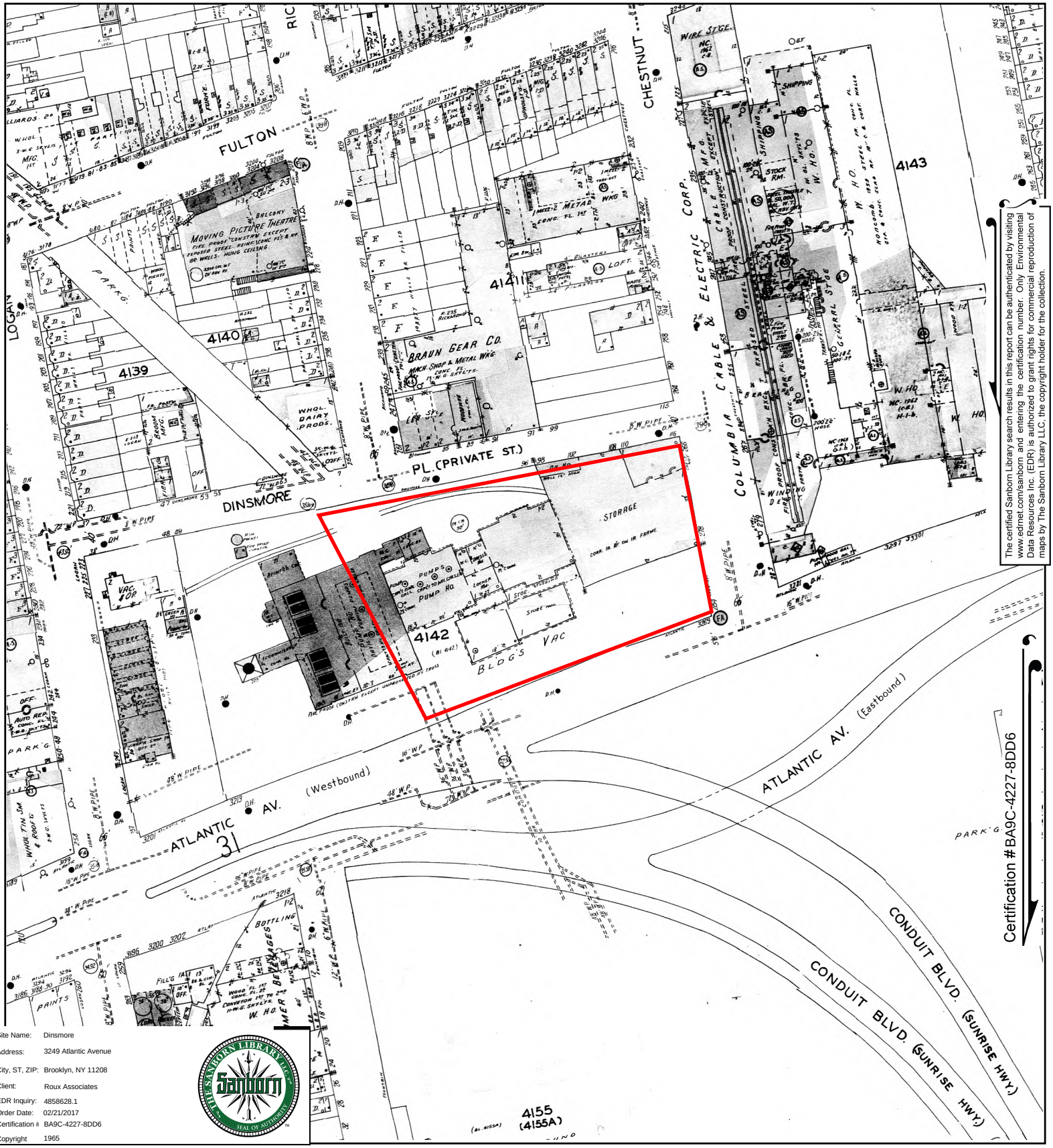
0 Feet 150 300 600

N

Certified Sanborn® Map

1965



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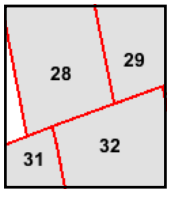

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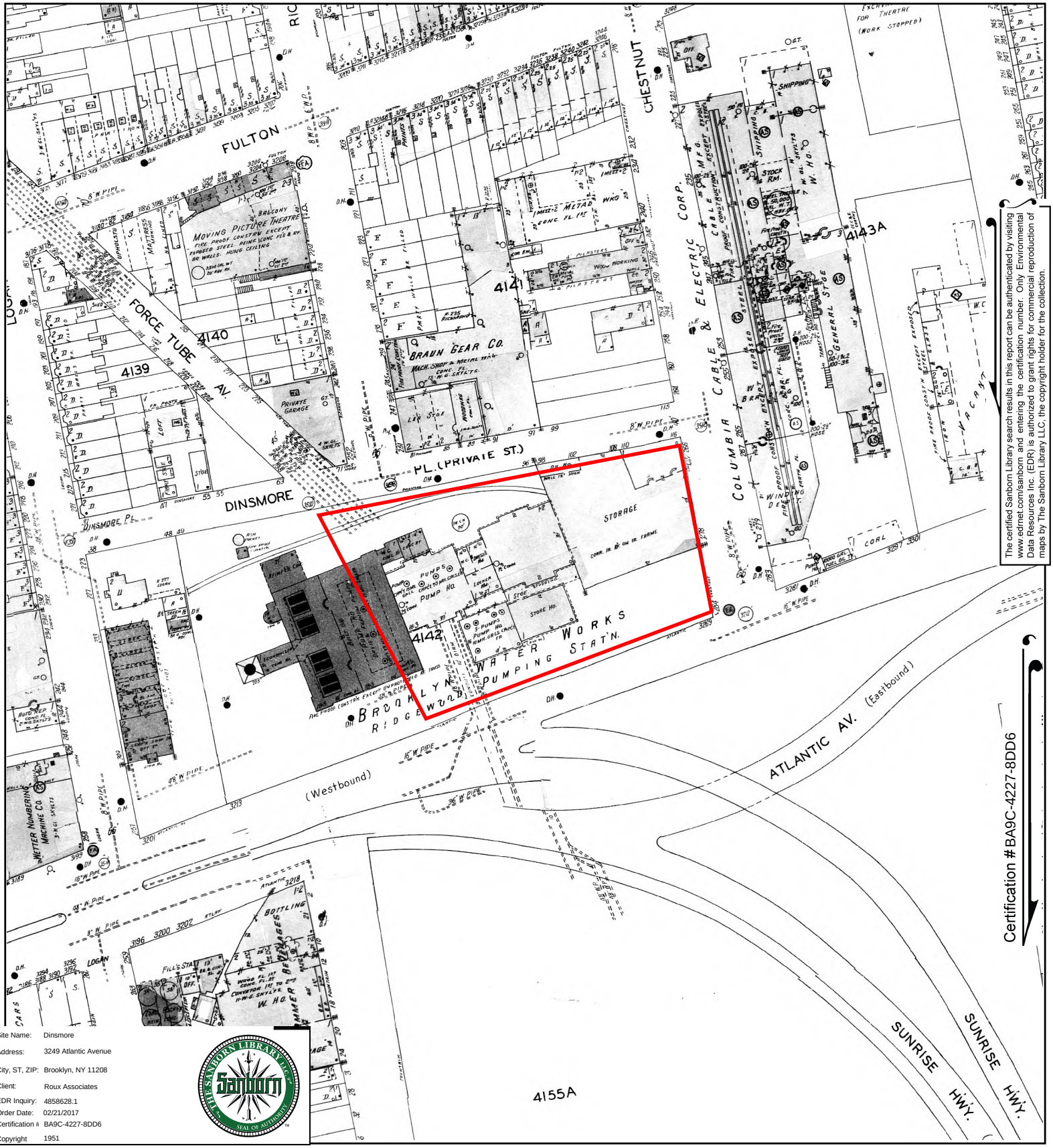

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City, ST, ZIP:	Brooklyn, NY 11208
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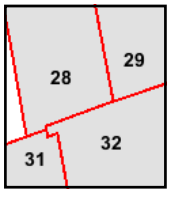

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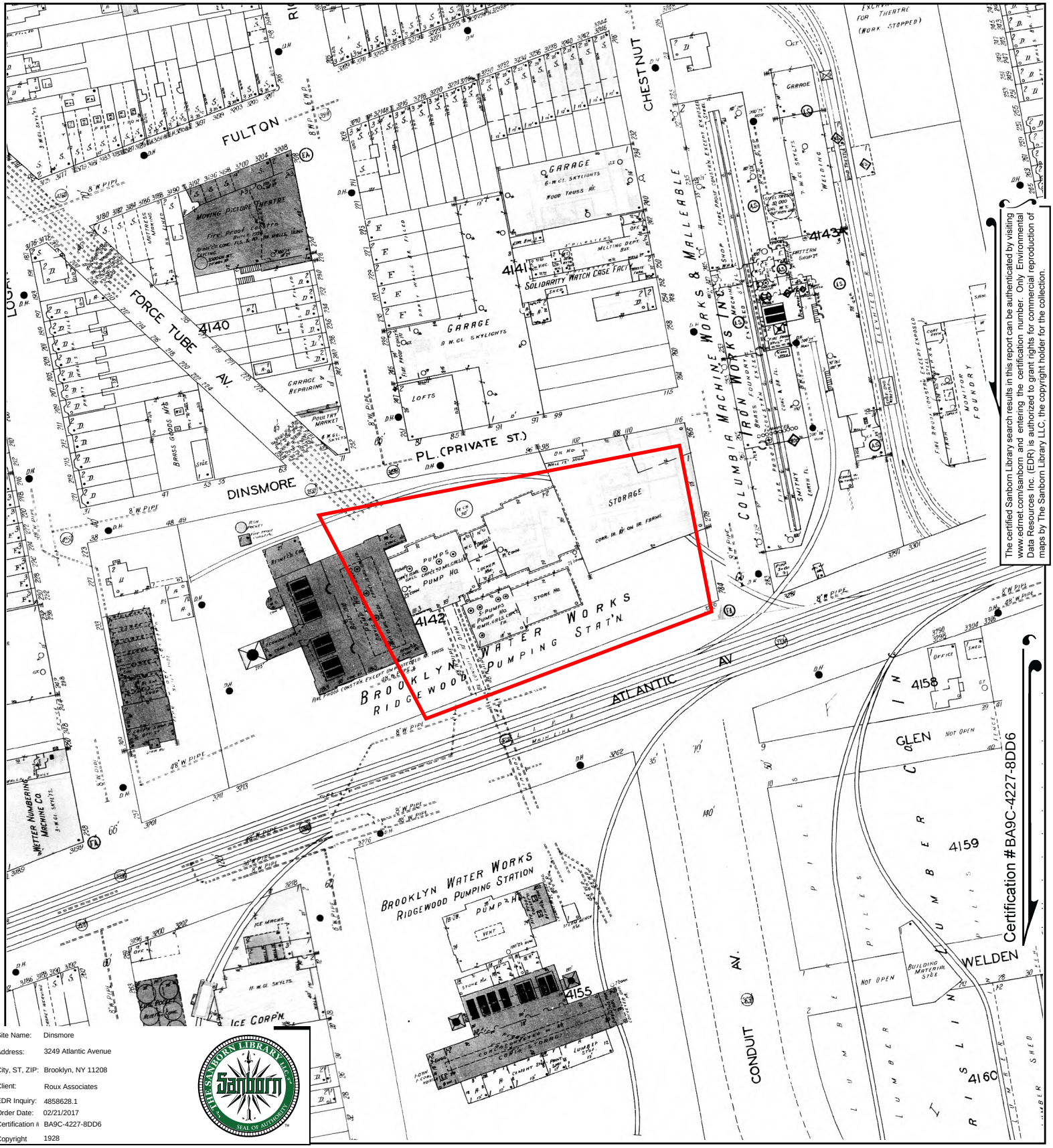

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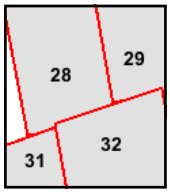

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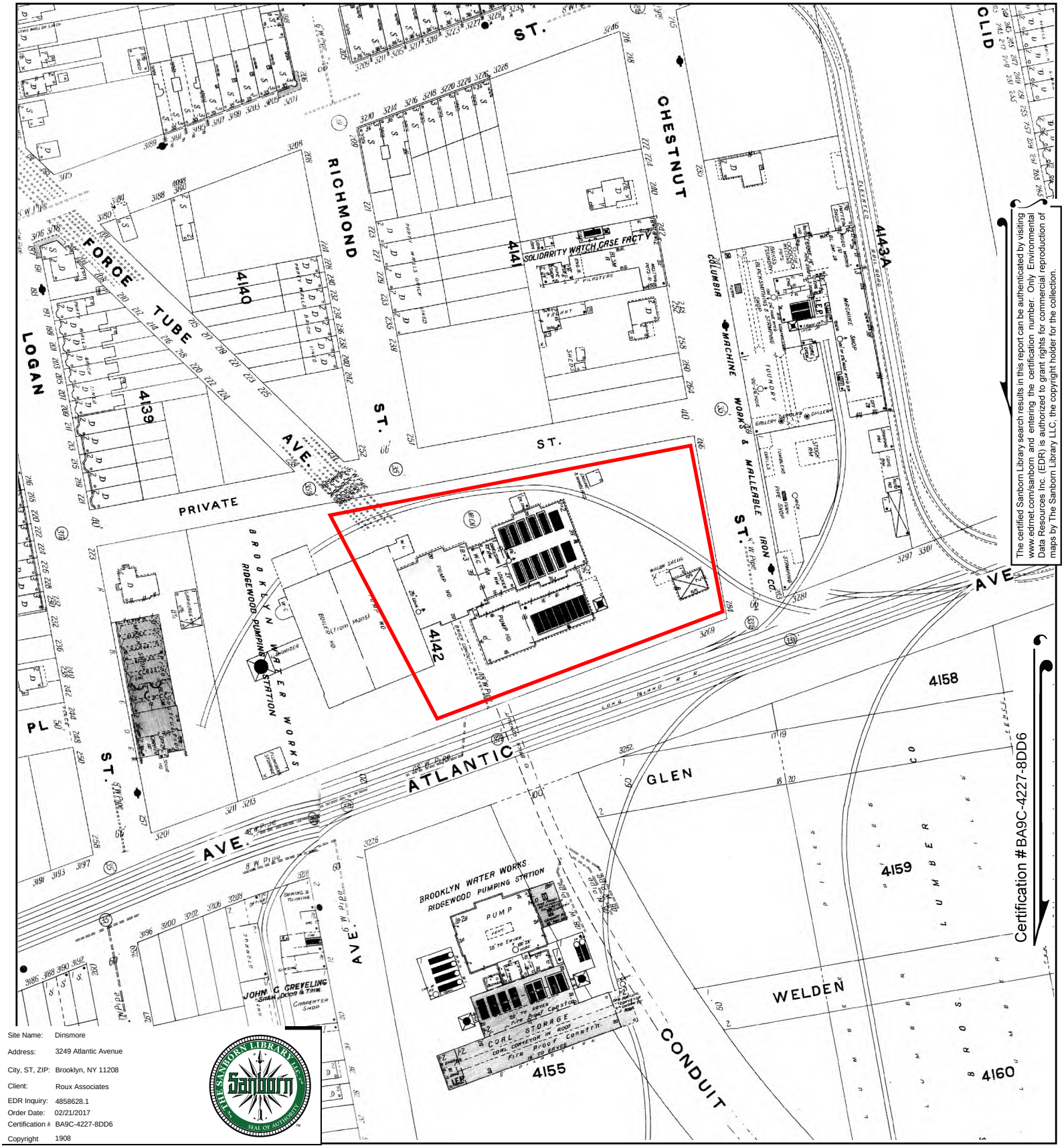

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Client:	Roux Associates
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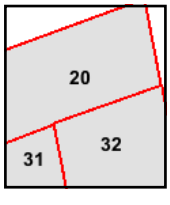

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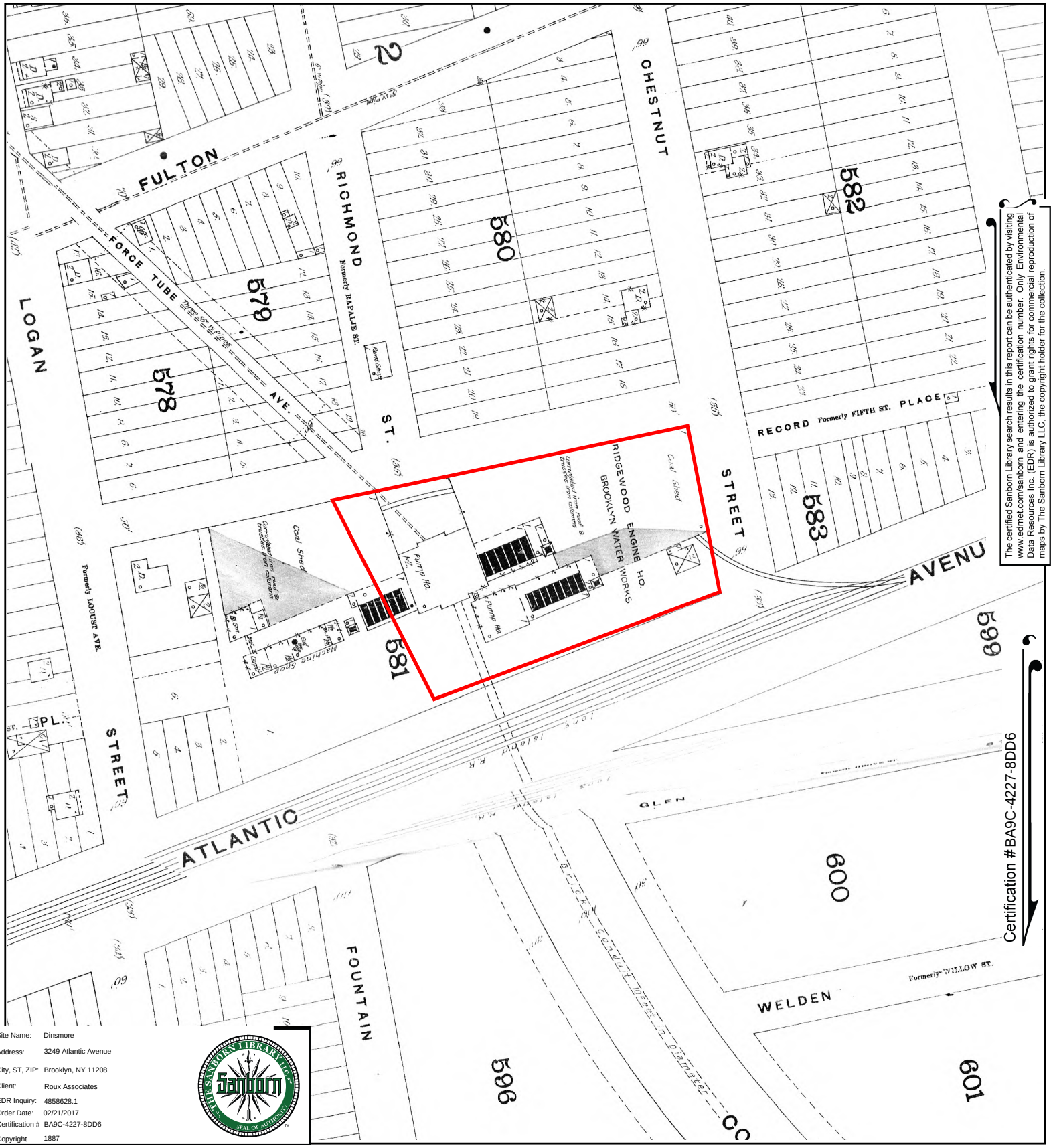

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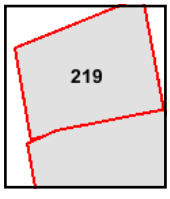

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APPENDIX H

In Situ Soil Waste Characterization Report
(Provided in Separate File)

APPENDIX I

Health and Safety Plan

Site-Specific Health and Safety Plan

Chestnut Commons
Block 4142 Lot 34
Brooklyn, New York

May 6, 2019

Prepared for:

MHANY Management, Inc.
One MetroTech North, 11th Floor
Brooklyn, New York 11201

Prepared by:

Roux Environmental Engineering and Geology, D.P.C.
209 Shafter Street
Islandia, New York 11749

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& Management
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D. ACORD® Automobile Loss Notice Form
E. Personal Protective Equipment Management Program
F. Respiratory Protection Management Program
G. Generic Community Air Monitoring Plan (CAMP)
H. Health and Safety Briefing/Daily Meeting Log
I. Heavy Equipment Exclusion Zone Program

Site-Specific Emergency Information

Emergency Phone Numbers

Most emergency services can be obtained by calling **911**. Where 911 service is not available, use the telephone numbers provided in the below table. The following is a master emergency phone list for use by the project management personnel. A more condensed version of the emergency numbers listed below will be posted throughout project work areas. Emergencies encountered on the site will be responded to by a combination of off-site emergency services and site personnel.

EMERGENCY CONTACT INFORMATION			
Roux Site Personnel			
Title	**Contact**		**Telephone**
Project Manager (PM)	Jessica Taylor		(631) 630-2395; (631) 766-0607
Site Health and Safety Officer/ Site Supervisor (SHSO/SS)	TBD when fieldwork scheduled		TBD
SHSO/SS Alternate	TBD when fieldwork scheduled		TBD
Outside Assistance			
Agency	**Contact**	**Telephone**	**Address/Location**
Ambulance/EMS	FDNY	(929) 278-8891	998 Liberty Avenue, Brooklyn, NY 11208
Police	NYPD (75th Pct)	(718) 827-3511	1000 Sutter Avenue, Brooklyn, NY 11208
Fire	FDNY (Engine 236)	(929) 278-8891	998 Liberty Avenue, Brooklyn, NY 11208

Emergency Medical Facility

Brookdale Hospital Medical Center
1 Brookdale Plaza
Brooklyn, New York, 11212

Hospital Phone #: 718-240-5000

- Head west on Dinsmore Pl toward Richmond St
- Turn left onto Logan St
- Turn left after Wendy's (on the right)
- Keep right to continue on S Conduit Blvd W
- Turn right onto Euclid Ave
- Turn right onto Linden Blvd
- Use left 3 lanes to turn slightly left onto Gregory "Jocko" Jackson Blvd/Linden Blvd
- Slight right toward Linden Blvd
- Turn right onto Rockaway Pkwy

Hospital entrance will be on the right.

Urgent Care Facility

CityMD Bushwick
399 Knickerbocker Avenue
Brooklyn, New York 11237

Urgent Care Phone #: 718-647-1700

- Head east on Dinsmore Pl toward Chestnut St
- Turn left onto Chestnut St
- Turn right onto Jamaica Ave
- Turn left onto Cypress Ave
- Turn left onto Cooper Ave
- Turn right onto Knickerbocker Ave

Destination will be on the right.

1. Introduction

On behalf of Chestnut Commons Apartment, LLC., this site-specific Health and Safety Plan (HASP) has been prepared by Roux Environmental Engineering and Geology, D.P.C. (Roux) for use by personnel from Roux (and any of Roux subcontractors) during the Remedial Investigation and any on-site work thereafter that will be performed at Chestnut Commons Block 4142 Lot 34 (Site; see Figure 1). These activities fall within the scope of operations covered by the Occupational Safety and Health Administration (OSHA) standards promulgated at 29 CFR 1910.120 and 29 CFR 1926.65, both commonly referred to as the Hazardous Waste Operations and Emergency Response (HAZWOPER) Standard. In accordance with the HAZWOPER Standard, this site-specific HASP was prepared to address the safety and health hazards associated with the investigative sampling and drilling activities being performed at the Site by Roux and to provide requirements and procedures for the protection of Roux employees, subcontractor personnel, government oversight personnel, Site personnel, and the general public. It also addresses client- and Site-specific requirements for health and safety.

Implementation of this HASP is the joint responsibilities of the project manager, the site health and safety officer, and all field staff, with assistance from the project principal and the office health and safety manager. The project manager for this project is Jessica Taylor, based on the scope of work, the field oversight personnel will act as both the Site Health and Safety Officer (SHSO) as well as Site Supervisor. If necessary, an alternate SS/SHSO will be identified during the project as needed.

1.1 Roles and Responsibilities

Overall Roles and Responsibilities (R&Rs) of Roux personnel are provided in Roux's Policies and Procedures Manual. Only those R&Rs specific to HASP requirements are listed below.

Project Manager (PM)

The PM has responsibility and authority to direct all work operations. The PM coordinates safety and health functions with the SHSO, has the authority to oversee and monitor the performance of the SHSO, and bears ultimate responsibility for the proper implementation of this HASP. The specific duties of the PM are:

- coordinating the site work plan;
- providing site supervisor(s) with work assignments and overseeing their performance; Coordinating safety and health efforts with the SHSO;
- ensuring effective emergency response through coordination with the Emergency Response Coordinator (ERC);
- serving as primary site liaison with public agencies and officials and site contractors; and
- exercising "stop work authority" when an imminent hazard or potentially dangerous work practice is identified or discovered.

Site Health and Safety Officer (SHSO) / Site Supervisor (SS)

The SHSO/SS has full responsibility and authority to develop and implement this HASP and to verify compliance. The SHSO/SS reports to the PM. The SHSO/SS is on-site or readily accessible to the site during all work operations and has the authority to halt site work if unsafe conditions are detected. The specific responsibilities of the SHSO include:

- managing the safety and health functions on this site;

- executing the work plan and schedule as detailed by the PM;
- serving as the site's point of contact for safety and health matters;
- ensuring site monitoring, worker training, and effective selection and use of Personal Protective Equipment (PPE);
- assessing site conditions for unsafe acts and conditions and providing corrective action;
- assisting the preparation and review of this HASP;
- maintaining effective safety and health records as described in this HASP;
- exercising "stop work authority" when an imminent hazard or potentially dangerous work practice is identified or discovered;
- coordinating with the others as necessary for safety and health efforts; and
- acting on the recommendations of the Corporate Health & Safety Manager.

Site Workers (Subcontractors)

Site workers are responsible for complying with this HASP, using the proper PPE, reporting unsafe acts and conditions, and following the work, safety, and health instructions of the PM and SHSO/SS.

2. Background

The Site historically contained a portion of the Ridgewood Engine House as a coal-fired Water Pumping Station that was used by the Brooklyn Water Works. The Engine House was demolished in the 1960's and a playground was planned for the entirety of Block 4142; however, it never appears to have been built. Other Site uses include heavy equipment storage and auto repair/service/sales/towing. Relevant background information is provided below, including a general description of the Site; a brief review of the Site's history with respect to hazardous material use, handling, and/or storage; and a review of known and potential releases of hazardous substances at the Site.

2.1 Site Description

The Site consists of one parcel within the East New York section of Brooklyn. The Site is approximately 28,000 square feet and is bound by Dinsmore Place to the north, Chestnut Street to the east, and Atlantic Avenue to the south. Currently, the Site is vacant and contains no structures. Development in the surrounding area is zoned for mixed-use (residential, commercial, school, and community- oriented uses) development.

2.2 Site History

The Site contained a portion of the Ridgewood Engine House as a coal-fired Water Pumping Station that was used by the Brooklyn Water Works as early as 1860. Water entered the pump house in the center of the building through below-grade conduits following the path of present-day Conduit Boulevard, and was pumped 0.8 miles northwest to the Ridgewood Reservoir in Queens. More specifically, portions of an oil house and open-air coal shed for the pumping station was located on the Site. The location of these underground features does not appear to be included in the current Site footprint. The portion of the pumping station site that is within the Site footprint is noted as a coal storage area.

The Site was in use by the Brooklyn Water Works through the 1920s and was vacant until its demolition by the City in the late 1960s. A playground was planned for the entirety of Block 4142, however, based on aerial photographs, it appears not to have been built. Later Sanborn Fire Insurance maps indicate the Site was used for "Heavy Equipment Storage." The findings of the Final Environmental Impact Statement (FEIS) for the 2016 East New York Rezoning indicated that past uses at the Site included auto repair/service/sales/towing, which was not corroborated by our preliminary review of available documentation.

2.3 Known and Potential Releases of Hazardous Substances at the Site

Former buildings were demolished on the Site. There is potential for historic fill of unknown origin and buried structures from demolition activities at the Site. Previous investigations found the subsurface soils were impacted with polyaromatic hydrocarbons (PAHs) and metals associated with historic fill. Elevated concentrations of lead were identified in soil in the south-central portion of the Site. One groundwater sample contained trichloroethene (TCE) at concentrations above the New York State Department of Environmental Conservation (NYSDEC) groundwater standard.

The Site is listed in the NY Spills database as "Atlantic and Chestnut" (NYSDEC Spill Case No. 9209821). According to information provided in the database, the spill was reported due to the release of automobile

fluids on the Site, which was used as a junkyard. The spill was closed since there was no evidence of stressed vegetation at the Site.

3. Scope of Work

Based on information gathered as a result of previous ESAs and at the request of MHANY Management, Inc., the purpose of the Remedial Investigation Work Plan (RIWP) was to investigate current site conditions in preparation for redevelopment and associated remedial activities. The proposed RIWP scope of work included the following:

- ground penetrating radar survey;
- installation of soil borings via hollow stem auger and direct push Geoprobe drill rigs;
- installation and sampling of monitoring wells; and
- installation and sampling of soil vapor sampling points.

This scope was completed as of the date of updated HASP but will remain included in the HASP in case additional sampling is necessary in the future.

Additional work at the Site will occur as per the Interim Remedial Workplan (IRM) and Remedial Action Work Plan (RAWP) for the Site. The majority of work during these scopes will occur during the proposed development at the Site (mixed-use building with a cellar) and the associated subsurface work. Once development activities commence, Roux will provide excavation support services to assist with environmental items related to the excavation and construction. The proposed IRM and RAWP scopes of work include the following:

- Oversight of support or excavation (SOE) installation;
- Oversight of excavations and backfilling;
- Oversight of soil disposal via live-loading into trucks;
- Community Air Monitoring Program implementation; and
- Collection of post-excavation samples.

If there are any changes with the scope, a revision of the HASP will be required to address any new hazards.

4. Site Control

This site control program is designed to reduce the spread of hazardous substances from contaminated areas to clean areas, to identify and isolate contaminated areas of the site, to facilitate emergency evacuation and medical care, to prevent unauthorized entry to the site, and to deter vandalism and theft.

4.1 Site Map

A map of the Site, showing site boundaries, designated work zones, and points of entry and exit is provided in Figure 2.

4.2 Site Access

Access to the Site is restricted to reduce the potential for exposure to its safety and health hazards. During hours of site operation, site entry and exit is authorized only at the points identified in Figure 2. Access for all equipment will be through designated Site entries and exits yet to be established. Roux will maintain Site access throughout the work day and lock all entrances and exits at the end of the day.

4.3 Buddy System

While working in the Exclusion Zone, if any is established, site workers use the buddy system. The buddy system means that personnel work in pairs and stay in close visual contact to be able to observe one another and summon rapid assistance in case of an emergency. The responsibilities of workers using the buddy system include:

- Remaining in close visual contact with your partner;
- Providing your partner with assistance as needed or requested;
- Observing your partner for signs of heat stress or other difficulties;
- Periodically checking the integrity of your partner's PPE; and
- Notifying the site manager or other site personnel if emergency assistance is needed.

4.4 Site Communications

The following communication equipment is used to support on-site communication: visual hand signals will be used during use of the drill rig, and workers will have cell phones on-Site. Should multiple operations be occurring at the Site concurrently, radios shall be issued for communication, if determined to be necessary.

A current list of emergency contact numbers shall be posted at the worksite and provided to site workers as appropriate.

5. Job Hazard Evaluation

Roux work at the Site is expected to entail a variety of physical, chemical, and biological hazards, all of which must be sufficiently managed to allow the work to be performed safely. Some of the hazards are Site-specific (i.e. they are associated with the nature, physical characteristics, and/or routine operation of the Site itself) while others are activity-specific (i.e., they are associated with (or arise from) the particular activity being performed). The various hazards can be grouped into the following categories:

Caught/Crushed – the potential to become caught in, under, between, or by an object or parts of an object, such as equipment with parts that open and close or move up and down ("pinch points") or equipment that rotates, and the accompanying potential to have body parts cut, mangled, or crushed thereby.

Contact – the potential to be struck by or against moving or stationary objects that can cause physical injury, such as heavy machinery, overhead piping, moving vehicles, falling objects, and equipment (including tools and hand-held equipment) or infrastructure with the ability to cut or impale.

Energy Sources – the potential for bodily harm associated with energy sources, most notably electricity, but also including latent energy sources such as compressed air and equipment under tension (which when released could cause injurious contact or a fall).

Ergonomics – the potential for musculoskeletal injury associated with lifting/carrying, pushing/pulling, bending, reaching, and other physical activity attributable to poor body position/mechanics, repetitive motion, and/or vibration.

Exposure – the potential for injury/illness due to physical, chemical, or biological exposures in the work environment, including, but not limited to, temperature extremes, solar radiation, and noise (physical), chemical splashes and hazardous atmospheres (chemical), and animal/insect bites and poisonous plants (biological).

Falls – the potential to slip or trip and thus fall or drop a load, resulting in bodily injury to oneself or others.

The foregoing is intended to provide Roux employees, Client, and Subcontractors with a general awareness of the hazards involved with the Site work. A more detailed review of the potential hazards associated with each specific activity planned for the Site (or ongoing activity, as the case may be) is provided in the activity-specific Job Safety Analysis (JSA) forms in Appendix A. As can be seen in the JSA forms, the hazards are identified by category per the above, and specific measures designed to mitigate/manage those hazards are also identified. In preparing the JSA forms, all categories of hazards were considered, and all anticipated potential hazards were identified to the extent possible based on the experience of the personnel preparing and reviewing the JSA forms. However, there is always the possibility for an unanticipated hazard to arise, potentially as condition change over the course of the workday. Roux personnel must maintain a continual awareness of potential hazards in the work zone, regardless of whether the hazard is identified in the JSA form. Particular attention should be paid to hazards associated with exposure to hazardous substances (see Table 1 for a listing of the hazardous substances most likely to be encountered in environmental media at the Site) and to Site personnel being located "in the line of fire" with respect to moving equipment, pinch points, and latent energy (e.g., being located or having body parts located within the swing radius of an excavator, between two sections of pipe being connected, below a piece of suspended equipment, or adjacent to a compressed air line).

5.1 Employee Notification of Hazards and Overall Site Information Program

The information in the JSAs and safety data sheets is made available to all employees and subcontractors who could be affected by it prior to the time they begin their work activities. Modifications to JSAs are communicated during routine pre-work briefings. Safety data sheets (SDS) will be maintained by the SHSO/SS for chemicals brought onsite. Copies of SDSs can be found in Appendix B.

6. Emergency Response Plan

This emergency response plan details actions to be taken in the event of site emergencies. The PM and SHSO is responsible for the implementation of emergency response procedures on-Site. The SHSO/PM provides specific direction for emergency action based upon information available regarding the incident and response capabilities and initiates emergency procedures and notification of appropriate authorities. In the event of an emergency, site personnel are evacuated and do not participate in emergency response activities, response is facilitated through external emergency services.

6.1 Emergency Response

The SHSO, after investigating the incident and relevant information, shall determine the level of response required for containment, rescue, and medical care. Limited on-site emergency response activities could occur therefore the SHSO is responsible for notifying external emergency response agencies. The SHSO provides relevant information to the responding organizations, including but not limited to the hazards associated with the emergency incident, potential containment problems, and missing site personnel.

6.2 Emergency Alerting and Evacuation

If evacuation notice is given, site workers leave the worksite, if possible, by way of the nearest exit. Appropriate primary and alternate evacuation routes and assembly areas have been identified and are shown on the Emergency Muster Area Map (Figure 2). The routes and assembly area will be determined by conditions at the time of the evacuation based on wind direction, the location of the hazard source, and other factors as determined by SHSO/PM.

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

6.3 Emergency Medical Treatment and First Aid

In the event of a work-related injury or illness, employees are required to follow procedures outlined below. All work-place injury and illness situations require the Roux Project and Corporate Management Team to be notified when an injury / illness incident occurs, and communication with the contracted Occupational Health Care Management Provider, AllOne Health, is initiated. The Injury/Illness Notification Flowchart is provided below and within Roux's Incident Investigation and Reporting program included as Appendix C.

If onsite personnel require any medical treatment, the following steps will be taken:

a. Notify Roux Project and Corporate Management Team for any work-related injury and/or illness occurrence and communicate with the contracted Occupational Health Care Management Provider, AllOne Health, immediately following the notifications provided above.

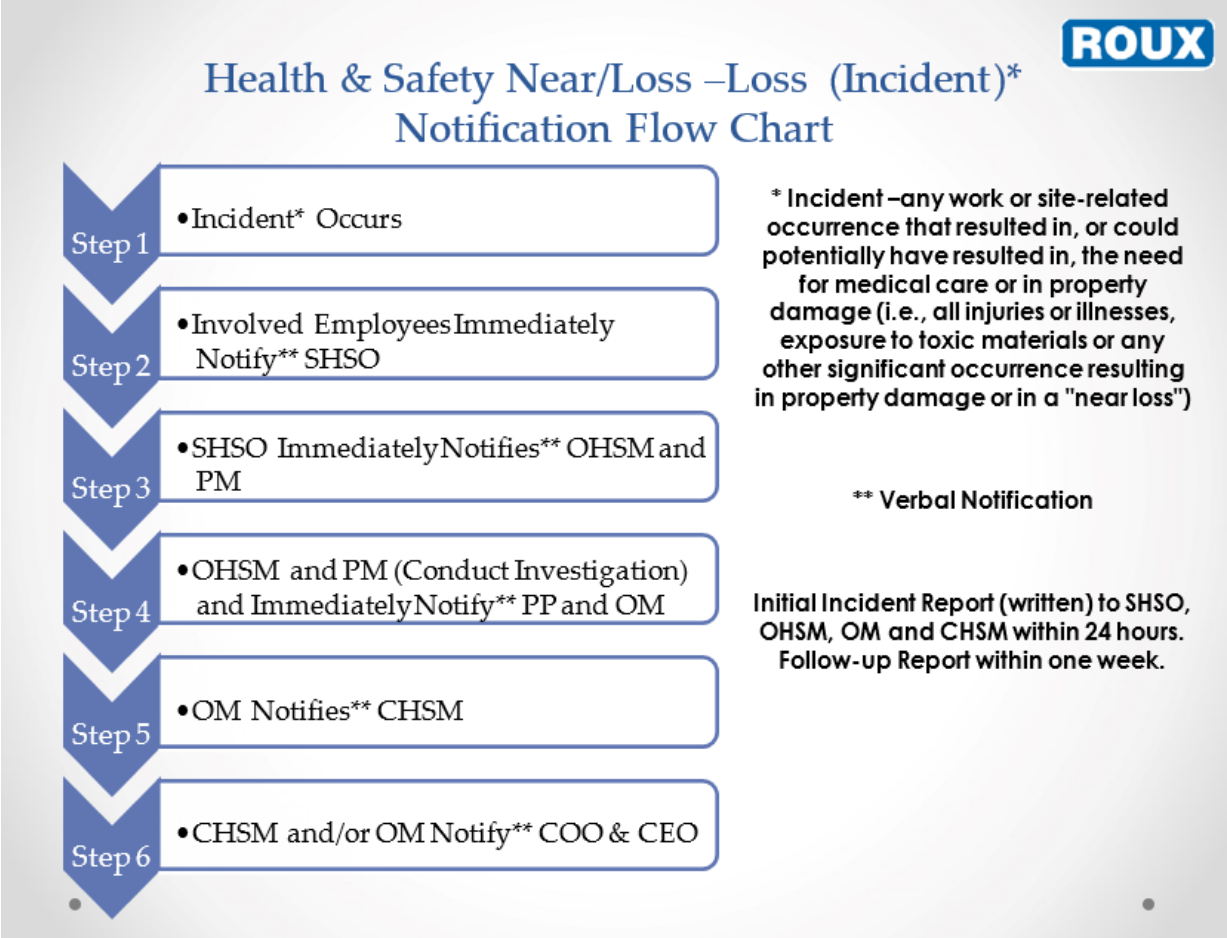
b. Based on discussions with the Project Team, Corporate Management, and the AOH evaluation, if medical attention beyond on-site First Aid is warranted, transport the injured / ill person (IP) to the Urgent Care Center, or notify the Fire Department or Ambulance Emergency service and request an ambulance or transport the victim to the hospital, and continue communications with Corporate

Management Team. A Hospital Route and Urgent Care Facility map with directions to Brookdale Hospital Medical Center and City MD, respectively, is included as Figure 3.

c. Decontaminate to the extent possible prior to administration of first aid or movement to medical or emergency facilities.

d. First aid medical support will be provided by onsite personnel trained and certified in First Aid, Cardio Pulmonary Resuscitation (CPR), Automatic External Defibrillation (AED), and Blood-Borne Pathogens (BBP) Awareness, until relieved by emergency medical services (EMS).

e. The SHSO and PM will perform a Loss Investigation (LI) and the Project Team will complete the final Loss Report. If a Roux employee is involved in a vehicular incident, the employee must also complete the ACORD® Automobile Loss Notice (included as Appendix D of this HASP).



6.4 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO or project principal 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.

- 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.

6.5 Electrical Storm Guidelines

In the event that lightning and/or thunder are observed while working outdoors, all outdoor activities shall stop and personnel shall seek proper shelter (e.g., substantial building, enclosed vehicle, etc.). Work shall not resume until the threat of lighting has subsided and no lightning or thunder has been observed for 30 minutes. If the possibility of lightning is forecast for the day, advise the on-Site personnel on the risks and proper procedure at the pre-work safety briefing. Continuously monitor for changing weather conditions and allow enough time to properly stop work if lightning is forecast.

7. Safety Procedures

This section of the HASP presents the specific safety procedures to be implemented during Roux activities at the Site in order to protect the health and safety of various on-site personnel. Minimum OSHA-mandated procedures are presented first, followed by client- and Site-specific procedures. Lastly, activity-specific procedures are discussed. These Site and activity-specific procedures supplement the general safety procedures included in Roux's Corporate Health and Safety Manual, which also must be followed in their entirely.

7.1 Training

At a minimum, Site personnel who will perform work in areas where there exists the potential for toxic exposure will be health and safety-trained prior to performing work on site per OSHA 29 CFR 1910.120(e) and 29 CFR 1926.65(e). More specifically, all Roux, subcontractor, and other personnel engaged in sampling and remedial activities at the Site and who are exposed or potentially exposed to hazardous substances, health hazards, or safety hazards must have received at a minimum the 40-hour initial HAZWOPER training consistent with the requirements of 29CFR 1910.120(e)(3)(i) training and a minimum of 3 days' actual field experience under the direct supervision of a trained experienced supervisor, plus 8 hours of refresher training on an annual basis. Depending on tasks performed, less training may be permitted. Evidence of such training must be maintained at the Site at all times. Furthermore, all on-site management and supervisory personnel directly responsible for or who supervise the employees engaged in Site remedial operations, must have received an additional 8 hours of specialized training at the time of job assignment on topics including, but not limited to, the employer's safety and health program and the associated employee training program, personal protective equipment program, spill containment program, and health hazard monitoring procedure and techniques, plus 8 hours of refresher training on an annual basis.

Roux personnel training records are maintained in a corporate database with records available upon request from either the OHSM/SHSO/Corporate Health and Safety Manager (CHSM) or Human Resources Department. Subcontractors on-Site will be required to maintain and provide training records to Roux. These records shall be maintained with the SHSO onsite.

7.2 Site-Specific Safety Briefings for Visitors

A site-specific briefing is provided to all site visitors who enter this site beyond the site entry point. For visitors, the site-specific briefing provides information about site hazards, the site lay-out including work zones and places of refuge, the emergency alarm system and emergency evacuation procedures, and other pertinent safety and health requirements as appropriate.

7.3 HASP Information and Site-Specific Briefings for Workers

Site personnel review this HASP and are provided in a site-specific tailgate briefing prior to the commencement of work to ensure that employees are familiar with this HASP and the information and requirements it contains as well as relevant JSAs. Additional briefings are provided as necessary to notify employees of any changes to this HASP as a result of information gathered during ongoing site characterization and analysis. Conditions for which we schedule additional briefings include but are not limited to: changes in site conditions, changes in the work schedule/plan, newly discovered hazards, and incidents occurring during site work.

7.4 Medical Surveillance

The medical surveillance section of the Health and Safety Plan describes how worker health status is monitored at this site. Medical surveillance is used when there is the potential for worker exposure to hazardous substances at levels above OSHA permissible exposure limits or other published limits. The purpose of a medical surveillance program is to medically monitor worker health to ensure personnel are not adversely affected by site hazards. The provisions for medical surveillance at this site are based on the site characterization and job hazard analysis found in Section 4 of this HASP and are consistent with OSHA requirements in 29 CFR 1910.120(f).

7.4.1 Site Medical Surveillance Program

Medical surveillance requirements are based on a worker's potential for exposure as determined by the site characterization and job hazard analysis documented in Section 4 and JSAs within Appendix A of this HASP and in compliance with the requirements of 29 CFR 1910.120(f)(2). Based on site information and use of direct reading instruments, limited use of respirators (less than 30 days per year), and the absence of an employee-staffed HAZMAT team, a limited medical surveillance program is required and implemented at this site. The medical surveillance program provides that:

1. Workers assigned to tasks requiring the use of respirators receive medical examinations in accordance with 29 CFR 1910.134(e) to ensure they are physically capable to perform the work and use the equipment, and
2. If a worker is injured, becomes ill, or develops signs or symptoms of possible over-exposure to hazardous substance or health hazards, medical examinations are provided to that worker as soon as possible after the occurrence and as required by the attending physician.
3. These medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided to workers free of cost, without loss of pay, and at a reasonable time and place. In addition, the need to implement a more comprehensive medical surveillance program will be re-evaluated after any apparent over-exposure.

7.4.2 Medical Recordkeeping Procedures

Medical recordkeeping procedures are consistent with the requirements of 29 CFR 1910.1020 and are described in the company's overall safety and health program. A copy of that program is available at our Islandia, New York office.

The following items are maintained in worker medical records:

- Respirator fit test and selection
- Physician's medical opinion of fitness for duty (pre-placement, periodic, termination)
- Physician's medical opinion of fitness for respirator protection (pre-placement, periodic)
- Exposure monitoring results

7.4.3 Program Review

The medical program is reviewed to ensure its effectiveness. The CHSM in coordination with the Human Resources Director is responsible for this review. At minimum, this review consists of:

- Review of accident and injury records and medical records to determine whether the causes of accidents and illness were promptly investigated and whether corrective measures were taken wherever possible,

- Evaluation of the appropriateness of required medical tests based on site exposures,
- Review of emergency treatment procedures and emergency contacts list to ensure they were site-specific, effective, and current.

7.5 Personnel Protection

Site safety and health hazards are eliminated or reduced to the greatest extent possible through engineering controls and work practices. Where hazards are still present, a combination of engineering controls, work practices, and PPE are used to protect employees. Appropriate PPE shall be worn by Site personnel when there is a potential exposure to chemical hazards or physical hazards (e.g., falling objects, flying particles, sharp edges, electricity, and noise), as determined by the SHSO. The level of personal protection, type and kind of equipment selected will depend on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors will be made before work can be safely executed.

Roux maintains a comprehensive written PPE program that addresses proper PPE selection, use, maintenance, storage, fit and inspection. PPE to be used at the Site will meet the appropriate American National Standards Institute (ANSI) standards and the following OSHA (General Industry) standards for minimum PPE requirements. This program can be found in Appendix E.

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

- Work uniform (long pants, sleeved shirt)
- Hard hat
- Steel or composite toe work boots
- Safety Glasses (must comply with one of the following ANSI/ISEA Z87.1-2010, ANSI Z87.1-2003, ANSI Z87.1-2003)
- Boot Covers (as needed)
- Hearing Protection (as needed)
- High visibility clothing (shirt/vest)
- Hand Protection (e.g., minimum cut resistance meeting ANSI 105-2000 Level 2)

Note that jewelry shall be removed or appropriately secured to prevent it from becoming caught in rotating equipment or unexpectedly snagged on a fixed object. (e.g., wrist watches, bracelets, rings, chains, and necklaces, open earrings). Do not wear loose clothing and all shoulder length or longer hair should be tied back.

Site specific PPE ensembles and materials are identified within task specific JSAs located within Appendix A. Levels of protection will be upgraded or downgraded in response to site conditions. Upgrades to PPE can include use of hearing protection whenever noise levels exceed 85dBA, nitrile gloves worn whenever skin hazards exist or when handling samples, and whenever total organic vapors exceed levels specified elsewhere in this plan, respiratory protection is necessary. Although not expected, Level C would involve an APR Cartridge classified as Organic Vapors and P-100 cartridge. Any upgrades or downgrades of the level of protection (i.e. not specified in the JSA) must be immediately communicated to all Roux personnel and subcontractors as applicable. PPE is used in accordance with manufacturer's recommendations. Additional information can be found within Roux's Personal Protective Equipment Corporate Management Program and Respiratory Protection Corporate Management Program found in Appendix E and Appendix F, respectively.

Intrusive activities (e.g., drilling, excavation activities, etc.) include any Site activity which will, or potentially will, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen deficient atmospheres. Prior to commencing with any field activity, the potential for such conditions should be evaluated to determine air monitoring requirements. General procedures for air monitoring are described below. During intrusive activities, continuous monitoring may be performed using various meters outlined in Section 7.6 Monitoring.

7.6 Monitoring

An air monitoring program is important to the safety of on- and off-Site personnel. A preliminary survey, to establish background conditions in the immediate sampling area, may be made prior to the initiation of Site work including, but not limited to, monitoring wind direction and approximate temperature during all invasive site activities. This survey will be conducted with the appropriate air monitoring instrument(s) as warranted by the field activity. Once this survey has been complete, any change in the type of PPE will be determined.

Air monitoring will be performed to verify the proper level of equipment is used and to determine if increased PPE or work stoppage is required. The following equipment may be used to monitor conditions:

- A Photoionization Detector (PID) with a lamp energy of 10.6 eV will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate. Concentrations shall be recorded during intrusive activities with the potential to encounter contaminant vapors.
- In accordance with the DER-10 Technical Guidance for Site Investigation and Remediation dated May 2010 (DER-10) issued by the New York State Department of Environmental Conservation (NYSDEC), a community air monitoring plan (CAMP) will be implemented during intrusive Site activities. The Generic CAMP, as provided in DER-10 Appendix 1A, is included in Appendix G of this HASP and includes action levels.

Monitoring equipment will be calibrated in accordance with applicable regulatory requirements and manufacturer specifications.

Below are monitoring action levels for Site-specific chemicals of concern. In the event that PID readings above the thresholds identified below are sustained for 5 minutes in the breathing zone, worker protection will require upgrading following notification to the OHSM and applicable parties (e.g., client, board of health, regulators, etc.).

PID Action Levels

Site Action Levels	
PID Reading in Breathing Zone (ppm)	**Action**
<5	No Action
≥5 - <25	Level C
≥25	Cease Field Operations

If PID measurements exceed 25 ppm above background for five minutes in the breathing zone, work activities will cease until airborne vapor levels can be reduced to less than 25 ppm and are quantified or the SHSO determines alternate methods to be followed in order to proceed.

7.7 Tailgate Safety Meetings

A designated Site worker will provide daily safety briefings (e.g., tailgate meetings) including, but not limited to, the following scenarios:

- When new operations are to be conducted;
- Whenever changes in work practices must be implemented; and
- When new conditions are identified and/or information becomes available.

Daily safety briefings shall be recorded on the Roux Daily Tailgate Health and Safety Meeting Log/Daily Site Safety Checklist, and all completed forms will become a part of the project file. The Safety Meeting Log is provided in Appendix H of this HASP.

7.8 Spill Containment

Spill containment equipment and procedures should, at a minimum, meet the requirements of the facility's Spill Prevention, Control, and Countermeasure Plan, if applicable. Otherwise, spill containment equipment and procedures must be considered depending on the task including, but no limited to, chemical/product transfer points and handling.

7.8.1 Initial Spill Notification and Response

Any worker who discovers a hazardous substance spill will immediately notify the SHSO/SS. The worker will, to his/her best ability, report the hazardous substance involved, the location of the spill, the estimated quantity of material spilled, the direction/flow of the spill material, related fire/explosion incidents, and any associated injuries without compromising their own safety.

7.8.2 Spill Evaluation and Response

In coordination with the SHSO/SS, the PM (Jessica Taylor) is responsible for evaluating spills and determining the appropriate response. When this evaluation is being made, the spill area will be isolated and demarcated to the extent possible. If necessary to protect nearby community members, notification of the appropriate authorities is made by the PM as appropriate. On-site response is limited to small spills (e.g., <10 gallons), large spills require external emergency responders who will be contacted by the SHSO.

7.9 Decontamination

The decontamination section of the HASP describes how personnel and equipment are decontaminated when they leave the Exclusion Zone. This section also describes how residual waste from decontamination processes is disposed. The site decontamination procedures are designed to achieve an orderly, controlled removal or neutralization of contaminants that may accumulate on personnel or equipment. These procedures minimize worker contact with contaminants and protect against the transfer of contaminants to clean areas of the site and off-site. They also extend the useful life of PPE by reducing the amount of time that contaminants contact and can permeate PPE surfaces. Decontamination is facilitated within the contamination reduction zone at this site.

7.9.1 Decontamination Procedures for Personnel and PPE

The following are general decontamination procedures established and implemented at this site:

- Decontamination is required for all workers exiting a contaminated area. Personnel may re-enter the Support Zone only after undergoing the decontamination procedures described below in the next section.
- Protective clothing is decontaminated, cleaned, laundered, maintained, and/or replaced as needed to ensure its effectiveness.
- PPE used at this site that requires maintenance or parts replacement is decontaminated prior to repairs or
- PPE used at this site is decontaminated or prepared for disposal on the premises. Personnel who handle contaminated equipment have been trained in the proper means to do so to avoid hazardous exposure.
- This site uses an off-site laundry for decontamination of PPE. The site has informed that facility of the hazards associated with contaminated PPE from this site.
- The site requires and trains workers that if their permeable clothing is splashed or becomes wetted with a hazardous substance, they will immediately exit the work zone, perform applicable decontamination procedures, shower, and change into uncontaminated clothing.
- Procedures for disposal of decontamination waste meet applicable local, State, and Federal regulations.

7.9.2 Decontamination Procedures for Equipment

All tools, equipment, and machinery from the Exclusion Zone or CRZ are decontaminated in the CRZ prior to removal to the Support Zone. Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure and to avoid cross-contamination and chemical incompatibilities.

General Equipment Decontamination Procedures that may apply:

1. Decontamination is required for all equipment exiting a contaminated area. Equipment may re-enter the Support Zone only after undergoing the equipment decontamination procedures.
2. Vehicles that travel regularly between the contaminated and clean areas of the site are carefully decontaminated each time they exit the Exclusion Zone and the effectiveness of that decontamination is monitored to reduce the likelihood that contamination will be spread to other parts of the site.
3. Particular attention is given to decontaminating tires, scoops, and other parts of heavy equipment that are directly exposed to contaminants and contaminated soil.

The following items may be used to decontaminate equipment:

- Fresh water rinse;
- Non-phosphorus detergent wash;
- Distilled water rinse;
- Acetone rinse;
- Distilled water rinse; and
- A steam cleaner or pressure washer (heavy equipment only)

7.9.3 Monitoring the Effectiveness of Decontamination Procedures

Visual examination and sampling are used to evaluate the effectiveness of decontamination procedures. Visual examination is used to ensure that procedures are implemented as described and that they appear to control the spread of contaminants under changing site conditions. Visual examination is also used to inspect for signs of residual contamination or for contaminant permeation of PPE.

Personnel who work in contaminated areas of the site, either the Contamination Reduction Zone (CRZ) or the Exclusion Zone, are trained in the principles and practices of decontamination described in this section of the HASP and in related SOPs. If site procedures are changed as a result of inspection and monitoring, all affected employees are notified of these changes.

7.10 Confined Space Entry

For the purpose of this project, all confined spaces are considered permit required and will not be performed by Roux personnel or any personnel within Roux's oversight. Confined space means a space with the following characteristics:

- large enough and so configured that an employee can barely enter and perform assigned work;
- limited or restricted means of entry and exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits); and
- not designed for continuous employee occupancy.

7.11 Client and Site-Specific

In addition to the OSHA-specific procedures discussed above, there may be client and site-specific safety procedures that must be adhered to during the performance of remedial activities at the Site.

7.12 Unusual or Significant Risks

Field activities that appear to have unusual or significant risks that cannot be adequately managed with existing risk tools such as HASPs, traffic safety plans, work permits, design and O&M practices, equipment HAZOPS or other safety tools must be referred to the CHSM to help with the assessment and management of the associated potential safety risks. Examples include the use of explosives for demolition, use of firearms to control wildlife, rappelling, demolition over water, etc.

7.13 Activity-Specific

In addition to the general hazards discussed above, there are activity-specific hazards associated with each work activity planned for the Site. An activity-specific JSA has been completed for each of the activities planned for the Site. JSAs are provided in Appendix A. In the event that new work activities or tasks are planned, JSAs will be developed and implemented prior to performing the new activities. In the absence of a JSA, the personnel performing work must prepare a field JSA and receive clearance from a designated competent safety official prior to performing any task with significant risk. In emergency situations where time is critical SPSAs will be utilized to identify the task, associated hazards and mitigative actions to take. For lower risk activities (as deemed by the discretion of a Competent Person) where a JSA is determined to not be needed, the individual(s) conducting the activities must perform SPSAs prior to and during the work.

As the proposed site development commences and construction oversight tasks begin, Roux personnel will likely to be exposed to heavy equipment while onsite. Roux personnel should always establish a minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). There should be no personnel or equipment entering the established Exclusion Zones while heavy equipment is in operating to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment. Additional information about Exclusion Zones is included Roux's Heavy Equipment Exclusion Zone Management Program in Appendix I.

8. Field Team Review

Each person performing work at or visiting this site shall sign this section after site-specific training is completed and before being permitted to access the Exclusion Zone.

I have read and understand this Site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site/Project: Chestnut Commons

Name Printed	Signature	Date

TABLE

1. Toxicological Properties of Hazardous Substances Present at the Site

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at MHANY Chestnut Commons, Brooklyn, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
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
Acenaphthylene	208-96-8	None Established	None established	None established	None established	inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory system	Eyes, skin, respiratory system	Yellow Solid Fl. Pt.=251°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
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, digestive 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 ST 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 [skin cancer]	None established	None established	None established	Inhalation; ingestion; skin absorption; skin and/or eye contact	Irritation eyes, skin, respiratory system, CNS; skin cancer	Skin	Pale Yellow crystal, solid BP: 438 C
Benzo[a]pyrene	50-32-8	None established [cancer]	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 fetus. 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 [cancer]	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
Benzo(g,h,i)perylene	191-24-2	None established	None established	California permisible exposure limits for chemical contaminants (Title 8, Article 107) PEL 0.2 mg/m3	None established	inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin, respiratory tract, very toxic to aquatic life with long lasting effects	Eyes, skin, respiratory system	Pale Yellow -Green Crystals BP: 550°C
Beryllium	7440-41-7 (metal)	TWA 0.00005 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
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
Carbon Tetrachloride	56-23-5	TWA 5 ppm STEL 10 ppm	Ca ST 2 ppm (12.6 mg/m3) [60 minute]	TWA 10 ppm C 25 ppm 200 ppm (5-minute maximum peak in any 4 hours)	Ca [200 ppm]	inhalation, skin absorbtion, ingestion, skin and/or eye contact	irritation eyes, skin; central nervous system depression; nausea, vomiting; liver, kidney injury; drowsiness, dizziness, incoordination; [potential occupational carcinogen]	central nervous system, eyes, lungs, liver, kidneys, skin	Colorless liquid with a characteristic ether-like odor. BP: 170°F
Carbon Monoxide	630-08-0	TWA 25 ppm	TWA 35 ppm C 200 ppm	TWA 50 ppm	1,200 ppm	inhalation	Carboxyhemogloemia	Blood	Colorless, odorless gas

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at MHANY Chestnut Commons, Brooklyn, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Chromium	7440-47-3	TWA 0.5 mg/m^3 (metal and Cr III compounds) TWA 0.05 mg/m^3 (water-soluble Cr VI 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
Coal Tar Pitch Volatiles; Chrysene; Phenanthrene; Pyrene	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
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%
1,2-Dichloroethane (Ethylene Dichloride)	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
1,2-Dichloroethene (total)	540-59-0	TWA 200 ppm	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
cis-1,2-Dichloroethene	156-59-2	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 %
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%
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
Dibenzofuran	132-64-9								
Diesel Fuel #2	68476-34-6	TWA 100 mg/m^3; Skin notation	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 20 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.

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at MHANY Chestnut Commons, Brooklyn, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Fuel Oil #2	68476-30-2	TWA 100 mg/m3; Skin notation	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% Class 1B Flammable Liquid
Hydrogen Sulfide	7783-06-4	TWA 1 ppm STEL 5 ppm	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; impairment of blood forming tissue	Skin	Fluorescent green-yellow crystalline solid BP: 536 C
Lead (inorganic)	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
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
Methylene Chloride (Dichloromethane)	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%
Naphtha (Rubber Solvent)	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
Naphthalene	91-20-3	TWA 10 ppm [skin]	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%
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
Polychlorinated Biphenyls (PCBs) (Chlorodiphenyl (42% Chlorine))	53469-21-9	TWA 1 mg/m^3	Ca TWA 0.001 mg/m^3	0.5 mg/m^3	5 ppm	Dermal; inhalation; ingestion; skin and/or eye contact	Irritation eyes; chloracne; liver damage; reproductive effects; [potential occupational carcinogen]	Eyes, skin, liver, respiratory system	Colorless to light-colored, viscous liquid, hydrocarbon odor, BP: 617 - 734°F, non-flammable, LEL: NA, UEL: NA
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

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at MHANY Chestnut Commons, Brooklyn, New York

Compound	CAS #	ACGIH TLV	NIOSH REL	OSHA PEL	IDLH	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Silver	7440-22-4 (metal)	TWA 0.1 mg/m^3 (metal, dust, fume) 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
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm 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
1,1,1-Trichloroethane (Methyl Chloroform)	71-55-6	TWA 350 ppm STEL 450 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; liver damage	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%
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 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% Class C Flammable Liquid
Zinc Oxide	1314-13-2	TWA 2 mg/m3 STEL 10 mg/m^3	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

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Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
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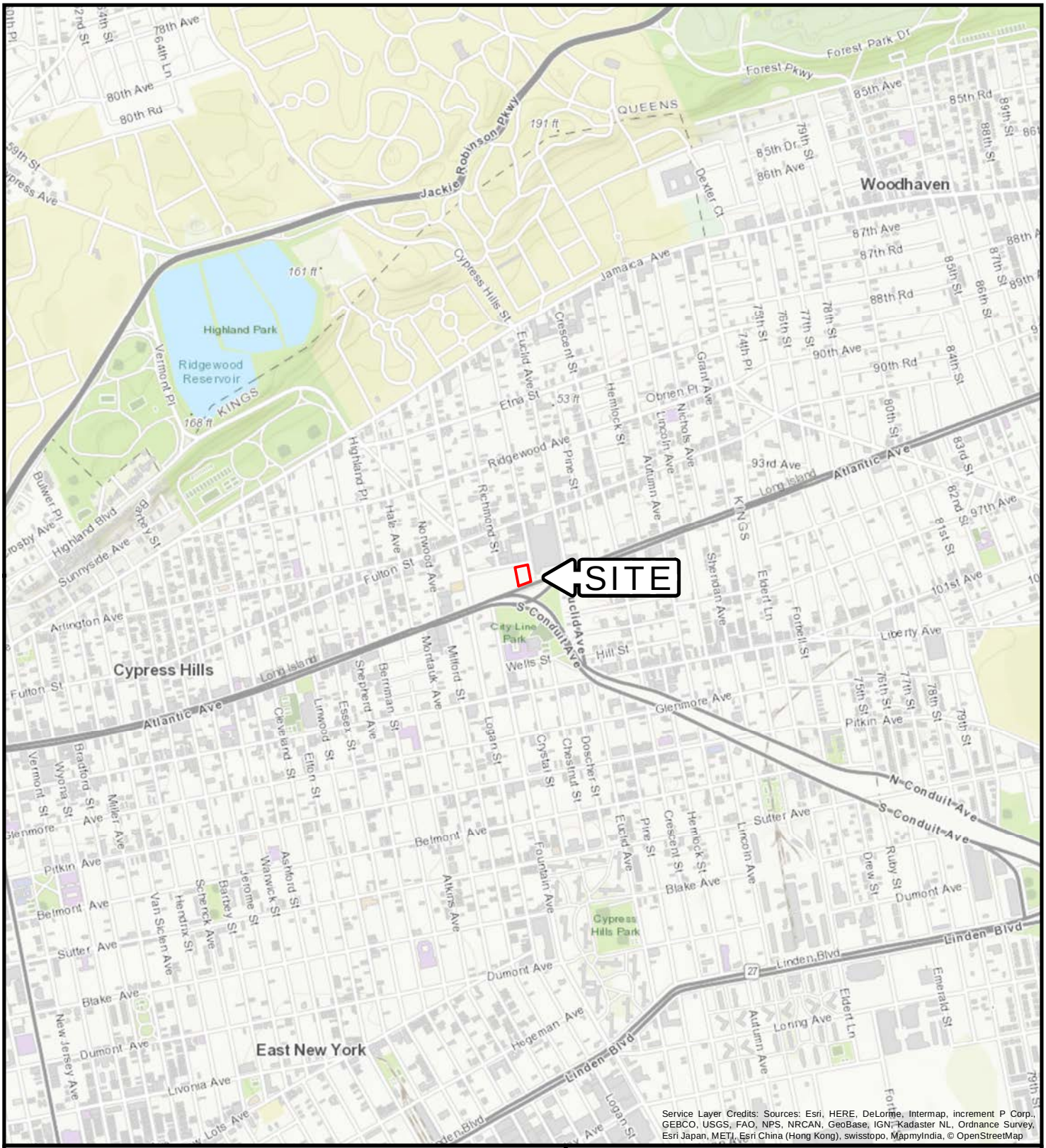
2017 TLVs® and BEIs®, American Conference of Industrial Hygienists

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.
CAS# - Chemical Abstracts Service registry number which is unique for each chemical.
Ft 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
SG - Specific Gravity
STEL – Short-term exposure limit (ST)
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)
VP - Vapor Pressure

FIGURES

1. Site Location Map
2. Site Plan
3. Route to Hospital and Urgent Care Facility


SITE
Woodhaven
Cypress Hills
East New York
QUEENS
KINGS
Highland Park
Ridgewood Reservoir
Cypress Hills Park
City Line Park
Jackie Robinson Pkwy
Atlantic Ave
Long Island
Linden Blvd
Pitkin Ave
Fulton St
Liberty Ave
Glenmore Ave
Sutter Ave
Belmont Ave
Dumont Ave
Blake Ave
Jamaica Ave
Forest Pkwy
Forest Park Dr
Cypress Hills St
Ridgewood Ave
Fulton St
Hill St
Wells St
Etna St
Highland Blvd
Sunnyside Ave
Arlington Ave
Vermont Pl
Bulwer Pl
Crosby Ave
Dexter Ct
Grant Ave
Obrien Pl
Nichols Ave
Lincoln Ave
Autumn Ave
Hemlock St
Crescent St
Euclid Ave
Pine St
Fountain Ave
Atkins Ave
Schenck Ave
Barbey St
Jerome St
Warwick St
Ashford St
Van Sicklen Ave
Hendrix St
New Jersey Ave
Livonia Ave
Hegeman Ave
Loring Ave
Eldert Ln
Sheridan Ave
Forbell St
Emerald St
Drew St
Ruby St
Dumont Ave
Blake Ave
Chestnut St
Crystal St
Logan St
Mountain Ave
Milford St
Norwood Ave
Richmond St
Hale Ave
Highland Pl
Shepherd Ave
Berriman St
Linwood St
Elton St
Cleveland St
Essex St
Bradford St
Wyona St
Miller Ave
Vermont St
Glenmore Ave
Pitkin Ave
Belmont Ave
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Warwick St
Ashford St
Van Sicklen Ave
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New Jersey Ave
Livonia Ave
Lots Ave
Linden Blvd
Pitkin Ave
Glenmore Ave
Sutter Ave
Belmont Ave
Dumont Ave
Blake Ave
Linden Blvd
Atlantic Ave
Fulton St
Liberty Ave
Glenmore Ave
Pitkin

LEGEND

- DRILLED SOILDER PILE
- DRIVEN SOILDER PILE

N

30 0 30'

Title:

SUPPORT OF EXCAVATION PLAN

CHESTNUT COMMONS ATLANTIC AVE SITE
BLOCK 4142, LOT 34, BROOKLYN, NY
NYSDEC BCP SITE C224276

Prepared for:

CHESTNUT COMMONS APARTMENTS LLC

ROUX

Compiled by: L.C.	Date: 05/06/19
Prepared by: M.S.R.	Scale: AS SHOWN
Project Mgr: J.T.	Project: 3002.0004Y000
File: 3002.0004Y112.2.mxd	

FIGURE 2

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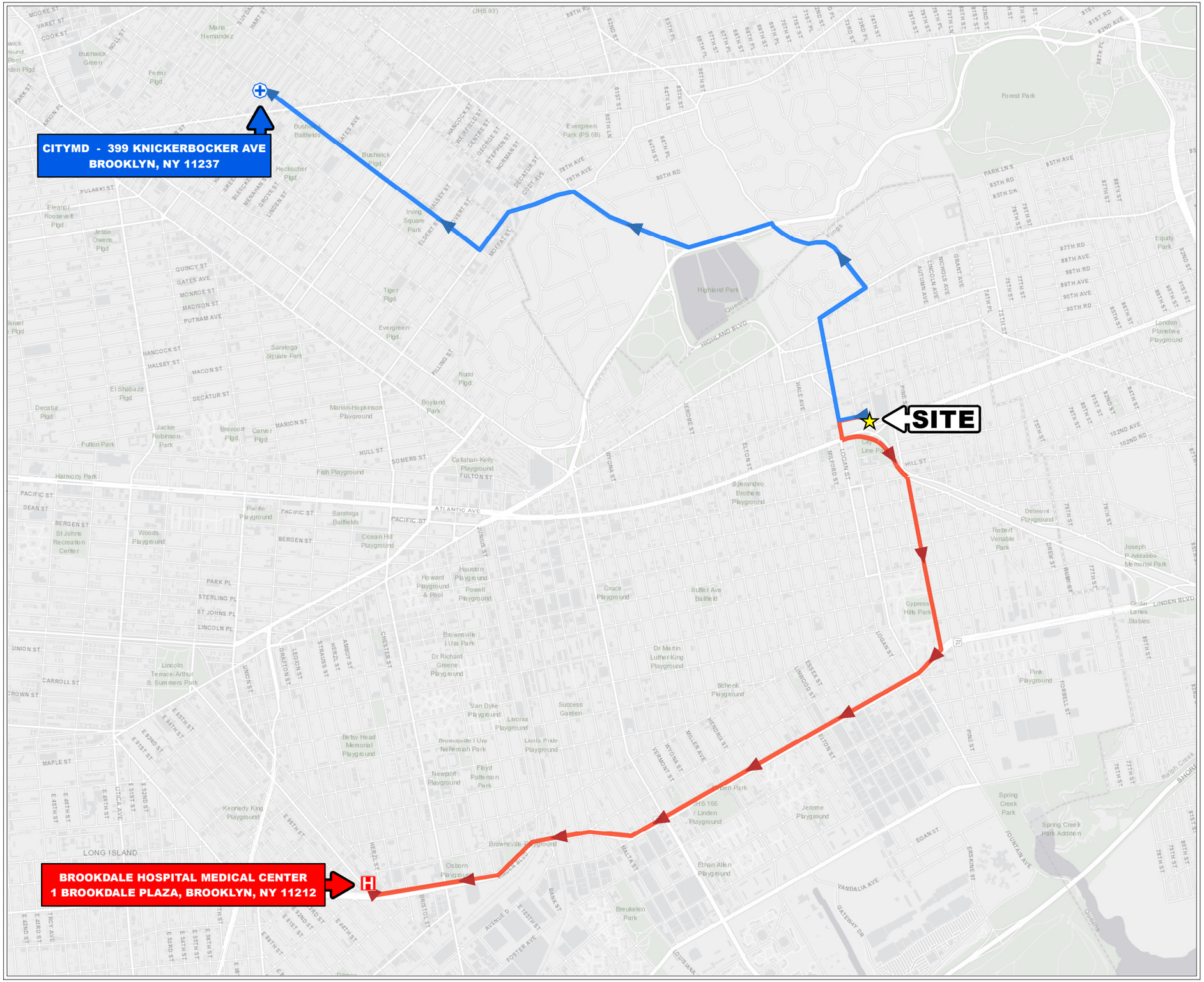

DIRECTIONS TO HOSPITAL

1. HEAD WEST ON DINSMORE PL TOWARD RICHMOND ST
   TAKE S CONDUIT BLVD W TO EUCLID AVE
2. TURN RIGHT ONTO EUCLID AVE
3. FOLLOW LINDEN BLVD AND AMBOY ST TO HEGEMAN
4. AVE
   TURN LEFT AT THE 1ST CROSS STREET ONTO
5. HEGEMAN AVE
6. TURN LEFT ONTO E 98TH ST/BROOKDALE PLAZA

DIRECTIONS TO CITYMD

1. HEAD WEST ON ATLANTIC AVE TOWARD CONDUIT BLVD N
2. CONTINUE ON HALE AVE TO HIGHLAND BLVD
3. TAKE VERMONT PL AND COOPER AVE TO KNICKERBOCKER AVE
4. TURN RIGHT ONTO KNICKERBOCKER AVE

1,400 0 1,400 Feet

Title:

HOSPITAL AND URGENT CARE ROUTE MAP

CHESTNUT COMMONS
BLOCK 4142, LOT 34, BROOKLYN, NY

Prepared For: MHANY MANAGEMENT, INC
URBAN BUILDERS COLLABORATIVE

ROUX

Compiled by: R.M.	Date: 11OCT18	FIGURE 1
Prepared by: M.S.R.	Scale: AS SHOWN	
Project Mgr: J.T.	Project: 3002.0004Y000	
File: 3002.0004Y105.1.mxd		

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APPENDICES

A. Job Safety Analysis (JSA) Forms
B. SDSs for Chemicals Used
C. Incident Investigation and Reporting Management Program
D. ACORD® Automobile Loss Notice Form
E. Personal Protective Equipment Management Program
F. Respiratory Protection Management Program
G. Generic Community Air Monitoring Plan (CAMP)
H. Health and Safety Briefing/Daily Meeting Log
I. Heavy Equipment Exclusion Zone Management Program

APPENDIX A

Job Safety Analysis (JSA) Forms

JOB SAFETY ANALYSIS	Cntrl. No.	DATE:	☒ NEW ☐ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY **GENERIC**	WORK TYPE	WORK ACTIVITY (Description)	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☐ GLOVES:
☐ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER
☐ LIFELINE / BODY HARNESS	☐ HEARING PROTECTION	☐ PPE CLOTHING:	
☐ SAFETY GLASSES	☐ SAFETY SHOES		

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 _ foot exclusion zone will be maintained around (indicate equipment).

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. [INSERT JOB STEP]	**1a. CONTACT:** [INSERT HAZARD]	1a.
	1b. CAUGHT: [INSERT HAZARD]	1b.
	1c. FALL: [INSERT HAZARD]	1c.
	1d. EXPOSURE: [INSERT HAZARD]	1d.
	1e. EXERTION: [INSERT HAZARD]	1e.
	1f. ENERGY SOURCE: [INSERT HAZARD]	1f.
2. [INSERT JOB STEP]	**2a. CONTACT:** [INSERT HAZARD]	2a.
	2b. CAUGHT: [INSERT HAZARD]	2b.

[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.

[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."

	2c. FALL: [INSERT HAZARD]	2c.
	2d. EXPOSURE: [INSERT HAZARD]	2d.
	2e. EXERTION: [INSERT HAZARD]	2e.
	2f. ENERGY SOURCE: [INSERT HAZARD]	2f.

[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.

[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".

JOB SAFETY ANALYSIS	Ctrl. No. GEN-006	DATE 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE:	WORK ACTIVITY (Description):	
Generic	**Drilling**	**Direct Push Soil Borings / Well Installation**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
Timothy Zei	Project Hydrogeologist	Raymond Olson	Staff Assistant Geologist
		Christine Pietrzyk	Office Health & Safety Manager
		Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health & Safety Manager

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: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing, Long Sleeve Shirt	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect Repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Geoprobe or Truck-Mounted Direct Push Drill Rig, Hand Tools, Photoionization Detector, Multi-Gas Meter (or equivalent), Macrocore liners, Liner Opening Tool, 20 lb. Type ABC Fire Extinguisher, 42" Cones & Flags, "Work Area" Signs, Water

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ) – All non-essential personnel will maintain a distance of 10 feet from drilling equipment while equipment is moving/engaged

"SHOW ME YOUR HANDS"
Driller and helper should show that hands are clear from controls and moving parts

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Mobilization of drilling rig (ensure the Subsurface Clearance Protocol and Drill Rig Checklist are completed)	**1a. CONTACT:** Equipment/property damage.	1a. The drill rig's tower/derrick will be lowered and secured prior to mobilization. 1a. A spotter should be utilized while moving the drill rig. If personnel move into the path of the drill rig, the drill rig will be stopped until the path is again clear. Use a spotter for all required backing operations. 1a. Set-up the work area and position equipment in a manner that eliminates or reduces the need for backing of support trucks and trailers. 1a. 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. 1a. Inspect the driving path for uneven terrain. Level or avoid if needed. 1a. Drill rig should have a minimum **exclusion zone of 10 feet** for non-essential personnel (i.e., driller helper, geologist) when the rig is moving/ in operation.
	1b. FALL: Slip/trip/fall hazards.	1b. Inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 1b. Do not climb over stored materials/equipment; walk around. Practice good housekeeping. 1b. Use established pathways and walk on stable, secure ground.
	1c. CONTACT: Crushing from roll-over.	1c Geoprobe should cross all hills/obstructions head on with the mast down to reduce risk of roll-over.
2. Raising tower/derrick of drill rig	**2a. CONTACT:** Overhead hazards.	2a. Prior to raising the tower/derrick, the area above the drilling rig will be inspected for wires, tree limbs, piping, or other structures, that could come in contact with the rig's tower and/or drilling rods or tools. 2a. Maintain a safe distance of 10' from overhead structures.
	2b. CONTACT: Pinch Points/Amputation Points when raising the rig and instability of rig	2b. Inspect the equipment prior to use and avoid pinch/amputation points. 2b. Lower outriggers to ensure stability prior to raising rig tower/derrick. 2b. If the rig needs to be mounted, be sure to use three points of contact.
3. Advancement of drilling equipment and well installation	**3a. CONTACT:** Flying debris	3a. Be aware of and avoid potential lines of fire and wear required PPE such as eye, ear, and hand protection.
	3b. EXPOSURE: Noise and dust.	3b. Wet borehole area with sprayer to minimize dust. 3b. Stand upwind and keep body away from rig. 3b. Dust mask should be worn if conditions warrant. 3b. Wear hearing protection when the drill rig is in operation.

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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
3. Advancement of drilling equipment and well installation (Continued)	**3a. CONTACT:** Flying debris	3c. Contain drill cuttings and drilling water to prevent fall hazards from developing in work area. 3c. See 1b.
	3b. EXPOSURE: Noise and dust.	3d. Ensure all Emergency Safety Stop buttons function properly. 3d. Always wear leather gloves when making connections and using hand tools; wear cut-resistant (i.e., Kevlar) gloves when handling cutting tools.
	3c. FALL: Slip/trip/fall hazards.	3d. Inspect the equipment prior to use for potential pinch/amputation points. Keep hands away from pinch/amputation points and use of tools is preferable compared to fingers and hands. 3d. Inspect drill head for worn surface or missing teeth; replace if damaged or blunt.
	3d. CAUGHT: Limb/extremity pinching; abrasion/crushing.	3d. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3d. All non-essential personnel should stay away from the immediate work area; position body out of the line-of-fire of equipment. 3d. Drillers and helpers will understand and use the "Show Me Your Hands" Policy. 3d. Spinning rods/casing have an **exclusion zone of 10 feet** while in operation.
	3e. CONTACT: Equipment imbalance during advancement of drill equipment.	3e. Drillers will advance the borehole with caution to avoid causing the rig to become imbalanced and/or tip. 3e. The blocking and leveling devices used to secure the rig will be inspected by drillers and Roux personnel regularly to see if shifting has occurred. 3e. In addition, personnel and equipment that are non-essential to the advancement of the borehole will be positioned away from the rig at a distance that is at least as far as the boom is high (**minimum exclusion zone of 10 feet**).
	3f. EXPOSURE: Inhalation of contamination/vapors.	3f. Monitor ambient air for dangerous conditions using a calibrated photoionization detector (PID) to periodically monitor the breathing zone of the work area. 3f. If a reading of >5ppm is recorded, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux PM of the condition. The Roux PM will then recommend additional precautions in accordance with the site specific health and safety plan. 3f. Use a multi-gas meter to monitor ambient air for dangerous conditions (i.e. unsafe levels of carbon monoxide when drilling indoors or the presence of explosive vapors).
	3g. EXERTION: Potential for muscle strain/injury while lifting and installing well casings, lifting sand bags, and/or lifting rods.	3g. Keep back straight and bend at the knees. 3g. Utilize team lifting for objects over 50lbs. 3g. Use mechanical lifting device for odd shaped objects.
4. Remove sample liner.	**4a. EXERTION:** Potential for muscle strain/injury while removing liner from probe rod.	4a Utilize team lifting for objects over 50lbs. 4a. Use hydraulic liner extruder if available.
	4b. CONTACT: Pinch points and cuts	4b. Place liner on sturdy surface when opening. 4b. Don cut-resistant gloves and use appropriate liner cutter when opening liners. 4b. Always cut away from the body.
	4c. EXPOSURE: Inhalation and/or dermal contact with contaminants.	4c. Wear chemical-resistant disposable gloves when handling liners. 4c. See 3e.
5. Decontaminate equipment.	**5a. EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	5a. Wear chemical-resistant disposable gloves and safety glasses. 5a. Contain decontamination water so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Spray equipment from side angle, not straight on, to avoid backsplash. 5a. See 3b.
	5b. EXPOSURE: To chemicals in cleaning solution including ammonia.	5b. See 4a. Review SDS to ensure appropriate precautions are taken and understood.

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
Generic	**O&M**	**Movement of 55-Gallon Drums/Drum Handling with Mobile Carrier**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Michael Sarni	Technician	Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health & Safety Manager

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 long sleeve shirt or long sleeve shirt and reflective safety vest.	
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel or composite toe		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Mobile Drum Carrier, safety cones, and caution tape

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): A 10-foot exclusion zone will be maintained around heavy equipment (i.e. forklift).

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Preparing for and Inspection of Drum	**1a. FALL:** Tripping/falling due to uneven surface. Loose debris/garbage in work area.	1a. Clear area of loose garbage and debris. Inspect 55-gal drums for proper condition, labeling, check drum ring and bolts for tightness, inspect mobile drum carrier. 1a. Do a Test Lift to get a general sense of the weight of the drum. 1a. Inspect and use established pathways to avoid uneven terrain, weather-related hazards (i.e., debris, puddles, ice, etc.), and other obstructions. 1a. Secure work area and coordinate and communicate the planned work activities with other personnel working in the area. 1a. Delineate work area with 42" safety cones.
	1b. CONTACT/EXPOSURE: Drums could potentially be damaged or contain hazardous material. Mobile drum carrier could potentially be in poor working condition causing malfunctioning during operation.	1b. Prior to inspecting drums don cut-resistant gloves. If drum is not properly labeled, do not open and cease all drum transport 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. 1b. Inspect mobile drum carrier to ensure its overall integrity. Look for rust marks or potential weak points where the drum carrier could malfunction. Inspect the wheels to ensure that they easily turn and nothing is impeding their movement.
	1c. EXERTION/CAUGHT: Potential pinching/exertion hazards while securing ring/ tightening bolts	1c. Keep back straight and knees slightly bent while securing drum ring/tightening bolt. Wear cut-resistant gloves.
2. Position drum clamp tightly in between drum ribs, securing drum clamp to drum with chain	**2a. CAUGHT:** Pinching fingers between drum clamp and handle/chain.	2a. Attach drum clamp with chain and tighten until snug. Do not place hands between drum clamp and drum as the chain is tightened; wear cut resistant gloves. Keep face away from drum when handling in case of escaping vapors.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Disengage safety latches on handle, pull handle down until drum is lifted off ground and safety latches are reengaged; slightly suspending drum off the ground	**3a. EXERTION/ CONTACT:** Potential muscle strain associated with lifting/engaging drum/handle. Drum could shift/slip downward and crush toes.	3a. Ascertain whether the drum is overweight; if it is, then two people are needed to lower handle while drum is secured with clamp so that safety latches can be engaged. Keep body out of the line of fire of the handle (do not position head above handle) as it is being pushed down. Do not allow feet/toes to be positioned under the drum as it is being lifted; wear steel/composite toe boots.
	3b. CAUGHT: Fingers could be pinched while engaging/disengaging safety latches on handle	3b. Wear cut-resistant gloves while disengaging/reengaging safety latches. 3b. Avoid placing hands in pinch points.
4. Transport drums to designated location and disengage drum clamp (repeat Step 3 in reverse order)	**4a. FALL:** Tripping/ falling due to obstructions and uneven terrain. Potential for drum to fall during transport.	4a. Ensure transport path is free of potential obstructions that may cause the drum/carrier to become unstable. Position drum clamp between the ribs on the drum to prevent possible slipping.

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Hand Tools**	**Pre-Clearing activities, including Air Knifing and Soil Vacuuming**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Alyssa Lau	Staff Engineer	Daniel Abberton	SHSM
		Mike Ritorto	Senior Hydrogeologist
		Laura Jensen	Staff Hydrogeologist

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Nitrile and cut resistant
☒ HARD HAT	☒ FACE SHIELD (while air knifing)	☐ SUPPLIED RESPIRATOR	
☐ LIFELINE / BODY HARNESS	☒ HEARING PROTECTION (as needed)	☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ OTHER: Dust mask (as needed)
☒ SAFETY GLASSES	☒ SAFETY SHOES: Steel or composite toed		

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Required Equipment: Air Knife, Vactor Truck (Vac Truck), Compressor, Hand Tools, Circular Saw, Dust Mask, Photoionization Detector, Multi-Gas Meter, Traffic Cones, Rigid Barrier, Caution Tape, 20 lb. Fire Extinguisher, "Work Area" and/or "Exclusion Zone" Signs

Commitment to LPS – All personnel onsite will actively participate in SPSA performance by verbalizing SPSAs throughout the day.

EXCLUSION ZONE: A 10 foot exclusion zone will be maintained around air knife and/or soil vacuum operations.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Verify pre-clearance protocol.	1a. **CONTACT**: Underground utility damage; property damage; personal injury. See Site Walk Inspection JSA for potential hazards.	1a. Confirm that local utility companies were contacted prior to drilling. 1a. Walk the Site to evaluate utility markings and review maps (**See Site Walk Inspection JSA for critical actions**). 1a. Review pre-clearing checklist form and sub-surface clearance form. Pre-clearing protocol indicates that clearance must be conducted to a minimum of 5 vertical feet below ground surface or 8 vertical feet below ground surface in the critical zone using hand tools.
2. Mobilize/demobilize and establish work area.	2a. **See Mobilization / Demobilization JSA for potential hazards.**	2a. **See Mobilization / Demobilization JSA for critical actions.**
3. Pre-clear with air knife, water lance, and soil vacuum, and/or clearance with hand tools	3a. **CONTACT**: Flying debris striking face or body	3a. **Maintain 10 foot exclusion zone.** Only (air knife/vac truck) operator and designated helper shall remain within exclusion zone while air knife/vac truck is active. Use the required PPE, including (at a minimum), cut resistant gloves, safety glasses with side shields, and long sleeved shirt. 3a. Wear a face shield to protect face from flying debris when using air knife. 3a. Aim air knife tip away from self and others, so to avoid line-of-fire hazards. 3a. Use anti-whip devices on compressor hoses.
	3b. **EXPOSURE/ENERGY SOURCE**: Inhalation/exposure to hazardous vapors; inhalation/exposure to dust; electrocution.	3b. Monitor breathing zone with a calibrated PID and multi-gas meter. If vapors sustain levels > 5 ppm, the Roux field personnel must temporarily cease work, instruct all Site personnel to step away from the area of elevated readings and inform the Roux Project Manager of the condition. The Roux Project Manager will then recommend additional precautions. 3b. Wear dust masks as needed 3b. Ensure no open flames/heat sources are present within the work area. 3b. No open flames/heat sources. 3b. Ensure vac truck is properly grounded prior to use. 3b. Do not use metal dig bar; use fiberglass or equivalent.
	3c. **CONTACT:** Damage to unknown/known utility with air knife.	3c. Avoid contacting utilities directly with the high pressure air stream and using the air knife tip as a physical digging tool. 3c. Keep the air knife tip constantly moving to reduce direct pressure on a potential utility. 3c. increase the distance between air knife tip and soil/utility. 3c. Continually remove soil slurry from hole with vacuum, which may have an abrasive effect on utility casings.
	3d. **ERGONOMICS** Poor body positioning when handling equipment and materials.	3d. Use proper body positioning and lifting techniques that minimizes muscle strain; keep back straight, lift with legs, keep load close to body, and never reach with a load.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Pre-clearing with air knife and soil vacuum, and/or clearance with hand tools (continued)	3d. **ERGONOMICS**: (continued) Poor body positioning when handling equipment and materials.	3d. Ensure that loads are balanced to reduce the potential for muscle strain. 3d. Two people or a mechanical lifting aid are required when lifting objects over 50 lb. or when the shape makes the object difficult to lift.
	3e. **FALL**: Tripping/falling due to uneven terrain, weather conditions, and materials/equipment stored at the Site.	3e. Inspect walking path for uneven terrain, weather-related hazards (e.g., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment. 3e. Walk around any stored materials/equipment; do not climb over. Practice good housekeeping. 3e. Use established pathways and walk on stable, secure ground. 3e. Equipment and tools will be stored at the lowest point of potential energy and out of the walkway and immediate work area (i.e., tools should not be propped against walls or nearby equipment or vehicles). 3e. Equipment and tools that are not anticipated to be used will be returned to a storage area that is out of the immediate work area. 3e. Ensure power cords/hoses are grouped when used within the work area. Mark out cords/hoses that cross pathways with traffic cones. 3e. Ensure all Site personnel and equipment stay a minimum of 2 feet from an open hole. Mark out open holes with traffic cones/caution tape, etc. 3e. Pre-cleared location will be finished flush to grade as to prevent a slip/trip hazard.
	3f. **CAUGHT**: Pinch points or amputation points associated with the equipment and vacuum hose.	3f. Always wear cut-resistant gloves when making connections and using hand tools. 3f. Inspect the equipment prior to use for potential pinch points. 3f. Test all emergency shutdown devices prior to using equipment. 3f. Ensure all jewelry is removed, loose clothing is secured, and PPE is secured close to the body. 3f. **All non-essential personnel shall maintain a 10 foot exclusion zone**; position body out of the line-of-fire. 3f. **Drillers and helpers will understand and use the "Show Me Your Hands Policy".**
	3g. **EXPOSURE**: Noise from vac truck and/or air compressor.	3g. Wear hearing protection when vac truck and air compressor are in operation. Otherwise, if sound levels exceed 85 dB, don hearing protection.
4. Move drum to staging area using drum cart.	4a. **EXPOSURE/CONTACT**: Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, soil).	4a. Wear chemically resistant gloves (i.e., Nitrile; worn in addition to cut resistant gloves). 4a. Do not overfill drums. Ensure that the drum lids are attached securely. 4a. Stage all drums in the designated storage area (per Roux Project Manager) and ensure they are labeled.
	4b. **ERGONOMICS**: Muscle strain while maneuvering drums with drum cart/lift gate.	4b. See 3d. Do not overfill drums. Use lift gate on back of truck to load and unload drums or drum cart to transport drums.
	4c. **CAUGHT**: Pinch points or amputation points associated with handling drum lid.	4c. Ensure that fingers are not placed under the lid of the drum. Wear cut-resistant gloves. Use 15/16" ratchet while sealing drum lid.
5. Decontaminate equipment and tools.	5a. **EXPOSURE/CONTACT**: To contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated groundwater, vapors).	5a. See 4a. 5a. Contain decontamination water (closed lid) so that it does not spill. 5a. Use an absorbent pad to clean spills, if necessary. 5a. Store all impacted materials/PPE in a designated storage container (per Roux Project Manager) and ensure the container is labeled.
	5b. **EXPOSURE**: To chemicals in cleaning solution.	5b. See 4a.

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JSA TYPE CATEGORY	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Site Recon**	**Mobilization/Demobilization**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Rebecca Lowy	Staff Assistant Geologist	Brian Hobbs	Senior Health & Safety Manager
Tally Sodre	OHSM	Joe Gentile	Corporate Health & Safety Manager

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: None

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs

EXCLUSION ZONE (EZ): A 10-foot exclusion zone will be maintained around equipment in use..

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; organize and store equipment neatly in one area at its lowest potential energy. 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 and to discuss any special hazards. Ensure that short-service employees (SSE) are identified. 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 whenever possible. 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-to-spotter 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.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
		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. 1b. Observe potential overhead and ground surface features that may interfere with moving equipment. Clear the path of physical hazards prior to initiating mobilization.
	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 (positioned to best block oncoming traffic) of work area. 1c. Wear leather gloves when handling any tools or equipment. Wear cut-resistant gloves (Kevlar or similar) when handling sharp objects/cutting tools/glass. 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. Avoid wearing loose clothing and/or ensure loose clothing is secure. 1c. Secure all items on the equipment, tighten up any items or features that have potential to shift or break during mobilization.
	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, turn with whole body, 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 unwieldy 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 treated with Permethrin, apply insect repellant containing DEET to exposed skin, 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: Weather related injuries.	1f. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, nausea, rapid and shallow breathing). Take breaks in cool places and hydrate as needed. 1f. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). Take breaks in warm areas 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 (if you must raise your voice for normal conversation).

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JSA TYPE CATEGORY: **GENERIC**	WORK TYPE: **Gauging & Sampling**	WORK ACTIVITY (Description): **Soil Sampling**	
DEVELOPMENT TEAM	**POSITION / TITLE**	**REVIEWED BY:**	**POSITION / TITLE**
MaryBeth Lyons	Project Scientist	Brian Hobbs	Senior Health & Safety Manager
		Joe Gentile	Corporate Health and Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST ☒ HARD HAT ☐ LIFELINE / BODY HARNESS ☒ SAFETY GLASSES ☒ FLAME RESISTANT CLOTHING (as needed)	☐ GOGGLES ☐ FACE SHIELD: ☒ HEARING PROTECTION: (as needed) ☒ SAFETY SHOES: Composite-toe or steel toe boots	☐ AIR PURIFYING RESPIRATOR ☐ SUPPLIED RESPIRATOR ☒ PPE CLOTHING: Fluorescent reflective vest or high visibility clothing	☒ GLOVES: Leather, Nitrile and cut resistant ☒ OTHER: Insect repellant, sunscreen (as needed)

REQUIRED AND / OR RECOMMENDED EQUIPMENT

Recommended Equipment: 42" traffic cones, caution tape, trowel

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

EXCLUSION ZONE (EZ): A 10-foot exclusion zone will be maintained around moving equipment, if present.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Secure location	**1a. CONTACT:** Personnel and vehicular traffic may enter the work area.	1a. If in an area with foot or vehicle traffic, delineate the work area with 42" traffic cones and/or caution tape to prevent exposure to traffic and inform others of work activity. 1a. Wear reflective vest and/or high visibility clothing. 1a. Face the direction of any vehicular traffic. Position vehicle to protect worker from traffic. 1a. Communicate work activity with adjacent work areas.
	1b. FALL: Tripping/falling due to uneven terrain or entry/exit from excavations.	1b. Inspect pathways and work area for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions. 1b. Use established pathways and walk on stable, secure ground. 1b. Stage equipment and tools in a convenient, stable, and orderly manner. Store equipment at lowest potential energy. 1b. Roux employees should stay 5 feet from in-progress excavations and trenches. Should entry to an excavation be required (when stabilization is complete), ladders must be employed for steep embankments, excavations, pits, and trenches.
	1c. EXPOSURE: Exposure to sun and excessive heat, possibly causing sunburn, heat exhaustion or heat stroke. Exposure to cold temperatures possibly causing cold stress. Skin burn as a result of fire, if applicable. Exposure to explosive vapors due to tank farm operations. Exposure to airborne dust due to high wind speeds. Biological hazards - ticks, bees/wasps, poison ivy, thorns, insects, etc.	1c. Wear sunscreen with an SPF 15 or greater whenever 30 minutes or more of exposure is expected. 1c. Use a tent to shade the work area from direct sunlight particularly when warm temperatures are expected. 1c. Be aware of the location of all Site personnel. 1c. Watch for heat stress symptoms (muscle cramping, exhaustion, dizziness, rapid and shallow breathing). 1c. Watch for cold stress symptoms (severe shivering, slowing of body movement, weakness, stumbling or inability to walk, collapse). 1c. Take breaks for rest and water as necessary. Move to an area that is well shaded or a climate controlled area (i.e., car, site trailer, etc.). 1c. No open flames/heat sources. 1c. Flame retardant clothing must be worn when specified by Site policy. 1c. Cell phones should be disabled when specified by Site policy. 1c. Pre-treat field clothing with Permethrin prior to site visit to kill ticks and insects. 1c. Wear long sleeved shirts and tuck in (or tape) pant legs into socks or boots to prevent ticks from reaching skin. 1c. Spray insect repellant containing DEET on exposed skin when working in overgrown areas of the Site. 1c. Inspect area to avoid contact with biological hazards. 1c. Wear cut-resistant gloves when handling branches, shrubs, etc. that may lie within the walking path. 1c. Wear spoggles if the average wind speeds are above 15 mph. 1c. Personnel shall examine themselves and co-worker's outer clothing for ticks periodically when onsite. 1c. If skin comes in contact with poison ivy, wash skin thoroughly with soap and water. If rash persists after washing, immediately notify your supervisor, the OM and OHSM for possible consultation with a physician at an approved Occupational Health Clinic.

[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 – 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
2. Collect Soil Sample	**2a. CONTACT:** Personal injury from pinch points, cuts, and abrasions from sampling equipment tools, and material within soil sample. Personal injury from contact with moving equipment while sampling. Personal injury from contact with glass sample jars.	2a. Wear cut-resistant (i.e., Kevlar) gloves under chemical-resistant (nitrile) disposable gloves when handling soil samples and sampling jars. 2a. Where possible, use trowel or equivalent tool to avoid contact with soil. 2a. If sampling from bucket of heavy equipment, ensure all equipment is off and operator utilizes the “show me your hands” policy. 2a. See 1a.
	2b. EXPOSURE: Exposure to contamination (impacted soil) and/or lab preservatives.	2b. Wear chemical-resistant (nitrile) disposable gloves over cut resistant gloves to protect hands when handling samples; use containment material or plastic sheeting to protect surrounding areas. 2b. Wear safety glasses to protect eyes from dust or air-borne contaminants that may results from disturbing the soil. 2b. Where possible, remain upgradient from sample location if collecting soil sample from stockpile, drill rig, etc. to avoid breathing contaminant vapors, if they are present. 2b. When collecting soil sample from hand auger, put large zip lock bag over entire auger to prevent spillage of soil on to the ground. 2b. Open sample jars slowly and fill carefully to avoid contact with preservatives.
	2c. EXERTION: Exertion due to repetitive motion and ergonomics.	2c. Utilize a table or raised surface for soil sampling if multiple soil samples are going to be taken to minimize repetitive bending motion.
3. Decontaminate equipment	**3a. EXPOSURE/CONTACT:** Contamination (e.g., Separate Phase Hydrocarbons (SPH), contaminated vapors and/or soil). **3b. EXPOSURE:** Chemicals in cleaning solution including ammonia.	3a. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3a. Use an absorbent pad to clean spills. 3a. Properly dispose of used materials/PPE in provided drums in designated drum storage area. 3a. Remain upwind of sample and avoid breathing contaminant vapors, if they are present. 3b. Wear chemical-resistant (nitrile) disposable gloves and safety glasses. 3b. Work on the upwind side of decontamination area. 3b. Use an absorbent pad to clean spills. 3b. Properly dispose of used materials/PPE in provided drums in designated drum storage area. Ensure that all drums are properly labeled and secured.

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JOB SAFETY ANALYSIS	Ctrl. No. GEN-021	DATE: 1/4/2018	☐ NEW ☒ REVISED	PAGE 1 of 2

JSA TYPE CATEGORY:	WORK TYPE	WORK ACTIVITY (Description)
GENERIC	**Gauging and Sampling**	**Soil Vapor Sampling (Permanent Monitoring Points)**

DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE
Jeff Wills	Project Hydrogeologist	Brian Hobbs	Senior Health & Safety Manager
Julie Moriarity	Project Scientist	Joe Gentile	Corporate Health and Safety Manager

REQUIRED AND / OR RECOMMENDED PERSONAL PROTECTIVE EQUIPMENT

☐ LIFE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☒ GLOVES: Cut-resistant & Nitriles
☒ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☒ OTHER: Bug Spray, Sun Screen, Knee Pads or kneeling pad
☐ 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

9/16" Socket and Wrench, Non-Toxic Clay, Teflon-Lined Tubing, Masterflex Tubing, Air Pump with Low Flow, Dry Cal, Enclosure (Bucket with 2 holes), Helium Gas Canister, Summa Canisters and Flow Controllers, MultiRae Photo Ionization Detector (PID), Helium Detector, Tubing Cutter, 42-inch Safety Cones, Caution Tape or Retractable Cone Bars

COMMITMENT TO SAFETY- All personnel onsite will actively participate in hazard recognition and mitigation throughout the day by verbalizing SPSAs.

EXCLUSION ZONE (EZ): A 5-foot exclusion zone will be maintained for non-essential personnel.

Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
1. Define and secure work area.	**1a. FALL:** Potential tripping hazards.	1a. Ensure work area is secure and inform others (third party) of work activity. 1a. Remove tripping hazards and inspect walking path for uneven terrain, weather-related hazards (i.e., ice, puddles, snow, etc.), and obstructions prior to mobilizing equipment.
	1b. CONTACT: Potential contact with moving vehicles or pedestrians.	1b. If working alongside roads, look both ways before entering roadways, face traffic, and utilize work vehicle to protect employees. 1b. Delineate work area (including vehicles) with traffic safety cones and caution tape or retractable cone bars. 1b. Maintain a 5-foot exclusion zone. 1b. Wear high visibility clothing or reflective safety vest.
	1c. EXERTION: Muscle strain while lifting and carrying equipment.	1c. When carrying equipment to/from work area, keep back straight, lift with legs, keep load close to body, never reach with a load. Ensure that loads are balanced. Use mechanical assistance/make multiple trips to carry equipment.
2. Remove well cover / close well cover.	**2a. CONTACT/CAUGHT:** Pinch points and scrapes associated with hand tools and well covers.	2a. Keep hands away from pinch points. 2a. Use hand tools with extensions to remove and replace well covers. 2a. Wear cut-resistant gloves. 2a. Use knee pads or kneeling pad when repetitive kneeling on rough ground is anticipated.
	2b. FALL: Potential tripping hazards associated with installing bolts.	2b. Place security bolts in secure location so not to create tripping hazards. Replace security bolts so that they fit flush with monitoring well covers.
	2c. EXERTION: Physical exertion to remove bolts that were over torqued or stripped.	2c. Replace any security bolts that show signs of stripping. Do not over tighten. 2c. Use body positioning and bending techniques that minimize muscle strain; keep back straight, bend at the knees. 2c. See 2a.

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Assess [1]JOB STEPS	Analyze [2]POTENTIAL HAZARDS	Act [3]CRITICAL ACTIONS
3. Screen vapor point with PID.	**3a. FALL:** Potential tripping hazards associated with equipment. **3b. EXPOSURE:** Inhalation of soil vapor	3a. Place equipment in one area close to the sampling location. 3b. Identify area where equipment is to be stored within the work area (away from main walking path). 3a. Don't leave equipment on the ground. Return equipment to storage area between uses. 3b. Replace brass caps immediately upon completion to avoid soil vapors migrating to the surface through sample tubing. 3b. Stand upwind of sample point during screening activities.
4. Remove / replace brass caps at the end of the sam`ple tubing.	**4a. CONTACT:** Pinch points associated with hand tools and brass caps. **4b. EXPOSURE:** Potential pathway for vapors to migrate to land surface.	4a. Use wrench to remove and replace brass caps. 4a. Wear cut-resistant gloves to protect against pinch points and scrapes. 4b. See 3b. 4b. Stand up wind of sample point location.
5. Set up soil vapor sampling equipment and calibration of meters.	**5a. FALL:** Potential tripping hazards associated with equipment and tubing.5b. **5b. CONTACT:** Pinch points associated with handling equipment. **5c. EXPOSURE:** Inhalation of calibration gas and helium.	5a. See 3a. 5a. Keep tubing slack to a minimum and locate the summa canister as close to the sampling location as possible. 5a. Avoid stepping over equipment and tubing. 5b. Do not place fingers/hands under sampling equipment. 5b. Make multiple trips when unloading equipment in work area. 5b. Wear cut-resistant gloves to protect against pinch points while handling sampling equipment. 5c. Review SDS for each type of calibration gas used before calibrating. 5c. Calibrate meters in a well-ventilated area and keep air flow regulator away from face. 5c. Close valve on canisters after use to avoid inhalation of excess helium or calibration gas. 5c. Stand up wind of bucket during helium tracer gas test.
6. Cleaning Work Area.	**6a. FALL:** Potential tripping hazards associated with equipment and tubing. **6b. CONTACT:** Storing and transport of equipment in car.	6a. See 3a. 6a. See 3b. 6b. Ensure that equipment is placed securely in the vehicle. Do not stack equipment on top of each other. Secure equipment so that it will not slide while being transported. 6b. Wear cut-resistant gloves while handling/loading equipment.

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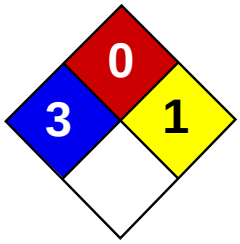
APPENDIX B

SDSs for Chemicals Used



Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

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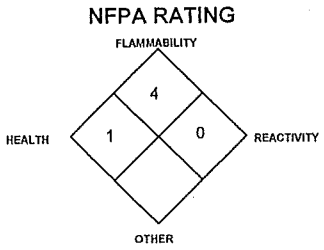
Last Updated: 05/21/2013 12:00 PM

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 ScienceLab.com 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 ScienceLab.com has been advised of the possibility of such damages.

MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:	**ISOBUTYLENE - C_4H_8** Document Number: Isobutylene
PRODUCT USE:	For general analytical/synthetic chemical uses.
SUPPLIER/MANUFACTURER'S NAME: ADDRESS:	MESA Specialty Gases & Equipment 3619 Pendleton Avenue, Suite C Santa Ana, CA 92704
BUSINESS PHONE: EMERGENCY PHONE:	1-714-434-7102 INFOTRAC: 1-800-535-5053
DATE OF PREPARATION:	May 10, 1999

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	OTHER
Isobutylene	115-11-7	> 99.0%	There are no specific exposure limits for Isobutylene. Isobutylene is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					
Maximum Impurities		< 1.0%	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Isobutylene is a colorless, liquefied, flammable gas with an unpleasant odor similar to burning coal. The liquefied gas rapidly turns into a gas at standard atmospheric temperatures and pressures. Isobutylene is an asphyxiant and presents a significant health hazard by displacing the oxygen in the atmosphere. Rapid evaporation of liquid from the cylinder may cause frostbite. Both the liquid and gas pose a serious fire hazard when accidentally released. The gas is heavier than air and may travel to a source of ignition and flash back to a leak or open container. Flame or high temperature impinging on a localized area of a cylinder of Isobutylene can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of overexposure, death may occur. Isobutylene also has some degree of anesthetic action and can be mildly irritating to the mucous membranes. The effects associated with various levels of oxygen are as follows:

CONCENTRATION	SYMPTOMS OF EXPOSURE
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

HAZARDOUS MATERIAL INFORMATION SYSTEM

HEALTH	(BLUE)	1
FLAMMABILITY	(RED)	4
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT		B

EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications

See Section 16 for Definition of Ratings

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms**. Overexposure to Isobutylene may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, headache, dizziness, and nausea. At high concentrations, unconsciousness or death may occur. Contact with liquefied gas or rapidly expanding gases may cause frostbite.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to Isobutylene.

TARGET ORGANS: Respiratory system.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO ISOBUTYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

4. FIRST-AID MEASURES (Continued)

Remove victim(s) to fresh air as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

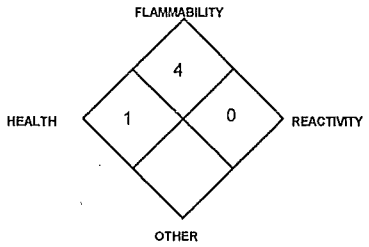
Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

5. FIRE-FIGHTING MEASURES

FLASH POINT (Closed Cup): -10°C (< 14°F)
AUTOIGNITION TEMPERATURE: 465°C (869°F)
FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.8%
Upper (UEL): 9.6%

NFPA RATING



See Section 16 for Definition of Ratings

FIRE EXTINGUISHING MATERIALS: Extinguish Isobutylene fires by shutting off the source of the gas. Use water spray or a foam agent to cool fire-exposed containers, structures, and equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this material may ignite and produce toxic gases, including carbon monoxide and carbon dioxide.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected pressure storage vessels of Isobutylene can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion), or by exothermic decomposition. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

Explosion Sensitivity to Mechanical Impact: Not sensitive.
Explosion Sensitivity to Static Discharge: Static discharge may cause Isobutylene to ignite explosively if released.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable or explosive mixture formation. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Because of the potential for a BLEVE, evacuation of non-emergency personnel is essential. If water is not available for cooling or protection of vessel exposures, evacuate the area. Refer to the North American Emergency Response Guidebook for additional information. Other information for pre-planning can be found in the American Petroleum Institute Publications 2510 and 2510A.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided. Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves resistant to tears, and Self-Contained Breathing Apparatus.**

Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut off with water spray. Allow the gas to dissipate. Monitor the surrounding area for combustible gas levels and oxygen. Combustible gas concentration must be below 10% of the LEL (LEL = 1.8%) prior to entry. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE GAS. Protection of all personnel and the area must be maintained.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Isobutylene IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Isobutylene could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Isobutylene. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "*Oxygen Deficient Atmospheres*".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Isobutylene dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the presence of potentially explosive air-gas mixtures and level of oxygen.

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Maintain level of gas below the level listed in Section 2 (Composition and Information on Ingredients). Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Isobutylene. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards.

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of liquid Isobutylene.

HAND PROTECTION: Wear gloves resistant to tears when handling cylinders of Isobutylene. Use low-temperature protective gloves (e.g., Kevlar) when working with containers of liquid Isobutylene.

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well as fire retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY @ 21.1°C (70°F): 2.396 kg/m^3 (0.1496 lb/ft^3)
SPECIFIC GRAVITY (air = 1): 1.997
SOLUBILITY IN WATER: Insoluble.
EVAPORATION RATE (nBuAc = 1): Not applicable.
ODOR THRESHOLD: Not established.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
pH: Not applicable.
FREEZING POINT: -140°C (-220.6°F)
BOILING POINT @ 1 atm: -6.9°C (19.6°F)
EXPANSION RATIO: Not applicable
VAPOR PRESSURE (psia): 39
SPECIFIC VOLUME (ft^3/lb): 6.7

APPEARANCE AND COLOR: Colorless gas with the unpleasant odor of burning coal. The liquid is also colorless and has the same unpleasant odor of burning coal.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: When ignited in the presence of oxygen, this gas will burn to produce carbon monoxide and carbon dioxide.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride).

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks, and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for pure Isobutylene.

ISOBUTYLENE:
LC_{50} (rat, inhalation) = 620 g/m^3/4 hours
LC_{50} (mouse, inhalation) = 415 g/m^3/2 hours

SUSPECTED CANCER AGENT: Isobutylene is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, CAL/OSHA, and therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Isobutylene may be mildly irritating to the mucous membranes. In addition, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Isobutylene is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Isobutylene on the human reproductive system.

Mutagenicity: No mutagenic effects have been described for Isobutylene.
Embryotoxicity: No embryotoxic effects have been described for Isobutylene.
Teratogenicity: No teratogenic effects have been described for Isobutylene.
Reproductive Toxicity: No reproductive toxicity effects have been described for Isobutylene.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e., within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by overexposure to Isobutylene.

11. TOXICOLOGICAL INFORMATION (Continued)

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Isobutylene.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen-deficient environments. No adverse effect is anticipated to occur to plant life, except for frost produced in the presence of rapidly expanding gases. See Section 11, Toxicological Information, for additional information on effects on animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of Isobutylene on aquatic life.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to MESA Specialty Gases & Equipment Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

For Isobutylene Gas:

PROPER SHIPPING NAME:	Isobutylene
HAZARD CLASS NUMBER and DESCRIPTION:	2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1055
PACKING GROUP:	Not Applicable
DOT LABEL(S) REQUIRED:	Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115

Alternate Description:

PROPER SHIPPING NAME:	Petroleum gases, liquefied
HAZARD CLASS NUMBER and DESCRIPTION:	2.1 (Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1075
PACKING GROUP:	Not Applicable
DOT LABEL(S) REQUIRED:	Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115

MARINE POLLUTANT: Isobutylene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Isobutylene is not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDSL INVENTORY STATUS: Isobutylene is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Isobutylene is listed on the TSCA Inventory.

15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS: Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 lb. Depending on specific operations involving the use of Isobutylene, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Isobutylene is not listed in Appendix A; however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Isobutylene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Liquefied Petroleum Gas.
California - Permissible Exposure Limits for Chemical Contaminants: Liquefied Petroleum Gas.
Florida - Substance List: Isobutylene.
Illinois - Toxic Substance List: No.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Isobutylene.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: Liquefied Petroleum Gas.
Missouri - Employer Information/Toxic Substance List: No.
New Jersey - Right to Know Hazardous Substance List: Isobutylene.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.
Pennsylvania - Hazardous Substance List: Isobutylene.
Rhode Island - Hazardous Substance List: Liquefied Petroleum Gas.
Texas - Hazardous Substance List: Liquefied Petroleum Gas.
West Virginia - Hazardous Substance List: Liquefied Petroleum Gas.
Wisconsin - Toxic and Hazardous Substances: Liquefied Petroleum Gas.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Isobutylene is not on the California Proposition 65 lists.

LABELING:

DANGER:

FLAMMABLE LIQUID AND GAS UNDER PRESSURE.
CAN FORM EXPLOSIVE MIXTURES WITH AIR.
MAY CAUSE FROSTBITE.

Keep away from heat, flames, and sparks.
Store and use with adequate ventilation.
Cylinder temperature should not exceed 52°C (125°F).
Do not get liquid in eyes, on skin, or clothing.
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

FIRST AID:

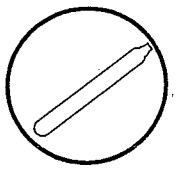
IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

IN CASE OF FROSTBITE, obtain immediate medical attention.

DO NOT REMOVE THIS PRODUCT LABEL.

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas
Class B1: Flammable Gas



16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA Specialty Gases & Equipment assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA Specialty Gases & Equipment assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:
ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average **(TWA)**, the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level **(C)**. Skin absorption effects must also be considered.
OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.
IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration **(OSHA)**. NIOSH issues exposure guidelines called Recommended Exposure Levels **(RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:
HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).
NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued): Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:
Much of the information related to fire and explosion is derived from the National Fire Protection Association **(NFPA)**. Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:
Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD_{50}** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC_{50}** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m^3** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo, LDLo**, and **LDo**, or **TC, TCo, LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

REGULATORY INFORMATION:
This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act **(SARA)**; the Canadian Domestic/Non-Domestic Substances List **(DSL/NDSL)**; the U.S. Toxic Substance Control Act **(TSCA)**; Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act **(CERCLA or Superfund)**; and various state regulations.

Manufactured for

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CORPORATION

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MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen, 0.0015-23.5%; Propane, 0-1.1%; n-Pentane, 0-0.75%; n-Hexane; 0-0.48%; Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

NOTE: MIXTURES COMPRISED OF AN AIR BALANCE GAS CONTAIN BETWEEN 19.5-23.5% OXYGEN.

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50016 (Replaces ISC MSDS No.1810-2187, 1810-2343, 1810-3366, 1810-3937 1810-7219, 1810-7599, 1810-6179)

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE:	Calibration of Monitoring and Research Equipment
SUPPLIER/MANUFACTURER'S NAME:	CALGAZ
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	1-410-228-6400
General MSDS Information	1-713/868-0440
Fax on Demand:	1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIHTLV		OSHA		IDLH	OTHER
			TWA ppm	STEL ppm	TWA ppm	STEL ppm	ppm	ppm
Oxygen	7782-44-7	0.0015 - 23.5%	There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%.					
Propane	74-98-6	0 - 1.1%	2500	NE	1000	NE	2100	NIOSH REL: 1000 DFG MAK: 1000 ppm
n-Pentane	109-66-0	0 - 0.75%	600	750	1000 600 (Vacated 1989 PEL)	750 (Vacated 1989 PEL)	1500	NIOSH REL: TWA = 120 STEL = 610 (ceiling) 15 minutes DFG MAKs: TWA =1000 PEAK = 2•MAK, 60 min., momentary value
n-Hexane	110-54-3	0 - 0.48%	50	NE	500 50 (Vacated 1989 PEL)	NE	1100	NIOSH REL: 50 DFG MAK: 50
Hydrogen Sulfide	7783-06-4	0.001-0.025 %	10 NIC = 5	15 NIC = 5	10 (Vacated 1989 PEL)	20 (ceiling), 50 (10 min. peak, once per shift) 15 (Vacated 1989 PEL)	100	NIOSH REL: STEL = 10 (ceiling), 10 minutes DFG MAKs: TWA = 10 PEAK = 2•MAK, 10 min., momentary value
Carbon Monoxide	630-08-0	0.0005 - 1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 (ceiling) (Vacated 1989 PEL)	1200	NIOSH RELs: TWA = 35 STEL = 200 ceiling DFG MAKs: TWA = 30 PEAK = 2•MAK, 15 min., average value, 1 hr interval DFG MAK Pregnancy Risk Classification: B
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established. NIC = Notice of Intended Change See Section 16 for Definitions of Terms Used.

NOTE: ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this gas mixture, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. The Propane, n-Pentane, and n-Hexane components can cause anesthetic or peripheral neuropathy effects. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A significant health hazard associated with this gas mixture is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas mixture is used in a confined space or other poorly-ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Exposure to this component can result in respiratory arrest, coma, or unconsciousness. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows

CONCENTRATION OF HYDROGEN SULFIDE	OBSERVED EFFECT
0.3-30 ppm	Odor is obvious and unpleasant.
50 ppm	Eye irritation. Dryness and irritation of nose, throat.
Slightly higher than 50 ppm	Irritation of the respiratory system.
100-150 ppm	Temporary loss of smell.
200-250 ppm	Headache, vomiting nausea. Prolonged exposure may lead to lung damage. Exposures of 4-8 hours can be fatal.
300-500	Swifter onset of symptoms. Death occurs in 1-4 hours.
500 ppm	Headache, excitement, staggering, and stomach ache after brief exposure. Death occurs within 0.5 - 1 hour of exposure.
> 600 ppm	Rapid onset of unconsciousness, coma, death.
> 1000 ppm	Immediate respiratory arrest.
NOTE:	This gas mixture contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	3
FLAMMABILITY HAZARD	(RED)	0
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
See Section 8			

For Routine Industrial Use and Handling Applications

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs.

Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

CONCENTRATION OF CARBON MONOXIDE	OBSERVED EFFECT
All exposure levels: ..	Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red.
200 ppm:	Slight symptoms (i.e. headache) after several hours of exposure.
400 ppm:	Headache and discomfort experienced within 2-3 hours of exposure.
1,000 -2000 ppm:	Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.
200-2500 ppm:	Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.
> 2500 ppm:	Potential for collapse and death before warning symptoms.

Another hazard associated with this gas mixture is the potential for anesthetic and peripheral neuropathy effects after inhalation over-exposures to the Propane, n-Pentane and n-Hexane components of this gas mixture. Specific human over-exposure data are available for n-Pentane and n-Hexane, as follows:

CONCENTRATION OF n-PENTANE	OBSERVED EFFECT
Brief (10 minute) up to 5,000 ppm:	No symptoms.
Higher than 5,000 ppm:	Exhilaration, dizziness and headache can occur.
Long term:	Can cause chronic neurological disorder causing damage to the nerves in the hands and feet (peripheral neuropathy)

CONCENTRATION OF n-HEXANE	OBSERVED EFFECT
Brief (10 minute) at 1,500 ppm:	Irritation of the respiratory tract, nausea and headache.
5000 ppm:	Dizziness and drowsiness can occur.
Long term at 500 ppm:	Can affect the nerves in the arms and legs. Effects include numbing or tingling sensations in the fingers and toes, tiredness, muscle weakness, cramps and spasms in the leg, difficulty in holding objects or walking, abdominal pains, loss of appetite, weight loss. More serious exposures can cause damage to the nerves in the hands and feet (peripheral neuropathy).
Eyes and Vision:	Abnormal color perception and pigment changes in the eyes have been reported among industrial workers exposed to 423-1280 ppm for 5 years or more.
Blood Cells:	Mild forms of anemia have also been associated with exposure to hexane. These are of temporary nature.

Additionally, if mixtures of this gas mixture contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN	OBSERVED EFFECT
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea, vomiting, collapse, or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

SKIN and EYE CONTACT: The Hydrogen Sulfide component of this gas mixture may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in “gas eyes” or “sore eyes” with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. However, the Hydrogen Sulfide and Carbon Monoxide components of this gas mixture are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness.

Inhalation over-exposures to Propane, n-Pentane, and n-Hexane can cause anesthetic effects and motor neuropathy (i.e. pain and tingling in feet and hands).

3. HAZARD IDENTIFICATION (Continued)

CHRONIC: Abnormal color perception and pigment changes in the eyes have been reported among persons exposed to 420 -1300 ppm of n-Hexane for five years. Additionally, long-term exposure to low levels of n-Hexane or n-Pentane can affect the nerves in the arms and legs. Effects include numbing or tingling sensation, tiredness, cramps, spasms in legs, difficulty holding objects or walking, loss of appetite and weight loss. Pentane isomers, such as n-Pentane, and Propane can cause sensitization of the heart to epinephrine. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture.

TARGET ORGANS: ACUTE: Respiratory system, blood system, central nervous system, cardiovascular system. CHRONIC: Reproductive system, cardiovascular system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

SKIN EXPOSURE: If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention.

EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by over-exposure to this gas mixture. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, n-Hexane or n-Pentane in this gas mixture, central nervous system conditions, eye disorders, or skin problems may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

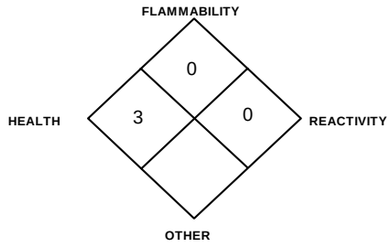
UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture contains toxic gases, Hydrogen Sulfide and Carbon Monoxide, and presents an extreme health hazard to firefighters. This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not Sensitive.

Explosion Sensitivity to Static Discharge: Not Sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

NFPA RATING



6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components of this gas mixture, than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this gas mixture is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C, 70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Carbon Monoxide levels exceed the exposure levels given in Section 2 (Composition and Information on Ingredients) or if oxygen levels are below 19.5%, or if either level is unknown during emergency response to a release of this gas mixture. If respiratory protection is required for emergency response to this gas mixture, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134) or equivalent State standards. The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

Up to 100 ppm: Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; or gas mask with canister to protect against hydrogen sulfide; or SAR; or full-facepiece SCBA.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA

NOTE: The IDLH concentration for Hydrogen Sulfide is 100 ppm.

NIOSH/OSHA RECOMMENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:

Up to 350 ppm Supplied Air Respirator (SAR)

Up to 875 ppm Supplied Air Respirator (SAR) operated in a continuous flow mode.

Up to 1200 ppm Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air Respirator (SAR).

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with canister to protect against carbon monoxide; or escape-type SCBA.

NOTE: End of Service Life Indicator (ESLI) required for gas masks.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: No special protection is needed under normal circumstances of use. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ ft^3 (1.153 kg/m^3)

FREEZING/MELTING POINT @ 10 psig: -210°C (-345.8°F)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

BOILING POINT: -195.8°C (-320.4°F)

pH: Not applicable.

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft^3/lb): 13.8

The following information is for the gas mixture.

APPEARANCE AND COLOR: This gas mixture is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide.

HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of Hydrogen Sulfide (a component of this gas mixture) may cause olfactory fatigue, so that there are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Propane, n-Hexane, and n-Pentane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this gas mixture (Hydrogen Sulfide, Propane, n-Pentane, n-Hexane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the

n-PENTANE:

LD_{50} (intravenous, mouse) = 446 mg/kg.

LC_{50} (inhalation, rat) = 364 g/m^3/4 hours

LCLo (inhalation, mouse) = 325 g/m^3/2 hours

n-HEXANE:

Eye, rabbit = 10 mg/ mild

TCLo (inhalation, rat) = 10,000 ppm/7 hr.

TCLo (inhalation, rat) = 5000 ppm/20 hours; teratogenic effects

LD50 (oral, rat) = 28710 mg/kg

LDLo (intraperitoneal, rat) = 9100 mg/kg

LCLo (inhalation, mouse) = 120,000 mg/kg

LD50 (rat, oral): 28,710 mg/kg

ACUTE INHALATION (mouse): 30,000 ppm, narcosis within 30 to 60 minutes; 35,000-40,000 ppm, convulsions and death.

DERMAL (rabbit): 2 to 5 ml/kg for 4 hours resulted in restlessness and discoordination,; death occurred at 5 ml/kg.

HYDROGEN SULFIDE:

LCLo (inhalation, human) = 600 ppm/30 minutes

LDLO (inhalation, man) = 5.7 mg/kg; central nervous system, pulmonary effects

n-HEXANE (continued):

CHRONIC INHALATION (rat): 400-600 ppm, 5 days/week, peripheral neuropathy in 45 days; 850 ppm for 143 days, loss of weight and degeneration of the sciatic nerve. (mouse): 250 ppm, peripheral neuropathy within 7 months; no effects at 100 ppm.

PROPANE:

Long-Term Inhalation: No toxicity or abnormalities were observed when monkeys were exposed to approximately 750 ppm for 90 days. Similar results were obtained when monkeys were exposed to an aerosol spray containing 65% propane and isobutane.

CARBON MONOXIDE:

TCLo (inhalation, mouse) = 65 ppm/24 hours (7-18 preg): rep. effects

TCLo (inhalation, mouse) = 8 pph/1 hour (female 8D post): ter. effects

HYDROGEN SULFIDE (continued):

LCLo (inhalation, human) = 800 ppm/5 minutes

LC_{50} (inhalation, rat) = 444 ppm

CARBON MONOXIDE (continued):

TCLo (inhalation, human) = 600 mg/m^3/10 minutes

LCLo (inhalation, man) = 4000 ppm/30 minutes

TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system and blood system effects.

LCLo (inhalation, human) = 5000 ppm/5 minutes

LCLo (inhalation, dog) = 4000 ppm/46 minutes

LCLo (inhalation, rabbit) = 4000 ppm

LC_{50} (inhalation, rat) = 1811 ppm/4 hours

LC_{50} (inhalation, guinea pig) = 2450 ppm/4 hours

LC_{50} (inhalation, guinea pig) = 5718 ppm/4 hours

LCLo (inhalation, mammal) = 5000 ppm/5 minutes

LD_{50} (inhalation, wild bird) = 1334 ppm

HYDROGEN SULFIDE (continued):

LC_{50} (inhalation, mouse) = 673 ppm/1 hour

LCLo (inhalation, mammal) = 800 ppm/5 minutes

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: The Hydrogen Sulfide component of this gas mixture, is irritating to the eyes, and may be irritating to the skin.

SENSITIZATION OF PRODUCT: The components of this gas mixture are not known to be skin or respiratory sensitizers. Pentane isomers (i.e. n-Pentane) and Propane can cause cardiac sensitization to epinephrine.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for the components of this gas mixture.

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. The Carbon Monoxide component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe

11. TOXICOLOGICAL INFORMATION (continued)

exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

Reproductive Toxicity: The components of this gas mixture are not expected to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) have been determined for the components of this gas mixture, as follows:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE • Carboxyhemoglobin in blood • Carbon monoxide in end-exhaled air	 • End of shift • End of shift	 • 3.5% of hemoglobin • 20 ppm
n-HEXANE • 2,5-Hexanedione in urine • n-Hexane in end-exhaled air	• End of shift	• 5 mg/g creatinine

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65

PROPANE: Log K_{ow} = 2.38. Water Solubility = 62.4 ppm, 25°C. Propane is readily degraded by soil bacteria.

PENTANE: Log K_{ow} = 3.39. Water Solubility = 38.5 mg/L. LOG BCF (n-pentane) = calculated, 1.90 and 2.35, respectively. Photolysis, hydrolysis, and bioconcentration are not anticipated to be important fate processes. Biodegradation and soil adsorption are anticipated to be more important processes for this compound.

n-HEXANE: Log K_{ow} = 3.90-4.11. Water Solubility = 9.5 mg/L. Estimated Bioconcentration Factor =2.24 and 2.89. Bioconcentration in aquatic organisms is low. Hexane is volatile. Rapid volatilization from water and soil is anticipated for this compound. Hexane will float in slick on surface of the water

HYDROGEN SULFIDE: Water Solubility = 1 g/242 mL at 20°C.

CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0 °C, 2.3 ml at 20°C.

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this gas mixture's effects on plant and animal life. The Hydrogen Sulfide and Carbon Monoxide components of this gas mixture, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this gas effects on aquatic life. The presence of more than a trace of Carbon Monoxide is a hazard to fish. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture.

TLm (Asellussp) = 0.111 mg/L/96 hour
TLm (Cranfgonyx sp) =1.07 mg/L/96 hour
TLm (Gammarrus) = 0.84 mg/L/96 hour
LC_{50} (fly inhalation) = 380 mg/m^3/960 minutes
LC_{50} (fly inhalation) = 1500 mg/m^3/7 minutes
TLm (Lepomis macrochirus, bluegill sunfish) = 0.0478 mg/L/96 hour
TLm (Lepomis macrochirus, bluegill sunfish) = 0.0448 mg/L/96 hour at 21-22 °C
TLm (Pimephlaes promelas, fathead minnow) = 0.0071-0.55 mg/L/96 hour
TLm (Salvenilis foninalis, brook trout) = 0.0216-0.038 mg/L/96 hour at 8-12.5 °C

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

HAZARD LABEL: Class 2.2 (Non-Flammable Gas)

SPECIAL PROVISIONS: None

EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12

ERAP INDEX: None

PASSENGER CARRYING SHIP INDEX: None

PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: This gas is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
n-Hexane	NO	YES	YES
Hydrogen Sulfide	YES	YES	YES

15. REGULATORY INFORMATION (Continued)

U.S. SARA THRESHOLD PLANNING QUANTITY: Section 302 EHS TPQ = Hydrogen Sulfide = 500 lbs (227 kg);
U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.
U.S. CERCLA REPORTABLE QUANTITY (RQ): Hexane = 5000 lb (2270 kg); Hydrogen Sulfide = 100 lbs (45.4 lb)
OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Sulfide, Carbon Monoxide, Propane, n-Pentane and n-Hexane are subject to the reporting requirements of CFR 29 1910.1000.
- Hydrogen Sulfide, Propane and n-Pentane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.
- Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs.
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen, Oxygen and n-Hexane are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater. Carbon Monoxide, Propane and n-Pentane are listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
Florida - Substance List: Oxygen, Carbon Monoxide, n-Pentane, n-Hexane, Hydrogen Sulfide.
Illinois - Toxic Substance List: Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
Kansas - Section 302/313 List: No.
Massachusetts - Substance List: Oxygen, Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
Michigan - Critical Materials Register: No.
Minnesota - List of Hazardous Substances: Carbon Monoxide, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
Missouri - Employer Information/Toxic Substance List t: n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.
New Jersey - Right to Know Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane.
North Dakota - List of Hazardous Chemicals, Reportable Quantities: Hydrogen Sulfide.
Pennsylvania - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
Rhode Island - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Propane, n-Pentane, n-Hexane, Hydrogen Sulfide.
Texas - Hazardous Substance List: n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.
West Virginia - Hazardous Substance List: n-Pentane, n-Hexane, Propane, Hydrogen Sulfide.
Wisconsin - Toxic and Hazardous Substances: n-Pentane, n-Hexane, Propane, Hydrogen Sulfide

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive harm.
ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are on the Canadian DSL Inventory.
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances List.
CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2A, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 *"Safe Handling of Compressed Gases in Containers"*
AV-1 *"Safe Handling and Storage of Compressed Gases"*
"Handbook of Compressed Gases"

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 3519, La Mesa, CA 91944-3519
619/670-0609

Fax on Demand: 1-800/231-1366

AIR LIQUIDE™

This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

APPENDIX C

Incident Investigation and Reporting Management Program

INCIDENT INVESTIGATION AND REPORTING MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/19**
REVISION NUMBER	:	**4**

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APPENDICES

Appendix A – Accident Report and Investigation Form

Appendix B – Near Loss Form

Appendix C – Injury Illness Reporting Flow Chart

1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following management program for reporting Environmental Health and Safety (EHS) incidents and near losses, investigation and correcting the causes of incidents, tracking incidents and corrective actions taken, and sharing the cause and corrective actions with Roux personnel. These practices and procedures establish a method to track progress and improvements to the company EHS performance.

2. SCOPE AND APPLICABILITY

These procedures apply to all Roux employees. Employees are required to follow these procedures for all incidents involving Roux personnel, or other personnel (e.g., subcontractors) working for Roux, regardless of the specific work activity or work location.

This program is intended, in part, to fulfill the Occupational Safety and Health Administration (OSHA) occupational injury and illness reporting and recording requirements cited in the Code of Federal Regulations (CFR) at 29 CFR 1904.

3. RESPONSIBILITIES

It shall be the responsibility of all Roux employees to report all incidents as soon as possible to the PM (or Administrative Manager for office-related incidents), SHSO, OHSM and OM, regardless of severity. Additionally, the following positions have specific responsibilities for implementing this specific SOP.

3.1 Corporate Health and Safety Manager (CHSM)

- The CHSM has the responsibility of ensuring that a system is in place for reporting, investigation, correction, and communicating of EHS incidents and near losses.
- The CHSM has the overall responsibility of implementing and communicating the contents of this program to Office Health and Safety Managers (OHSMs).
- The CHSM will review all incidents and corrective actions taken. The CHSM will provide a summary of serious incidents to the Board of Directors.
- The CHSM will communicate learnings from incidents and corrective actions taken to all personnel, through quarterly communications.
- The CHSM will periodically review and evaluate the effectiveness of this procedure.

3.2 Office Manager (OM)

- The OM will designate the individual to serve as the OHSM responsibility for ensuring that requirements in this procedure are met.
- The OM will ensure that sufficient resources are allocated to fulfill the requirements of this procedure.
- The OM will conduct final review of all incident reports prepared under this procedure.

3.3 Office Health and Safety Manager (OHSM)

- It is the responsibility of the OHSM to review draft incident reports and assist the OM in finalizing reports of all accidents, illnesses and incidents related to work activity, and to assist the SHSO when necessary.

- The OHSM may not approve a site-specific HASP unless the HASP includes incident reporting procedures and forms.
- The OHSM will suggest and implement corrective actions to prevent the same type of incident from re-occurring.
- The OHSM will keep all incident reports, corrective action taken, and follow-up forms on file. The OHSM will provide copies of all final reports and forms to the CHSM within one week of the incident. If a serious incident occurs, the CHSM will be notified as soon as possible.
- The occurrence of a serious incident will trigger an EHS audit by the OHSM.

3.4 Project Manager (PM)

- It shall be the PM's responsibility to promptly correct any deficiencies that were determined to cause or contribute to the incident investigated.
- If a site-specific HASP is not utilized, the PM must ensure that field personnel have copies of the Roux Accident Reporting and Investigation Forms.
- The PM has the responsibility of ensuring that the SHSO and other field personnel understand the need for timely incident reporting.
- In the event of an incident, the PM will determine the root cause of the incident with the assistance of the SHSO and/or OHSM. The PM should provide input as to corrective preventative measures.

3.5 Site Health and Safety Officer (SHSO)

- The SHSO shall provide the details of the incident to the OHSM, PM and OM. The OM or his delegate will provide additional notifications, such as, in the event of a work-related motor vehicle accident, to include Roux Legal.
- It is the SHSO's responsibility to immediately notify the OHSM and the PM when any incident occurs. Such notification should take place immediately following the completion of any emergency actions required by the HASP.
- The SHSO should provide input as to corrective preventative measures.
- The SHSO must ensure that corrective actions proposed by the OHSM or OM are carried out.

3.6 All Personnel

- All personnel are responsible for reporting and describing the details of any incident in which they are involved to the SHSO and PM. Such notification should take place immediately following the completion of any emergency actions required by the HASP and after the loss and before the scene is disturbed or vehicles moved.

4. PROCEDURE

4.1 Incident Investigation

On receiving a report of incident or near loss occurrence from a Roux employee, the SHSO or OHSM shall immediately investigate the circumstances and shall make appropriate recommendations to prevent recurrence. The Incident Report form can be found in **Appendix A**, and Near Loss form can be found in **Appendix B**. The OHSM may participate in the investigation of more serious accidents and incidents that occur on-site. The Corporate Health and Safety Manager (CHSM) shall also be immediately notified by telephone on occurrence of a serious accident or incident. At the CHSM's discretion, he may also participate in the investigation.

4.2 Incident Report

Details of the incident shall be documented using the Accident Report and Investigation Forms (Appendix A) within twenty-four (24) hours of the incident and shall be distributed to the SHSO, the OHSM, PM, OM and the CHSM. The CHSM will update OSHA Forms 301 and the 300 log when necessary.

Appendix A – Accident Report and Investigation Form

☐ Roux Environmental Engineering and Geology, D.P.C.
☐ Roux Associates, Inc. ☐ Remedial Engineering, P.C.

ACCIDENT REPORT

Brian Hobbs, Corporate Health and Safety Manager
Cell: (631) 807-0193; Office: (631) 630-2416

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) Date: _____
☐ Final (5-10 days) 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.)

☐CAMP	☐Gauging	☐Subsurface Clearance
☐Construction	☐O&M	☐Trucking
☐Drilling	☐Other Soil Work (e.g. Compaction)	☐Waste Mgmt.
☐Driving	☐Sampling	☐Work Area Prep.
☐Excavation / Trenching	☐Site Walk/Inspection	☐Other

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

Date Investigation Started (MM/DD/YYYY):

Factors, Root Causes, and Solution (FRCS): Complete FRCS form and answer all 7 factor questions. If answering NO to Factors 1 – 4 identify root cause(s) and explain why QIs) occurred. If answering YES to Factors 5 – 7 circle the root cause(s). Transfer the solutions guidance that addresses each root cause from the FRCS form to this form. Attach your completed FRCS Worksheet. If Factors 1-7 do not apply to the incident, write "External Cause" in the Factor column below and leave the remaining fields blank.

DESCRIPTION OF UNDESIRABLE BEHAVIOR/CONDITION

1.

2.

FACTOR(S) AND SOLUTION(S): HOW TO REDUCE POSSIBILITY OF INCIDENT RECURRING
Selection of factors and solutions reflects the analysis of investigation team and is not meant to be a legally binding conclusion as to the Root Cause and/or solution.

CAUSAL FACTOR/ BEHAVIOR/ CONDITION	ROOT CAUSE	SOLUTION(S) [Must Match Root Cause(s)]	PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE

INVESTIGATION TEAM:

PRINT NAME	JOB POSITION	DATE	SIGNATURE

QUALITY REVIEW Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

Name: **Job Title:**

PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)

Date	Solution	Verifier / Validator Name and Job Title	**Details** (of I & V performed)

Appendix B – Near Loss Form

HEALTH & SAFETY NEAR LOSS
ROUX REPORT FORM

☐ **Roux Environmental Engineering and Geology, D.P.C.**
☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**

(Check applicable company name)

PART 1: ADMINISTRATIVE INFORMATION

Office: ☐ New York ☐ Massachusetts ☐ New Jersey ☐ Illinois ☐ CA - Los Angeles ☐ CA - Oakland

Project Manager:	**Project Principal:**
Project Name:	**Project Location:**

PART 2: NEAR LOSS INCIDENT DETAILS

Date\Time Occurred (MM/DD/YYYY HH:MM)**:**	**Date\Time Submitted** (MM/DD/YYYY HH:MM)**:**

NEAR LOSS INCIDENT TYPE - What could have happened? - Select all that apply (1-7)

1. ☐ Fire / Explosion
2. ☐ Injury / Illness
3. ☐ Security (e.g., theft, trespassing, vandalism)
4. ☐ Environmental (Spill, permit exceedance, etc.)
5. ☐ Transportation of personnel (vehicle accident)
6. ☐ Property/Equipment Damage
7. ☐ Business Interruption

Event Leading to Potential Injury/Illness:

Job Task*:	**Equipment Involved*:**

WHAT HAPPENED? Do not include individuals' names. Ensure photos, sketches, etc. are not personally identifiable unless written consent has been obtained.

Summary (1-2 sentences. Provide brief description of the incident. Provide facts only, no speculation or opinion)**:**

Incident Details (Brief factual details of what, where, when; include photos, sketches, etc. as attachments)**:**

Immediate Corrective Actions Taken:

SERIOUS INJURY OR FATALITY (SIF): IF AN ACTUAL SIF, USE EXISTING ROUX ACCIDENT REPORTING FORM

Could this have resulted in a SIF? ☐ **Yes** ☐ **No**

A potential SIF is defined as likely to have caused an injury resulting in significant physical body damage with probable long term and/or life altering complications.

INCIDENT INVOLVED:

Roux Employee: ☐ **Yes** ☐ **No** **Subcontractor Company Name:**

INVESTIGATION TEAM

NAME	JOB TITLE	NAME	JOB TITLE

PART 3: INCIDENT INVESTIGATION FINDINGS AND REPORT QUALITY REVIEW

Date Investigation Started (mm/dd/yyyy):

Factors, Root Causes, and Solution (FRCS): Complete FRCS form and answer all 7 factor questions. If answering NO to Factors 1 – 4 identify root cause(s) and explain why QIs) occurred. If answering YES to Factors 5 – 7 circle the root cause(s). Transfer the solutions guidance that addresses each root cause from the FRCS form to this form. Attach your completed FRCS Worksheet. If Factors 1-7 do not apply to the incident, write "External Cause" in the Factor column below and leave the remaining fields blank. Do not include individuals' names.

DESCRIPTION OF UNDESIRABLE BEHAVIOR/CONDITION

1.

2.

FACTOR(S) AND SOLUTION(S): HOW TO REDUCE POSSIBILITY OF INCIDENT RECURRING
Selection of factors and solutions reflects the analysis of investigation team and is not meant to be a legally binding conclusion as to the Root Cause and/or solution.

Behavior / Condition	Root Cause	Solution(s) (Must Match Root Cause)	Person Responsible for Completion	Completion Target Date	Completion Actual Date

QUALITY REVIEW Correct root cause(s) identified? Do root cause(s) and solution(s) match? Are solution(s) feasible / maintainable?

Name: **Job Title:**

PART 4: Date Solutions were Implemented & Validated (Were Solutions Effective?)

Date	Solution	Verifier / Validator Name and Job Title	**Details** (of I & V performed)

***JOB TASK - Select the most appropriate one** (primary job associated with incident-related work activity, avoid "Other" if possible)

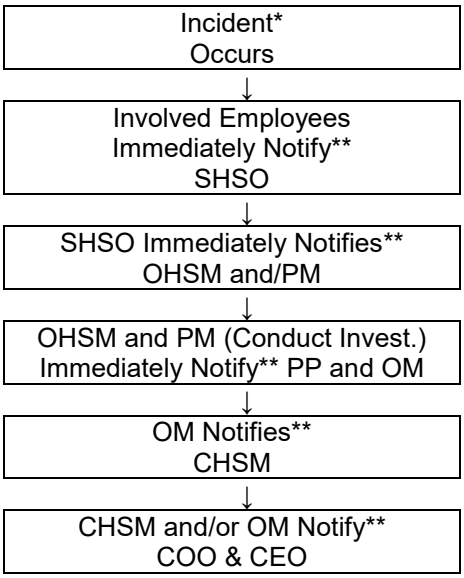
1. CAMP
2. Construction
3. Drilling
4. Driving
5. Excavation/Trenching
6. Gauging
7. O&M
8. Other Soil Work (e.g. Compaction)
9. Sampling
10. Site Walk/ Inspection
11. Subsurface Clearance
12. Trucking
13. Waste Management
14. Work Area Preparation
15. Other

***EQUIPMENT INVOLVED THAT CONTRIBUTED TO H&S NEAR LOSS - Select all that apply**

1. Air Stripper
2. API Separator
3. Automobile
4. Boom Material
5. Bulldozer
6. Cable
7. Carbon Drum / Vessel
8. Chain Block
9. Compressor, Air
10. Control Panel (local)
11. Crane (mobile)
12. Drill Rig
13. Drilling Equipment, Vacuum
14. Drum, Vertical
15. Dump Truck
16. Electric Heater
17. Electrical Power Supply
18. Engine, Combustion
19. Equipment Safety Grounding
20. Excavator / Power Shovel
21. Exclusion Zone Equipment
22 Fan / Blower
23 Fencing
24 Filter
25. Fire Extinguisher
26. Forklift
27. Front End Loader
28. Grader
29. Hammer
30. Knife
31. Non-Powered Equipment
32. Powered Equipment
33. Drill
34. Grinder
35. Hydraulic Torque Wrench
36. Powered Saw
37. Impact Wrench
38. Saw
39. Screwdriver
40. Shears
41. Shovel
42. Snip
43. Wrench
44. Hoist
45, Hook/Clamp/Buckle, etc.
46. Jack
47. Ladder, Extension
48. Ladder, Platform
49. Ladder, Step
50. Lock Out / Tag Out
51. Maintenance Tool, General
52. Manifold
53, Manlift/Basket/Cherry Picker
54. Motor, Electric
55. Oxidizer
56. Pallet
57. Piping
58. Piping, Hose
59. Piping, Injection/Mixing Point
60. Hydrojet
61. Centrifugal Pump
62. Diaphragm Pump
63. Reciprocating Pump
64. Regenerative Pump
65. Rotary Pump
66. Transfer Pump
67. Submersible Pump
68. Face Shield
69. Fall Protection
70. Gloves
71. Hard Hat / Helmet
72. Hearing Protection
73. Respiratory PPE (Chemical)
74. Respiratory PPE (Particulate)
75. Safety Glasses
76. Safety Goggles
77. Safety Shoes / Boots
78. Safety Vest / Clothing
79. Rope
80. Bailer
81. Geoprobe
82. Hand Auger
83. PID
84. Multi-Gas Meter
85. Sample Container
86. Split-Spoon Sampler
87. Sling
88. Snow Blower
89. Snow Plow
90. Space Heater
91. Air Sparging System
92. Carbon Treatment Sys
93. Chemical Oxidation S
94. Dual Phase Product Recovery System
95. Groundwater Pump and Treat System
96. POET System
97. Shed or Trailer
98. Vapor Extraction System
99. Vapor-Phase Treatment System
100. Other System, Type:___
101. Surge Tank
102. Underground Tank
103. Telemetry System
104. Testing Devices
105. Tractor Trailer
106. Truck, Flatbed
107. Truck, Pickup
108. Truck, Tank Truck
109. Truck, Vacuum
110. Safety Valve
111. Block Valve
112. Extraction Well
113. Monitoring Well
114. Recovery Well
115. Winch
116. Wire Rope
117. No Equipment Involved
118. MPT – Traffic Control Devices
118. Not in List (describe):___

Appendix C – Injury Illness Reporting 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.

APPENDIX D

ACORD® Automobile Loss
Notice Form

AUTOMOBILE LOSS NOTICE

DATE (MM/DD/YYYY)

AGENCY	PHONE (A/C, No, Ext):	COMPANY	NAIC CODE:	MISCELLANEOUS INFO (Site & location code)
The Graham Company The Graham Building One Penn Square West Philadelphia, PA 19102	215-567-6300	Starr Indemnity & Liability		
FAX (A/C, No): 215-599-9175				
E-MAIL ADDRESS: CLICK HERE TO SUBMIT TO THE GRAHAM COMPANY				
CODE:	SUB CODE:			
AGENCY CUSTOMER ID: Mallory M. Stanko, Esquire, Claims Consultant				

POLICY NUMBER	POLICY TYPE	REFERENCE NUMBER	CAT #
1000198966171 (AOS)			

EFFECTIVE DATE	EXPIRATION DATE	DATE OF ACCIDENT AND TIME		PREVIOUSLY REPORTED
9/21/17	9/21/18		AM / PM	YES X NO

INSURED

NAME AND ADDRESS	SOC SEC # OR FEIN:
Roux Associates, Inc. 209 Shafter Street Islandia, NY 11749	

RESIDENCE PHONE (A/C, No):

BUSINESS PHONE (A/C, No, Ext):

CELL PHONE (A/C, No):

E-MAIL ADDRESS:

CONTACT

☐ CONTACT INSURED

NAME AND ADDRESS	WHEN TO CONTACT: 9:00 a.m. to 5:00 p.m.	WHERE TO CONTACT
Cindy Albanese, Paralegal		Business

RESIDENCE PHONE (A/C, No):

BUSINESS PHONE (A/C, No, Ext): 631-232-2376

CELL PHONE (A/C, No):

E-MAIL ADDRESS: calbanese@rouxinc.com

LOSS

LOCATION OF ACCIDENT (Include city & state)	AUTHORITY CONTACTED: / REPORT #:	VIOLATIONS/CITATIONS

DESCRIPTION OF ACCIDENT (Use separate sheet, if necessary)

POLICY INFORMATION

BODILY INJURY (Per Person)	BODILY INJURY (Per Accident)	PROPERTY DAMAGE	SINGLE LIMIT	MEDICAL PAYMENT	OTC DEDUCTIBLE	OTHER COVERAGE & DEDUCTIBLES (UM, no-fault, towing, etc.)
			$1,000,000		$1,000	Rental Reimbursement $60 for 60 Days Towing $50 PPV
LOSS PAYEE					COLLISION DED $1,000	

UMBRELLA/EXCESS ☐ UMBRELLA ☐ EXCESS CARRIER: LIMITS: AGGR PER CLAIM/OCC SIR/DED

INSURED VEHICLE

VEH #	YEAR	MAKE:	BODY TYPE:	PLATE NUMBER	STATE
		MODEL:	V.I.N.:		

OWNER'S NAME & ADDRESS

RESIDENCE PHONE (A/C, No):

BUSINESS PHONE (A/C, No, Ext):

DRIVER'S NAME & ADDRESS

☐ (Check if same as owner)

RESIDENCE PHONE (A/C, No):

BUSINESS PHONE (A/C, No, Ext):

RELATION TO INSURED (Employee, family, etc.)	DATE OF BIRTH	DRIVER'S LICENSE NUMBER	STATE	PURPOSE OF USE	USED WITH PERMISSION?
					☐ YES ☐ NO

DESCRIBE DAMAGE

ESTIMATE AMOUNT	WHERE CAN VEHICLE BE SEEN?	WHEN CAN VEH BE SEEN?	OTHER INSURANCE ON VEHICLE

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PROPERTY DAMAGED **VEHICLE?** ☐ YES ☐ NO **YR:** **MAKE:** **MODEL:** **PLATE #:**

DESCRIBE PROPERTY (Other Than Vehicle)	**OTHER VEH/PROP INS?** ☐ YES ☐ NO	**COMPANY OR AGENCY NAME:** **POLICY #:**
OWNER'S NAME & ADDRESS		**RESIDENCE PHONE (A/C, No):** **BUSINESS PHONE (A/C, No, Ext):**
OTHER DRIVER'S NAME & ADDRESS ☐ (Check if same as owner)		**RESIDENCE PHONE (A/C, No):** **BUSINESS PHONE (A/C, No, Ext):**
DESCRIBE DAMAGE		
ESTIMATE AMOUNT	**WHERE CAN DAMAGE BE SEEN?**	

INJURED

NAME & ADDRESS	PHONE (A/C, No)	PED	INS VEH	OTH VEH	AGE	EXTENT OF INJURY
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		

WITNESSES OR PASSENGERS

NAME & ADDRESS	PHONE (A/C, No)	INS VEH	OTH VEH	OTHER (Specify)
		☐	☐	
		☐	☐	
		☐	☐	

REPORTED BY		**REPORTED TO**	
SIGNATURE OF INSURED	**DATE (MM/DD/YYYY)**	**SIGNATURE OF PRODUCER**	**DATE (MM/DD/YYYY)**

REMARKS (Include Adjuster Assigned)

ALL RESERVATIONS OF RIGHTS/DENIAL LETTERS MUST BE SENT TO THE GRAHAM COMPANY FIRST.

ALL FIRST PARTY DRAFTS MUST BE SENT DIRECTLY TO THE GRAHAM COMPANY.

Applicable in Arizona

For your protection, Arizona law requires the following statement to appear on this form. Any person who knowingly presents a false or fraudulent claim for payment of a loss is subject to criminal and civil penalties.

Applicable in Arkansas, Delaware, District of Columbia, Kentucky, Louisiana, Maine, Michigan, New Jersey, New Mexico, North Dakota, Pennsylvania, South Dakota, Tennessee, Texas, Virginia, Washington and West Virginia

Any person who knowingly and with intent to defraud any insurance company or another person, files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact, material thereto, commits a fraudulent insurance act, which is a crime, subject to criminal prosecution and civil penalties. In DC, LA, ME, TN, VA and WA, insurance benefits may also be denied.

Applicable in California

For your protection, California law requires the following to appear on this form: Any person who knowingly presents a false or fraudulent claim for payment of a loss is guilty of a crime and may be subject to fines and confinement in state prison.

Applicable in Colorado

It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance, and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policy holder or claimant for the purpose of defrauding or attempting to defraud the policy holder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado Division of Insurance within the Department of Regulatory Agencies.

Applicable in Florida and Idaho

Any person who knowingly and with the intent to injure, defraud, or deceive any insurance company files a statement of claim containing any false, incomplete or misleading information is guilty of a felony.*

* In Florida - Third Degree Felony

Applicable in Hawaii

For your protection, Hawaii law requires you to be informed that presenting a fraudulent claim for payment of a loss or benefit is a crime punishable by fines or imprisonment, or both.

Applicable in Indiana

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

Applicable in Minnesota

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

Applicable in Nevada

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

Applicable in New Hampshire

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

Applicable in New York

Any person who knowingly and with intent to defraud any insurance company or other person files an application for commercial insurance or a statement of claim for any commercial or personal insurance benefits containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, and any person who in connection with such application or claim knowingly makes or knowingly assists, abets, solicits or conspires with another to make a false report of the theft, destruction, damage or conversion of any motor vehicle to a law enforcement agency, the Department of Motor Vehicles or an insurance company, commits a fraudulent insurance act, which is a crime, and shall also be subject to a civil penalty not to exceed five thousand dollars and the value of the subject motor vehicle or stated claim for each violation.

Applicable in Ohio

Any person who, with intent to defraud or knowing that he/she is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

Applicable in Oklahoma

WARNING: Any person who knowingly and with intent to injure, defraud or deceive any insurer, makes any claim for the proceeds of an insurance policy containing any false, incomplete or misleading information is guilty of a felony.

APPENDIX E

Personal Protective Equipment Management Program

PERSONAL PROTECTIVE EQUIPMENT MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	**:**	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	**:**	**01/19**
REVISION NUMBER	**:**	**4**

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1. PURPOSE

Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") has instituted the following program to establish guidelines for the selection of personal protective equipment (PPE) for use by Roux personnel performing field activities in hazardous environments. PPE is not meant to be a substitute for engineering, work practice, and/or administrative controls, but PPE should be used in conjunction with these controls to protect the employees in the work place. Clothing, body coverings, and other accessories designed to prevent worker exposure to workplace hazards are all types of PPE. To ensure adequate PPE employee-owned PPE is evaluated on a case-by-case basis to insure its adequacy, maintenance and sanitation.

2. SCOPE AND APPLICABILITY

These guidelines apply to all PPE selection decisions to be made in implementing the Roux program. The foundations for this program are the numerous Occupational Health and Safety Administration (OSHA) standards related to PPE cited in 29 CFR 1910 Subpart I, 29 CFR 1926 Subpart E, and the hazardous environment work employee protection requirements under the OSHA Hazardous Waste Operations and Emergency Response (HAZWOPER) standard at 29 CFR 1910.120 and 1926.65. To ensure hazard assessments are documented the levels of protection, types of protection and tasks requiring protection are covered in site-specific Health and Safety Plans (HASPs) and Job Safety Analyses (JSAs).

3. PROCEDURES

Due to the varied nature of site activities and the different potential hazards associated with different sites, several aspects must be considered when selecting PPE. The following text describes PPE selection logic and provides guidelines and requirements for the appropriate selection and use of PPE.

3.1 Introduction

To harm the body, chemicals must first gain entrance. The intact skin and the respiratory tract are usually the first body tissues attacked by chemical contaminants. These tissues provide barriers to some chemicals but in many cases, are damaged themselves or are highly permeable by certain chemical compounds. Personal protective equipment therefore is used to minimize or eliminate chemical compounds coming into contact with these first barrier tissues.

The proper selection of equipment is important in preventing exposures. The PM making the selection will have to take several factors into consideration. The level of protection, type and kind of equipment selected depends on the hazardous conditions and in some cases cost, availability, compatibility with other equipment, and performance. An accurate assessment of all these factors must be made before work can be safely carried out.

3.2 Types of PPE

The type and selection of PPE must meet certain general criteria and requirements as required under OSHA 29 CFR 1910.132 and 1926.95. In addition to these general requirements, specific requirements and specifications exist for some types of PPE that form the basis of the protective clothing scheme. Following is a list of the common types of specific PPE and the specific requirements for the PPE type, where applicable:

1. Hard Hats - Regulated by 29 CFR 1910.135 and 1926.100; and, specified in ANSI Z89.1.

2. Face Shields and Safety Glasses - Regulated by 29 CFR 1910.133 and 1926.102; and, specified in ANSI Z87.1.
3. Respiratory Protection - Regulated by 29 CFR 1910.134 and 1926.103.
4. Hand Protection - Not specifically regulated.
5. Foot Protection - Regulated by 29 CFR 1910.136 and 1926.96; and, specified in ANSI Z41.1.
6. Protective Clothing (e.g., fully encapsulated suits, aprons) - Not specifically regulated.

3.3 Protective Clothing Selection Criteria

3.3.1 Chemicals Present

The most important factor in selecting PPE is the determination of what chemicals the employee may be exposed to. On field investigations, the number of chemicals may range from a few to several hundred. The exact chemicals or group of chemicals present at the site (certain groups tend to require similar protection) can be determined by collecting and analyzing samples of the air, soil, water, or other site media. When data are lacking, research into the materials used or stored at the site can be used to infer chemicals possibly on the site.

Once the known or suspected chemicals have been identified, and taking into consideration the type of work to be performed, the most appropriate clothing shall be selected.

Protective garments are made of several different substances for protection against specific chemicals. There is no universal protective material. All will decompose, be permeated by, or otherwise fail to protect under given circumstances. Fortunately, most manufacturers make guides to the use of their products (i.e., Dupont's Tyvek™ Permeation Guide). These guides are usually for gloves and coveralls and typically provide information regarding chemical degradation rates (failure of the material to maintain structural integrity when in contact with the chemical), and may provide information on the permeation rate (whether or not the material allows the chemical to pass through). When permeation tables are available, they shall be used in conjunction with degradation tables to determine the most appropriate protective material.

During most site work, chemicals are usually in mixed combinations and the protective materials are not in continuous contact with pure chemicals for long periods of time; therefore, the selected material may be adequate for the particular chemical and type of work being performed, yet not the "best" protecting material for all site chemicals and activities. Selection shall depend upon the most hazardous chemicals based on their hazards and concentrations. Sometimes layering, using several different layers of protective materials, affords the best protection.

3.3.2 Concentration of the Chemical(s)

One of the major criteria for selecting protective material is the concentration of the chemical(s) in air, liquid, and/or solid state. Airborne and liquid chemical concentrations should be compared to the OSHA standards and/or American Conference of Governmental Industrial Hygienists (ACGIH) and National Institute for Occupational Safety and Health (NIOSH) guidelines to determine the level of skin or other absorptive surface (e.g., eyes) protection needed. While these standards are not designed specifically for skin exposed directly to the liquid, they may provide skin designations indicative of chemicals known to have significant skin or dermal absorption effects. For example, airborne levels of PCB on-site may be

low because it is not very volatile, so the inhalation hazard may be minimal; however, PCB-containing liquid coming in direct contact with the skin may cause overexposure. Thus, PCB has been assigned a skin designation in both the OSHA and ACGIH exposure limit tables.

3.3.3 Physical State

The characteristics of a chemical may range from nontoxic to extremely toxic depending on its physical state. Inorganic lead in soil would not be considered toxic to site personnel, unless it became airborne, since it is generally not absorbed through the intact skin. Organic lead in a liquid could be readily absorbed. Soil is frequently contaminated with hazardous materials. Concentrations will vary from a few parts per million to nearly one hundred percent. The degree of hazard is dependent on the type of soil and concentration of the chemical. Generally speaking, "dry" soils do not cause a hazard to site personnel if they take minimal precautions such as wearing some type of lightweight gloves.

3.3.4 Length of Exposure

The length of time a material is exposed to a chemical increases the probability of breakthrough. Determinations of actual breakthrough times for short-term exposures indicate that several different materials can be used which would be considered inadequate under long-term exposures. It should be kept in mind that during testing, a pure (100% composition) liquid is usually placed in direct contact with the material producing a worst-case situation.

3.3.5 Abrasion

When selecting protective clothing, the job the employee is engaged in must be taken into consideration. Persons moving drums or performing other manual tasks may require added protection for their hands, lower chest and thighs. The use of leather gloves and a heavy apron over the other normal protective clothing will help prevent damage to the normal PPE and thus reduce worker exposures.

3.3.6 Dexterity

Although protection from skin and inhalation hazards is the primary concern when selecting PPE, the ability to perform the assigned task must be maintained. For example, personnel cannot be expected to perform work that requires fine dexterity if they must wear a thick glove. Therefore, the PPE selection process must consider the task being performed and provide PPE alternatives or techniques that allow dexterity to be maintained while still protecting the worker (e.g., wearing tight latex gloves over more bulky hand protection to increase dexterity).

3.3.7 Ability to Decontaminate

If disposable clothing cannot be used, the ability to decontaminate the materials selected must be taken into consideration. Once a chemical contacts the material, it must be cleaned before it can be reused. If the chemical has completely permeated the material, it is unlikely that the clothing can be adequately decontaminated and the material should be discarded.

3.3.8 Climactic Conditions

The human body works best with few restraints from clothing. Protective clothing adds a burden by adding weight and restricting movement as well as preventing the natural cooling process. In severe situations, a modified work program must be used.

Some materials act differently when they are very hot and very cold. For example, PVC becomes almost brittle in very cold temperatures. If there are any questions about the stability of the protective materials under different conditions, the manufacturer should be contacted.

3.3.9 Work Load

Like climactic conditions, the type of work activity may affect work duration and the ability or personnel to perform certain tasks. Similarly, the amount of protective materials a person wears will affect their ability to perform certain tasks. For example, a person in a total encapsulating suit, even at 72 ^{o}F, cannot work for more than a short period of time without requiring a break.

The work schedule should be adjusted to maintain the health of the employees. Special consideration should be given to the selection of clothing that both protects and adds the least burden when personnel are required to perform strenuous tasks. Excessive bodily stress frequently represents the most significant hazard encountered during field work.

3.4 Types of Protective Materials

1. Cellulose or Paper
2. Natural and Synthetic Fibers
    a. Tyvek™
    b. Nomex™
3. Elastomers
    a. Polyethylene
    b. Saran
    c. Polyvinyl Chloride (PVC)
    d. Neoprene
    e. Butyl Rubber
    f. Viton

3.5 Protection Levels

3.5.1 Level A Protection

Level A protection (a fully encapsulated suit) is used when skin hazards exist or when there is no known data that positively rule out skin and other absorption hazards. Since Level A protection is extremely physiologically and psychologically stressful, the decision to use this protection must be carefully considered. At no time will Level A work be performed without the consent of the OM. The following conditions suggest a need for Level A protection:

- confined facilities where probability of skin contact is high;
- sites containing known skin hazards;
- sites with no established history to rule out skin and other absorption hazards;
- atmosphere immediately dangerous to life and health (IDLH) through the skin absorption route;
- site exhibiting signs of acute mammalian toxicity (e.g., dead animals, illnesses associated with past entry into site by humans);

- sites at which sealed drums of unknown materials must be opened;
- total atmospheric readings on the Photoionization Detector (PID), Flame Ionization Detector (FID), and similar instruments indicate 500 to 1,000 ppm of unidentified substances; and
- extremely hazardous substances (e.g., cyanide compounds, concentrated pesticides, Department of Transportation Poison "A" materials, suspected carcinogens and infectious substances) are known or suspected to be present and skin contact is possible.

The following items constitute Level A protection:

- open circuit, pressure-demand self-contained breathing apparatus (SCBA);
- totally encapsulated suit;
- gloves, inner (surgical type);
- gloves, outer;
- chemical protective;
- boots, chemical protective, steel toe and shank;
- radiation detector (if applicable); and
- communications.

3.5.2 Level B Protection

Level B protection is utilized when the highest level of respiratory protection is needed but hazardous material exposure to the few unprotected areas of the body is unlikely.

The following conditions suggest a need for Level B protection:

- the type and atmospheric concentration of toxic substances have been identified and they require the highest level of respiratory protection;
- IDLH atmospheres where the substance or concentration in the air does not present a severe skin hazard;
- the type and concentrations of toxic substances do not meet the selection criteria permitting the use of air purifying respirators; and
- it is highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of materials that will affect the skin of personnel.

Personal protective equipment for Level B includes:

- open circuit, pressure-demand SCBA;
- chemical protective clothing:
- overalls and long-sleeve jacket; or
- coveralls;
- gloves, inner (surgical type); gloves, outer, chemical protective;
- boots, chemical protective, steel toe and shank; and
- communications optional.

3.5.3 Level C Protection

Level C protection is utilized when both skin and respiratory hazards are well defined and the criteria for the use of negative pressure respirators have been fulfilled (i.e., known contaminants and contaminant concentrations, acceptable oxygen levels, approved filter/cartridge available, known cartridge service life, etc.). Level C protection may require carrying an emergency escape respirator during certain initial entry and site reconnaissance situations, or when applicable thereafter.

Personal protective equipment for Level C typically includes:

- full facepiece air-purifying respirator;
- emergency escape respirator (optional);
- chemical protective clothing:
  - overalls and long-sleeved jacket; or
  - coveralls;
- gloves, inner (surgical type);
- gloves, outer, chemical protective; and
- boots, chemical protective, steel toe and shank.

3.5.4 Level D Protection

Level D is the basic work uniform. Personal protective equipment for Level D includes:

- coveralls;
- safety boots/shoes;
- eye protection;
- hand protection;
- reflective traffic safety vest (mandatory for traffic areas or railyard);
- hard hat (with face shield is optional); and
- emergency escape respirator is optional.

3.5.5 Level E Protection

Level E protection is used when radioactivity above 10 mr/hr is detected at the site. Personal protective equipment for Level E includes:

- coveralls;
- air purifying respirator;
- time limits on exposure;
- appropriate dermal protection for the type of radiation present; and
- radiation dosage monitoring.

3.5.6 Additional Considerations

Field work will contain a variety of situations due to chemicals in various concentrations and combinations. These situations may be partially ameliorated by following the work practices listed below:

1. Some sort of foot protection is needed on a site. If the ground to be worked on is contaminated with liquid and it is necessary to walk in the chemicals, some sort of protective "booties" can be worn over the boots. This cuts down on decontamination requirements. They are designed with soles to help prevent them from slipping around. If non-liquids are to be encountered, a Tyvek™ bootie could be used. If the ground contains any sharp objects, the advantage of booties is questionable. Boots should be worn with either cotton or wool socks to help absorb the perspiration.

2. If the site situation requires the use of hard hats, chin straps should be used if a person will be stooping over where his/her hat may fall off. Respirator straps should not be placed over the hard hats. This will affect the fit of the respirator.

   Some types of protective materials conduct heat and cold readily. In cold conditions, natural material clothing should be worn under the protective clothing. Protective clothing should be removed prior to allowing a person "to get warm". Applying heat, such as a space heater, to the outside of the protective clothing may drive the contaminants through. In hot weather, under clothing will absorb sweat. It is recommended that workers use all cotton undergarments.

3. Body protection should be worn and taped to prevent anything from running into the top of the boot. Gloves should be worn and taped to prevent substances from entering the top of the glove. Duct tape is preferred, but masking tape can be used. When aprons are used, they should be taped across the back for added protection. However, this should be done in such a way that the person has mobility.

4. Atmospheric conditions such as precipitation, temperature, wind direction, wind velocity, and pressure determine the behavior of contaminants in air or the potential for volatile material getting into the air. These parameters should be considered in determining the need for and the level of protection.

5. A program must be established for periodic monitoring of the air during site operations. Without an air monitoring program, any changes would go undetected and might jeopardize response personnel. Monitoring can be done with various types of air pumps and filtering devices followed by analysis of the filtration media; personnel dosimeters; and periodic walk-throughs by personnel carrying real-time survey instruments.

6. For operations in the exclusion zone, different levels of protection may be selected, and various types of chemical-resistant clothing may be worn. This selection should be based on the job function, reason for being in the area, and the potential for skin contact with, or inhalation of, the chemicals present.

7. Escape masks must be readily available when levels of respiratory protection do not include a SCBA and the possibility of an IDLH atmosphere exists. Their use can be made on a case-by-case basis. Escape masks could be strategically located at the site in areas that have higher possibilities of vapors, gases or particulates.

APPENDIX F

Respiratory Protection Management Program

RESPIRATORY PROTECTION MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVISION NUMBER	:	**4**

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1. PURPOSE

The health and safety philosophy of Roux is to use effective engineering controls and administrative controls to eliminate or reduce exposure to respiratory hazards to the point where respirators are not required. The practices and procedures described herein constitute the program under which respiratory protection devices (RPDs) will be effectively utilized during activities that have the potential to result in personnel exposures to airborne hazardous materials. The primary objective of the respiratory protection management program (RPMP) is to prevent harmful exposures to air contaminants that cannot be controlled using accepted engineering control measures (e.g., general and local exhaust ventilation, enclosure or isolation, and substitution of less hazardous processes or materials) or administrative controls (e.g., procedures that minimize exposure to air contaminants). No Roux Associate, Inc. employee is authorized to enter an immediately dangerous to life and health (IDLH) atmosphere; therefore, the program does not allow the use of supplied-air respirators (SARs) or self-contained breathing apparatus (SCBA). Roux has a limited number of employees who are potentially exposed to respiratory hazards during routine operations; the hazards include particulates and toxic chemicals.

The respiratory protective devices will be of the type approved by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) or acceptable to the US Department of Labor, Occupational Safety and Health Administration (OSHA) for the specific contamination to which the employee is potentially exposed. Respiratory protective devices will be appropriate for the hazardous material(s) involved and the extent and nature of the work requirements and conditions.

2. SCOPE AND APPLICABILITY

The practices and procedures described in this program constitute under which respiratory protective device will be effectively utilized during Roux activities involving personnel exposures to hazardous materials. The RPMP applies to all employees who are provided RPDs, or who may be required to wear RPDs to protect their health. The RPMP is intended, in part, to meet the written respiratory protection management program requirements stipulated by OSHA at 29 CFR 1910.134 and 1926.103. All information provided in this program is derived from the OSHA standard; however, to ensure compliance with 1910.134 and 1926.103 requirements, the OSHA standards and applicable mandatory appendices should be consulted (see Appendix C). All respirators, training and medical examinations are provided at no cost to employees. Specific work-site procedures where respirators are required are covered in site-specific Health and Safety Plans (HASPs).

An effective RPMP includes the following elements:

- A written statement of company program, including assignment of individual responsibility, accountability, and authority of required activities of the respiratory protection management program;
- Written standard operating procedures governing the selection and use of respirators;

Respirator selection (from National Institutes for Occupational Safety and Health (NIOSH) and/or Mine Safety and Health Administration (MSHA) approved and certified models) on the basis of hazards to which the worker is exposed;

- Medical examination of workers to determine whether or not they may be assigned an activity where RPDs are required;
- User training in the proper use and limitations of respirators (as well as a way to evaluate the skill and knowledge obtained by the worker through training);
- Respirator fit testing;
- Regular cleaning and disinfecting of respirators;
- Routine inspection of respirators during cleaning;

(Note: Roux has no respirators designated for emergency use so monthly inspections and inspections after each use are not part of this program.);

- Storage or respirators in convenient, clean, and sanitary locations;
- Surveillance for work area conditions and degree of employee exposure (e.g., through air monitoring);
- Regular inspection and evaluation of the continued effectiveness of the program; and
- Recognition and resolution of special problems as they affect respiratory use (e.g., facial hair, eye glasses, etc.).

3. MEDICAL EXAMINATION/CLEARANCE

Only individuals who are medically cleared to wear respiratory protection will be issued RPDs. The use of any type of respirator imposes some physiological stress on the user; therefore, the respirator user must have a medical examination and evaluation performed by or under the supervision of a licensed physician to determine if a current or pre-existing medical condition exists that would be aggravated by respiratory protection. Employees who use respirators will be required to undergo a medical evaluation at the following frequency:

- Prior to assignment of a respirator for those employees who will be issued a negative pressure respirator.
- An employee reports medical signs or symptoms related to their ability to use a respirator.
- A physician, supervisor, or program administrator determines an employee needs to be re-evaluated.
- Information from the respiratory protection management program including observations made during fit testing and program evaluation indicating a need for employee re-evaluation.
- A change occurs in the workplace conditions that may result in a substantial increase in the physiological burden placed on an employee.
- At least annual thereafter.

The employee will be asked to complete a detailed medical questionnaire. It will be administered confidentially during the employee's normal working hours or at a time and place convenient to the employee. It is to be administered in a manner that ensures the employee understands its content. The detailed medical questionnaire will include the following data:

- Medical history (especially a history of asthma, emphysema, high blood pressure, artery disease, and any documented heart or lung problems).

- Work history (previous occupations, past exposures, etc.).
- Any other necessary medical information such as physical deformities, claustrophobia, or poor eye sight.

Medical tests typically conducted during the examination are:

- Pulmonary function
- Chest x-ray
- Blood chemistries
- Eye exam
- Hearing exam
- Electrocardiogram

A physician's statement that the employee can wear a respirator must be maintained on file for each employee required to wear a device. Medical records must be kept for the duration of employment plus 30 years. These examinations are confidential, conducted during normal working hours, and are convenient and understandable. During the examination, the employee is given a chance to discuss the results with the medical professional.

4. APPROVED EQUIPMENT & RESPIRATOR SELECTION

Approved respirators shall be used that provide adequate protection against the particular hazard for which it is designed in accordance with standards established by competent authorities, such as MSHA and NIOSH. To comply with the provisions of the OSHA Standard on Respiratory Protection, 29 CFR 1910.134 & 1926.103, all respiratory protective equipment purchased by Roux will have been tested by NIOSH and will carry a joint NIOSH/MSHA approval for that specific respirator assembly. Company owned respiratory protection equipment will either be maintained by the OHSM in a common equipment storage area or issued to individuals by their OHSM for their personal use as required on a project specific basis. Each respirator, which is individually assigned, will be identified in a way that does not interfere with its performance.

The proper selection of respiratory protection is based on the following factors:

- Actual exposure measurements taken by Health and Safety personnel or the potential for exposure.
- The contaminants' Permissible Exposure Limits (OSHA PELs) or Threshold Limit Values (ACGIH TLVs®) and their toxicology.
- The contaminants' form – gas, vapor or particulate.
- Warning properties of the contaminants.
- The contaminants' concentration or potential maximum concentration.
- Any eye irritating effects of the contaminants.
- The duration of exposure.
- The potential for an Immediately Dangerous to Life or Health (IDLH) atmosphere to exist.

- The availability of NIOSH/MSHA approved respiratory protection devices.
- The approval of the Project Manager, OHSM and CHSM.

5. INSPECTION AND MAINTENANCE

Respirators are properly maintained in order to retain their original effectiveness. This is done through periodic inspection, repair, cleaning, and proper storage.

5.1 Inspection

All respirators are to be inspected routinely by the user before and after each use and during cleaning. Items to check include: the condition of the facepiece, head bands, valves and hoses; and the canister, filter or cartridge fit.

5.2 Maintenance

Respiratory protection, which does not pass inspection, is to be replaced or repaired immediately. Repair of the device by the user will be limited to changing canisters, cartridges, filters, and head straps. Substitution of parts from different brands or types of respirators invalidates NIOSH/MSHA approval of the device. All other replacements or repairs are to be performed by the supplier of the device.

No attempt will be made to replace components or make adjustments, modifications, or repairs beyond the manufacturer's recommendations.

5.3 Reporting Respirator Problems:

Occasionally, an employee may find a defect in the design or performance of a respirator. The best course to follow is to report these findings to the Program Administrator, CHSM. If the respirator carries the approval of MSHA and NIOSH, the Program Administrator will report the findings to the respirator manufacturer and NIOSH. This will be done by notifying the manufacturer of the defect in a report format and forwarding a copy of the report to NIOSH. The report will include the following:

- Roux name, address, and telephone number;
- The name of the respirator manufacturer;
- The model number of respirator;
- The name and part number (if possible) of the defective part;
- The lot number and/or serial number of the respirator and/or defective part;
- A brief description of respirator usage when the defect was discovered;
- A description of the defect; and
- A description of the defect's adverse effect on respirator performance.

This report should be addressed to:

NIOSH Division of Safety Research
1095 Willowdale Road
Morgantown, WV 26505-2888

6. CLEANING AND DISINFECTING

Individually assigned RPDs are cleaned and disinfected as frequently as necessary to ensure proper protection is provided for the wearer. Respirators used in fit testing must be cleaned and disinfected after each use.

The following procedure is used for cleaning and disinfecting respirators:

- Employee leaves the work area for removal, cleaning, or discarding of his respirator. Filters, cartridges, or canisters are removed before washing the respirator and/or discarding, as necessary.
- Wash components in warm (43°C [110°F] maximum) water with a mild detergent or with a cleaner recommended by the manufacturer. A stiff bristle (not wire) brush may be used to facilitate the removal of dirt.
- Rinse components thoroughly in clean, warm (43oC [110oF] maximum), preferably running water. Drain. The importance of thorough rinsing cannot be overemphasized. Detergents or disinfectants that dry on facepieces may result in dermatitis. In addition, some disinfectants may cause deterioration of rubber or corrosion of metal parts if not completely removed.
- If the cleaner used does not contain a disinfecting agent, respirator components should be immersed for two minutes in one of the following:
    - Hypochlorite solution (50 ppm of chlorine) made by adding approximately one milliliter of laundry bleach to one liter of water at 43°C [110°F]; or
    - Aqueous solution of iodine (50 ppm iodine) made by adding approximately 0.8 milliliters of tincture of iodine (6-8 grams ammonium and/or potassium iodine/100 cc 45% alcohol) to one liter of water at 43°C [110°F]; or
    - Other commercially available cleansers of equivalent disinfectant quality when used as directed, if their use is recommended or approved by the respirator manufacturer.
- Components should be hand-dried with a clean, lint-free cloth or air dried.
- Reassemble facepiece, replacing filters, cartridges, and canisters where necessary.
- Test the respirator to ensure all components work properly.

7. STORAGE

When it is not being used, the respirator should be individually sealed in a plastic bag/container to protect it against dust, sunlight, extreme temperatures, excessive moisture, or damaging chemicals. It should be stored in such a way that the facepiece and exhalation valve are not being distorted.

8. TRAINING

Training shall be conducted by the Program Administrator or authorized representative (OHSM/SHSM). Respirators will not be issued to individuals who have not received appropriate training, fit testing, and medical clearance. The extent and frequency of employee training depends primarily on the nature and extent of the hazard. As a minimum, all respirator users will be retrained annually, when new types of respirators are used or when inadequacies in the employee's knowledge or use indicate need. Every employee who may have to wear a respirator will be trained in this Program and the proper use of the respirator.

The training includes:

- A review of this Program;
- Descriptions of the respirators;
- Intended use and limitations of the devices;
- Proper wearing, adjustment and testing for fit;
- Cleaning and storage methods; and
- Inspection and maintenance procedures.

This training is repeated as necessary, and at least annually, to ensure that users remain familiar with the proper use of respiratory protection. This training may be conducted as part of the annual hazardous waste (i.e., HAZWOPER) training program.

9. RECORDS

The following record is maintained by the Office Health and Safety Manager:

- The number and types of respirators in use.

The following record is to be maintained by the OHSM:

- A record of employee training programs.

The following record is to be maintained by the Human Resources Manager:

- Medical certification that the employee is capable of wearing a respirator under his/her given work conditions.

Records are kept in accordance with 29 CFR 1910.1020.

10. PROGRAM EVALUATION

The Corporate Health and Safety Manager will evaluate the program's effectiveness at least annually to assess the overall effectiveness of the Respiratory Protection Management Program. Specific evaluation will include inspection, maintenance, cleaning, storage; monitoring and use procedures to ensure desired results are consistently achieved. This evaluation includes employee input on respirator fit, selection, use and maintenance and any other concerns expressed by the employee. The Program evaluation requires consultation with employees. Program adjustments will be made as necessary to reflect the evaluation results.

APPENDIX A – CAPABILITIES AND LIMITATIONS OF RESPIRATORS

Capabilities And Limitations Of Respirators

Air-Purifying Respirators

General Limitations: Air-purifying respirators do not protect against oxygen deficient atmosphere or against skin irritations by, or sorption through the skin of airborne contaminants.

The maximum contaminant concentration against which an APR will protect is determined by the design efficiency and capacity of the cartridge, canister, or filter and the face piece-to-face seal on the user. For gases and vapors the maximum concentration for which the air-purifying element is designed is specified by the manufacturer or is listed on labels of cartridges and canisters.

Non-powered air-purifying respirators will not provide the maximum design protection specified unless the respirator is carefully fitted to the wearer's face to prevent inward leakage. The time period over which protection is provided is dependent on canister, cartridge, or filter type; concentrations of contaminant; humidity levels in the ambient atmosphere; and the wearer's respiratory rate.

The proper type of canister, cartridge, or filter must be selected for the particular atmosphere and conditions. Non-powered APRs may cause discomfort due to a noticeable resistance to inhalation. This problem is minimized in powered respirators. Respirator face pieces present special problems to individuals required to wear prescription lenses. These devices do have the advantage of being small, light, and simple in operation.

Use of air-purifying respirators in atmospheres immediately dangerous to life or health is limited to specific devices under specified conditions.

Vapor and Gas Removing Respirators

Limitations: No protection is provided against particulate contaminants. A rise in canister or cartridge temperature indicates a gas or vapor is being removed from the inspired air.

An uncomfortably high temperature indicates a high concentration of gas or vapor and requires an immediate return to fresh air.

Use should be avoided in atmospheres where the contaminant(s) lacks sufficient warning properties (i.e., odor, taste, or irritation at a concentration in air at or above the permissible exposure limit or TLV®.). Vapor and gas removing respirators are not approved for contaminants that lack adequate warning properties.

Not for use in atmospheres immediately dangerous to life or health unless the device is a powered type respirator with escape provisions.

(1) Full Facepiece Respirator
   - Provides protection against eye irritation in addition to respiratory protection.

(2) Quarter Mask and Half Mask Facepiece Respirator
   - A fabric covering (facelet) available from some manufacturers shall *not* be used.

Particulate-Removing Respirators

Limitations: Protection against non-volatile particles only. No protection against gases and vapors.

Combination Particulate and Vapor Gas Removing Respirators

Not for use in atmospheres immediately dangerous to life or health unless the device is a powered-type respirator with escape provisions.

(1) Full Facepiece Respirator.

- Provides protection against eye irritation in addition to respiratory protection.

(2) Quarter-Mask and Half-Mask Facepiece Respirator.

- A fabric covering (facelet) available from some manufacturers shall *not* be used unless approved for use with respirator.

Combination Particulate and Vapor Gas Removing Respirators

The advantages and disadvantages of the component sections of the combination respirator as described above apply.

APPENDIX B – RESPIRATOR FITTING

Respirator Fitting

1. **Most important point:** the topic of Respirator Fitting only applies to respirators having TIGHT-FITTING FACEPIECES.

2. **Respirator Seal Checks:**
   (a) Applies to all tight-fitting respirators.
   (b) Two seal checks: positive and negative pressure.
   (c) Both seal checks must be performed before each use and if the wearer questions the fit during each use.
   (d) These seal checks are the wearer's way of assuring, on a daily basis, that there is an adequate seal of the facepiece to his/her face, thereby assuring the optimum performance from the respirator.
   (e) Seal Checks are required by the OSHA Respiratory Protection Standard, 29 CFR 1910.134(g)(1)(iii).

3. **Respiratory Fit Tests:**
   (a) Purpose: Size Selection. Fit testing enables you to select the best-fitting size and make for a certain individual within a pre-determined type of respirator, such as half-mask air-purifying.
   (b) Two types of fit tests: Qualitative and Quantitative.
      i. **Qualitative Fit Tests:**
         1. Rely on wearer's subjective response to irritation, odor, and/or taste.
         2. Advantages: fast, no complicated equipment, and easily performed in the field.
         3. Disadvantages: since they rely on the wearer's subjective response, they are not entirely reliable.
         4. Three types of validated qualitative fit tests: Irritant Smoke (Stannic Chloride) Test; Banana Oil (Isoamyl Acetate) Test; and Taste (Saccharin Solution) Test.

      ii. **Quantitative Fit Tests:**
         1. Two types: Aerosol Generation System and Ambient Aerosol System.
            a. With the Aerosol Generation system (e.g., Dynatech-Frontier), facepiece leakage is quantified by the use of a detecting instrument and a test aerosol such as corn oil, di(2-ethylhexyl) sebacate (DEHS), polyethylene glycol 400 (PEG-400), and sodium chloride. The instrument measures the concentration of test aerosol outside the respirator and inside the respirator. From these values, a fit factor (FF) can be calculated (FF = Conc. Out/Conc. In). The higher the FF, the better fitting is the respirator.
            b. With the Ambient Aerosol System (e.g., TSI Portacount), the concentrations of ambient particles outside and inside the respirator are measured to derive a fit factor.

2. Advantages of quantitative fit tests: numerical fit is derived (FF), permanent documentation is produced, and tests do not depend on subjective responses.
3. Disadvantages: Expensive, trained operators required, and time consuming.

4. **Respirator Fitting Guidelines:**

(a) For all tight-fitting respirators, perform both seal checks before each use and during each use if the wearer questions the fit.

(b) For tight-fitting respirators operated in a negative pressure mode, comply with the qualitative/quantitative fit test requirements described in the applicable substance-specific OSHA standards:

- ***Acrylonitrile**, 29CFR1910.1045(h)*: qualitative or quantitative fit testing required initially and every 6 months thereafter; quantitative fit testing required if more than 10 employees.
- ***Arsenic**, 29CFR1910.1018(h):* qualitative or quantitative fit testing required initially and every 6 months thereafter; quantitative fit testing required if more than 20 employees.
- ***Benzene**, 29CFR1910.1028(g):* qualitative or quantitative fit testing required initially and annually thereafter; cookbook qualitative and quantitative fit testing procedures are included in an appendix.
- ***Chromium, Hexavalent**, 29CFR1910.1026*: follow requirements in 29CFR1910.134.
- ***Formaldehyde**, 29CFR1910.1048(g)*: qualitative or quantitative fit testing required initially and annually thereafter; cookbook qualitative and quantitative fit testing procedures are included in an appendix.
- ***Lead**, 29CFR1910.1025(f):* qualitative or quantitative fit testing required initially and every 6 months thereafter; cookbook qualitative fit test procedures are included in an appendix.

(c) If the air contaminant of interest is not covered by the preceding substance-specific OSHA standards, follow the 1910.134 requirements. Fit testing shall be performed on at least an annual basis for individuals requiring regular or periodic (more than once per year) respirator use.

(d) Fit test materials:

- Irritant smoke tubes and aspirator bulb; OR
- Banana oil (isoamyl acetate);
- 1 ml disposable pipettes;
- 55-gallon drum liners, and
- 1 quart wide-mouth canning jars with metric graduations, distilled (non-ozonated) water, and paper towels.

APPENDIX C – FIT TEST PROTOCOLS AND PROCEDURES OSHA 1910.134

Appendix A to § 1910.134: Fit Testing Procedures (Mandatory)

Part I. OSHA-Accepted Fit Test Protocols

A. Fit Testing Procedures—General Requirements

The employer shall conduct fit testing using the following procedures. The requirements in this appendix apply to all OSHA-accepted fit test methods, both QLFT and QNFT.

1. The test subject shall be allowed to pick the most acceptable respirator from a sufficient number of respirator models and sizes so the respirator is acceptable to, and correctly fits, the user.
2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine an acceptable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, because it is only a review.
3. The test subject shall be informed that he/she is being asked to select the respirator that provides the most acceptable fit. Each respirator represents a different size and shape, and if fitted and used properly will provide adequate protection.
4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those that obviously do not give an acceptable fit.
5. The more acceptable facepieces are noted in case the one selected proves unacceptable; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in the following item 6. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.
6. Assessment of comfort shall include a review of the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:
   (a) Position of the mask on the nose;
   (b) Room for eye protection;
   (c) Room to talk; and
   (d) Position of mask on face and cheeks.
7. The following criteria shall be used to help determine the adequacy of the respirator fit:
   (a) Chin properly placed;
   (b) Adequate strap tension, not overly tightened;
   (c) Fit across nose bridge;
   (d) Respirator of proper size to span distance from nose to chin;
   (e) Tendency of respirator to slip; and
   (f) Self-observation in mirror to evaluate fit and respirator position.
8. The test subject shall conduct a user seal check; either the negative and positive pressure seal checks described in Appendix B-1 of this section or those recommended by the respirator manufacturer which provide equivalent protection to the procedures in Appendix B-1. Before conducting the negative and positive pressure checks, the subject shall be told to seat the mask

on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the user seal check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, mustache, or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician or other licensed health care professional, as appropriate, to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. **Exercise regimen**. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. The fit test shall be performed while the test subject is wearing any applicable safety equipment that may be worn during actual respirator use that could interfere with respirator fit.

14. **Test Exercises.** (a) Employers must perform the following test exercises for all fit testing methods prescribed in this appendix, except for the CNP quantitative fit testing protocol and the CNP REDON quantitative fit testing protocol. For these two protocols, employers must ensure that the test subjects (i.e., employees) perform the exercise procedure specified in Part I.C.4(b) of this appendix for the CNP quantitative fit testing protocol, or the exercise procedure described in Part I.C.5(b) of this appendix for the CNP REDON quantitative fit-testing protocol. For the remaining fit testing methods, employers must ensure that employees perform the test exercises in the appropriate test environment in the following manner:

    (a) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

    (b) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as not to hyperventilate.

    (c) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily, so the subject can inhale at each side.

    (d) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

    (e) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the “Rainbow Passage,” count backward from 100, or recite a memorized poem or song.

    Rainbow Passage
    When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(f) Grimace. The test subject shall grimace by smiling or frowning. (This applies only to QNFT testing; it is not performed for QLFT)

(g) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT or QLFT units that do not permit bending over at the waist.

(h) Normal breathing. Same as exercise (1).

15. Each test exercise shall be performed for one minute, except for the grimace exercise which shall be performed for 15 seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried. The respirator shall not be adjusted once the fit test exercises begin. Any adjustment voids the test, and the fit test must be repeated.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

Note: This protocol is not appropriate to use for the fit testing of particulate respirators. If used to fit test particulate respirators, the respirator must be equipped with an organic vapor filter.

(a) *Odor Threshold Screening*

Odor threshold screening, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate at low levels.

(1) Three 1-liter glass jars with metal lids are required.

(2) Odor-free water (e.g., distilled or spring water) at approximately 25°C (77°F) shall be used for the solutions.

(3) The isoamyl acetate (IAA) (also known at isopentyl acetate) stock solution is prepared by adding 1 ml of pure IAA to 800 ml of odor-free water in a 1-liter jar, closing the lid and shaking for 30 seconds. A new solution shall be prepared at least weekly.

(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well-ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.

(5) The odor test solution is prepared in a second jar by placing 0.4 ml of the stock solution into 500 ml of odor-free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(6) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

(7) The odor test and test blank jar lids shall be labeled (e.g., 1 and 2) for jar identification. Labels shall be placed on the lids so that they can be peeled off periodically and switched to maintain the integrity of the test.

(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell

banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) *Isoamyl Acetate Fit Test*

(1) The fit test chamber shall be a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. If no drum liner is available, a similar chamber shall be constructed using plastic sheeting. The inside top center of the chamber shall have a small hook attached.

(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well-ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 ml of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber. An IAA test swab or ampule may be substituted for the IAA wetted paper towel provided it has been demonstrated that the alternative IAA source will generate an IAA test atmosphere with a concentration equivalent to that generated by the paper towel method.

(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

(7) If at any time during the test, the subject detects the banana-like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (b) (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait at least 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(9) If the subject passes the test, the efficiency of the test procedure shall be demonstrated by having the subject break the respirator face seal and take a breath before exiting the chamber.

(10)When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so that there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing plastic bag to keep the test area from being contaminated.

3. Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) *Taste threshold screening*. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a sweet taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. The nozzle is directed away from the nose and mouth of the person. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution is prepared by dissolving 0.83 gram of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so it collapses completely, then released and allowed to fully expand.

(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted. If the test subject reports tasting the sweet taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted. If the test subject reports tasting the sweet taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject is unable to taste saccharin and may not perform the saccharin fit test.

(12) Note to paragraph 3. (a): If the test subject eats or drinks something sweet before the screening test, he/she may be unable to taste the weak saccharin solution.

(13) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(14) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(15) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(b) *Saccharin solution aerosol fit test procedure*

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure described in 3. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected in section I. A. of this appendix. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through the slightly open mouth with tongue extended, and report if he/she tastes the sweet taste of saccharin.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of saccharin fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test. A minimum of 10 squeezes is required.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the original number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected. If the test subject does not report tasting the saccharin, the test is passed.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

(12) Since the nebulizer has a tendency to clog during use, the test operator must make periodic checks of the nebulizer to ensure that it is not clogged. If clogging is found at the end of the test session, the test is invalid.

4. Bitrex™ (Denatonium Benzoate) Solution Aerosol Qualitative Fit Test Protocol

The Bitrex™ (Denatonium benzoate) solution aerosol QLFT protocol uses the published saccharin test protocol because that protocol is widely accepted. Bitrex™ is routinely used as a taste aversion agent in household liquids which children should not be drinking and is endorsed by the American Medical Association, the National Safety Council, and the American Association of Poison Control Centers. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) *Taste Threshold Screening*

The Bitrex™ taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of Bitrex™.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches (30.5 cm) in diameter by 14 inches (35.6 cm) tall. The front portion of the enclosure shall be clear from the respirator and allow free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4-inch (1.9 cm) hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his or her slightly open mouth with tongue extended. The subject is instructed to report when he/she detects a bitter taste.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the Threshold Check Solution into the enclosure. This Nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The Threshold Check Solution is prepared by adding 13.5 milligrams of Bitrex™ to 100 ml of 5% salt (NaCl) solution in distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that the bulb collapses completely, and is then released and allowed to fully expand.

(7) An initial ten squeezes are repeated rapidly and then the test subject is asked whether the Bitrex™ can be tasted. If the test subject reports tasting the bitter taste during the ten squeezes, the screening test is completed. The taste threshold is noted as ten regardless of the number of squeezes actually completed.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the Bitrex™ is tasted. If the test subject reports tasting the bitter taste during the second ten squeezes, the screening test is completed. The taste threshold is noted as twenty regardless of the number of squeezes actually completed.

(9) If the second response is negative, ten more squeezes are repeated rapidly, and the test subject is again asked whether the Bitrex™ is tasted. If the test subject reports tasting the bitter taste during the third set of ten squeezes, the screening test is completed. The taste threshold is noted as thirty regardless of the number of squeezes actually completed.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the Bitrex™ is not tasted after 30 squeezes (step 10), the test subject is unable to taste Bitrex™ and may not perform the Bitrex™ fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken to dry, and refilled at least each morning and afternoon or at least every four hours.

(b) *Bitrex™ Solution Aerosol Fit Test Procedure*

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure as that described in 4. (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected according to section I. A. of this appendix. The respirator shall be properly adjusted and equipped with any type particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 337.5 mg of Bitrex™ to 200 ml of a 5% salt (NaCl) solution in warm water.

(6) As before, the test subject shall breathe through his or her slightly open mouth with tongue extended, and be instructed to report if he/she tastes the bitter taste of Bitrex™.

(7) The nebulizer is inserted into the hole in the front of the enclosure and an initial concentration of the fit test solution is sprayed into the enclosure using the same number of squeezes (either 10, 20 or 30 squeezes) based on the number of squeezes required to elicit a taste response as noted during the screening test.

(8) After generating the aerosol, the test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes used initially (e.g., 5, 10 or 15).

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of Bitrex™ is detected. If the test subject does not report tasting the Bitrex™, the test is passed.

(11) If the taste of Bitrex™ is detected, the fit is deemed unsatisfactory and the test is failed. A different respirator shall be tried and the entire test procedure is repeated (taste threshold screening and fit testing).

5. Irritant Smoke (Stannic Chloride) Protocol

This qualitative fit test uses a person's response to the irritating chemicals released in the "smoke" produced by a stannic chloride ventilation smoke tube to detect leakage into the respirator.

(a) *General Requirements and Precautions*

(1) The respirator to be tested shall be equipped with high efficiency particulate air (HEPA) or P100 series filter(s).

(2) Only stannic chloride smoke tubes shall be used for this protocol.

(3) No form of test enclosure or hood for the test subject shall be used.

(4) The smoke can be irritating to the eyes, lungs, and nasal passages. The test conductor shall take precautions to minimize the test subject's exposure to irritant smoke. Sensitivity varies, and certain individuals may respond to a greater degree to irritant smoke. Care shall be taken when performing the sensitivity screening checks that determine whether the test subject can detect irritant smoke to use only the minimum amount of smoke necessary to elicit a response from the test subject.

(5) The fit test shall be performed in an area with adequate ventilation to prevent exposure of the person conducting the fit test or the build-up of irritant smoke in the general atmosphere.

(b) *Sensitivity Screening Check*

The person to be tested must demonstrate his or her ability to detect a weak concentration of the irritant smoke.

(1) The test operator shall break both ends of a ventilation smoke tube containing stannic chloride and attach one end of the smoke tube to a low flow air pump set to deliver 200 milliliters per minute, or an aspirator squeeze bulb. The test operator shall cover the other end of the smoke tube with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(2) The test operator shall advise the test subject that the smoke can be irritating to the eyes, lungs, and nasal passages and instruct the subject to keep his/her eyes closed while the test is performed.

(3) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties and to determine if he/she can detect the irritating properties of the smoke. The test operator shall carefully direct a small amount of the irritant smoke in the test subject's direction to determine that he/she can detect it.

(c) *Irritant Smoke Fit Test Procedure*

(1) The person being fit tested shall don the respirator without assistance and perform the required user seal check(s).

(2) The test subject shall be instructed to keep his/her eyes closed.

(3) The test operator shall direct the stream of irritant smoke from the smoke tube toward the face seal area of the test subject, using the low flow pump or the squeeze bulb. The test operator shall begin at least 12 inches from the facepiece and move the smoke stream around the whole perimeter of the mask. The operator shall gradually make two more passes around the perimeter of the mask, moving to within six inches of the respirator.

(4) If the person being tested has not had an involuntary response and/or detected the irritant smoke, proceed with the test exercises.

(5) The exercises identified in section I.A. 14. of this appendix shall be performed by the test subject while the respirator seal is being continually challenged by the smoke, directed around the perimeter of the respirator at a distance of six inches.

(6) If the person being fit tested reports detecting the irritant smoke at any time, the test is failed. The person being retested must repeat the entire sensitivity check and fit test procedure.

(7) Each test subject passing the irritant smoke test without evidence of a response (involuntary cough, irritation) shall be given a second sensitivity screening check, with the smoke from the same smoke tube used during the fit test, once the respirator has

been removed, to determine whether he/she still reacts to the smoke. Failure to evoke a response shall void the fit test.

(8) If a response is produced during this second sensitivity check, then the fit test is passed.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable: Quantitative fit testing using a non-hazardous test aerosol (such as corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS], or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator; Quantitative fit testing using ambient aerosol as the test agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit; Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General

(a) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and ensure that test equipment is in proper working order.

(b) The employer shall ensure that QNFT equipment is kept clean, and is maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated Aerosol Quantitative Fit Testing Protocol

(a) *Apparatus*

(1) Instrumentation: Aerosol generation, dilution, and measurement systems using particulates (corn oil, polyethylene glycol 400 [PEG 400], di-2-ethyl hexyl sebacate [DEHS] or sodium chloride) as test aerosols shall be used for quantitative fit testing.

(2) Test chamber: The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the test agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the test agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(3) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high efficiency particulate air (HEPA) or P100 series filter supplied by the same manufacturer.

(4) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the test agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers that integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(5) The combination of substitute air-purifying elements, test agent, and test agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the test agent at any time during the testing process, based upon the length of the exposure and the exposure limit duration.

(6) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free-air flow is allowed into the sampling line at all times, and there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test

subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 1/4 inch.

(7) The test setup shall permit the person administering the test to observe the test subject inside the chamber during the test.

(8) The equipment generating the test atmosphere shall maintain the concentration of test agent constant to within a 10 percent variation for the duration of the test.

(9) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.

(10) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(11) The exhaust flow from the test chamber shall pass through an appropriate filter (i.e., high efficiency particulate filter [or P100 series filter]) before release.

(12) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(13) The limitations of instrument detection shall be taken into account when determining the fit factor.

(14) Test respirators shall be maintained in proper working order and be inspected regularly for deficiencies such as cracks or missing valves and gaskets.

(b) *Procedural Requirements*

(1) When performing the initial user seal check using a positive or negative pressure check, the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these pressure checks.

(2) The use of an abbreviated screening QLFT test is optional. Such a test may be utilized in order to quickly identify poor fitting respirators that passed the positive and/or negative pressure test and reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.

(3) A reasonably stable test agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain types of test units, the determination of the test agent's stability may be established after the test subject has entered the test environment.

(4) Immediately after the subject enters the test chamber, the test agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.

(5) A stable test agent concentration shall be obtained prior to the actual start of testing.

(6) Respirator restraining straps shall not be over-tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use. The respirator shall not be adjusted once the fit test exercises begin.

(7) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.

(8) Calculation of fit factors

(i) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.

(ii) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e., 7 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

(iii) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(A) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers that calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(B) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(C) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.

(D) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

$$Overall\ Fit\ Factor = \frac{Number\ of\ excercises}{1/ff_1 + 1/ff_2 + 1/ff_3 + 1/ff_4 + 1/ff_5 + 1/ff_6 + 1/ff_7 + 1/ff_8}$$

Where: ff_1, ff_2, ff_3, etc. are the fit factors for exercises 1, 2, 3, etc.

(9) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.

(10) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media.

3. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount™) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, which allows the probe to sample the air from inside the mask. A probed respirator is required for each make, style, model, and size that the employer uses and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer, TSI Inc., also

provides probe attachments (TSI sampling adapters) that permit fit testing in an employee's own respirator. A minimum fit factor pass level of at least 100 is necessary for a half-mask respirator and a minimum fit factor pass level of at least 500 is required for a full facepiece negative pressure respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) *Portacount Fit Test Requirements*

(1) Check the respirator to make sure the sampling probe and line are properly attached to the facepiece and that the respirator is fitted with a particulate filter capable of preventing significant penetration by the ambient particles used for the fit test (e.g., NIOSH 42 CFR 84 series 100, series 99, or series 95 particulate filter) per manufacturer's instructions.

(2) Instruct the person to be tested to don the respirator for five minutes before the fit test starts. This purges the ambient particles trapped inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual shall already have been trained on how to wear the respirator properly.

(3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendency of the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.

(4) Have the person wearing the respirator do a user seal check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same model respirator, or another model of respirator.

(5) Follow the manufacturer's instructions for operating the Portacount and proceed with the test.

(6) The test subject shall be instructed to perform the exercises in section I. A. 14. of this appendix.

(7) After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of respirator shall be tried.

(b) *Portacount Test Instrument*

(1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

(2) Since the pass or fail criterion of the Portacount is user programmable, the test operator shall ensure that the pass or fail criterion meet the requirements for minimum respirator performance in this Appendix.

(3) A record of the test needs to be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style, and size of respirator used; and date tested.

4. Controlled negative pressure (CNP) quantitative fit testing protocol

The CNP protocol provides an alternative to aerosol fit test methods. The CNP fit test method technology is based on exhausting air from a temporarily sealed respirator facepiece to generate and then maintain a constant negative pressure inside the facepiece. The rate of air exhaust is controlled so that a constant negative pressure is maintained in the respirator during the fit test. The level of pressure is selected to replicate the mean inspiratory pressure that causes leakage into the respirator under normal use conditions. With pressure held constant, air flow out of the

respirator is equal to air flow into the respirator. Therefore, measurement of the exhaust stream that is required to hold the pressure in the temporarily sealed respirator constant yields a direct measure of leakage air flow into the respirator. The CNP fit test method measures leak rates through the facepiece as a method for determining the facepiece fit for negative pressure respirators. The CNP instrument manufacturer Occupational Health Dynamics of Birmingham, Alabama also provides attachments (sampling manifolds) that replace the filter cartridges to permit fit testing in an employee's own respirator. To perform the test, the test subject closes his or her mouth and holds his/her breath, after which an air pump removes air from the respirator facepiece at a pre-selected constant pressure. The facepiece fit is expressed as the leak rate through the facepiece, expressed as milliliters per minute. The quality and validity of the CNP fit tests are determined by the degree to which the in-mask pressure tracks the test pressure during the system measurement time of approximately five seconds. Instantaneous feedback in the form of a real-time pressure trace of the in-mask pressure is provided and used to determine test validity and quality. A minimum fit factor pass level of 100 is necessary for a half-mask respirator and a minimum fit factor of at least 500 is required for a full facepiece respirator. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) *CNP Fit Test Requirements*

(1) The instrument shall have a non-adjustable test pressure of 15.0 mm water pressure.

(2) The CNP system defaults selected for test pressure shall be set at -- 15 mm of water (-0.58 inches of water) and the modeled inspiratory flow rate shall be 53.8 liters per minute for performing fit tests.

(Note: CNP systems have built-in capability to conduct fit testing that is specific to unique work rate, mask, and gender situations that might apply in a specific workplace. Use of system default values, which were selected to represent respirator wear with medium cartridge resistance at a low-moderate work rate, will allow inter-test comparison of the respirator fit.)

(3) The individual who conducts the CNP fit testing shall be thoroughly trained to perform the test.

(4) The respirator filter or cartridge needs to be replaced with the CNP test manifold. The inhalation valve downstream from the manifold either needs to be temporarily removed or propped open.

(5) The employer must train the test subject to hold his or her breath for at least 10 [20] seconds.

(6) The test subject must don the test respirator without any assistance from the test administrator who is conducting the CNP fit test. The respirator must not be adjusted once the fit-test exercises begin. Any adjustment voids the test, and the test subject must repeat the fit test.

(7) The QNFT protocol shall be followed according to section I. C. 1. of this appendix with an exception for the CNP test exercises.

(b) *CNP Test Exercises*

(1) Normal breathing: In a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject needs to hold head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, being careful not to hyperventilate. After the deep breathing

exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during test measurement.

(3) Turning head side to side: Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side. After the turning head side to side exercise, the subject needs to hold head full left and hold his or her breath for 10 seconds during test measurement. Next, the subject needs to hold head full right and hold his or her breath for 10 seconds during test measurement.

(4) Moving head up and down: Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling). After the moving head up and down exercise, the subject shall hold his or her head full up and hold his or her breath for 10 seconds during test measurement. Next, the subject shall hold his or her head full down and hold his or her breath for 10 seconds during test measurement.

(5) Talking: The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute. After the talking exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(6) Grimace: The test subject shall grimace by smiling or frowning for 15 seconds.

(7) Bending Over: The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud-type QNFT units that prohibit bending at the waist. After the bending over exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement.

(8) Normal Breathing: The test subject shall remove and re-don the respirator within a one-minute period. Then, in a normal standing position, without talking, the subject shall breathe normally for 1 minute. After the normal breathing exercise, the subject shall hold his or her head straight ahead and hold his or her breath for 10 seconds during the test measurement. After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become unacceptable, another model of a respirator shall be tried.

(c) *CNP Test Instrument*

(1) The test instrument must have an effective audio-warning device, or a visual-warning device in the form of a screen tracing, which indicates when the test subject fails to hold his or her breath during the test. The test must be terminated and restarted from the beginning when the test subject fails to hold his or her breath during the test. The test subject then may be refitted and retested.

(2) A record of the test shall be kept on file, assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model, style and size of respirator used; and date tested.

5. Controlled negative pressure (CNP) REDON quantitative fit testing protocol

(a) When administering this protocol to test subjects, employers must comply with the requirements specified in paragraphs (a) and (c) of Part I.C.4 of this appendix ("Controlled negative pressure (CNP) quantitative fit testing protocol"), as well as use the test exercises described below in paragraph (b) of this protocol instead of the test exercises specified in paragraph (b) of Part I.C.4 of this appendix.

(b) Employers must ensure that each test subject being fit tested using this protocol follows the exercise and measurement procedures, including the order of administration, described below in Table A-1 of this appendix.

Table A-1. CNP REDON Quantitative Fit Testing Protocol

Exercises[1]	Exercise Procedure	Measurement Procedure
Facing Forward	Stand and breathe normally, without talking, for 30 seconds.	Face forward, while holding breath for 10 seconds.
Bending Over	Bend at the waist, as if going to touch his or her toes, for 30 seconds.	Face parallel to the floor, while holding breath for 10 seconds.
Head Shaking	For about three seconds, shake head back and forth vigorously several times while shouting.	Face forward, while holding breath for 10 seconds.
REDON 1	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask.	Face forward, while holding breath for 10 seconds.
REDON 2	Remove the respirator mask, loosen all facepiece straps, and then redon the respirator mask again.	Face forward, while holding breath for 10 seconds.

[1] Exercises are listed in the order in which they are to be administered.

(c) After completing the test exercises, the test administrator must question each test subject regarding the comfort of the respirator. When a test subject states that the respirator is unacceptable, the employer must ensure that the test administrator repeats the protocol using another respirator model.

(d) Employers must determine the overall fit factor for each test subject by calculating the harmonic mean of the fit testing exercises as follows:

$$Overall\ Fit\ Factor = \frac{N}{\left[1/FF_1 + 1/FF_2 + 1/FF_N\right]}$$

Where:

N = The number of exercises;

FF_1 = The fit factor for the first exercise;

FF_2 = The fit factor for the second exercise; and

FF_N = The fit factor for the nth exercise.

Part II. New Fit Test Protocols

A. Any person may submit to OSHA an application for approval of a new fit test protocol. If the application meets the following criteria, OSHA will initiate a rulemaking proceeding under section 6(b)(7) of the OSH Act to determine whether to list the new protocol as an approved protocol in this Appendix A.

B. The application must include a detailed description of the proposed new fit test protocol. This application must be supported by either:

1. A test report prepared by an independent government research laboratory (e.g., Lawrence Livermore National Laboratory, Los Alamos National Laboratory, the National Institute for Standards and Technology) stating that the laboratory has tested the protocol and had found it to be accurate and reliable; or
2. An article that has been published in a peer-reviewed industrial hygiene journal describing the protocol and explaining how test data support the protocol's accuracy and reliability.

C. If OSHA determines that additional information is required before the Agency commences a rulemaking proceeding under this section, OSHA will so notify the applicant and afford the applicant the opportunity to submit the supplemental information. Initiation of a rulemaking proceeding will be deferred until OSHA has received and evaluated the supplemental information.

[63 FR 20098, April 23, 1998; 69 FR 46993, August 4, 2004]

Appendix B-1 to § 1910.134: User Seal Check Procedures (Mandatory)

The individual who uses a tight-fitting respirator is to perform a user seal check to ensure that an adequate seal is achieved each time the respirator is put on. Either the positive and negative pressure checks listed in this appendix, or the respirator manufacturer's recommended user seal check method shall be used. User seal checks are not substitutes for qualitative or quantitative fit tests.

I. Facepiece Positive and/or Negative Pressure Checks

A. Positive pressure check. Close off the exhalation valve and exhale gently into the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

B. Negative pressure check. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. The design of the inlet opening of some cartridges cannot be effectively covered with the palm of the hand. The test can be performed by covering the inlet opening of the cartridge with a thin latex or nitrile glove. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

II. Manufacturer's Recommended User Seal Check Procedures

The respirator manufacturer's recommended procedures for performing a user seal check may be used instead of the positive and/or negative pressure check procedures provided that the employer demonstrates that the manufacturer's procedures are equally effective.

[63 FR 1152, Jan. 8, 1998]

APPENDIX D - OSHA 1910.134 (MANDATORY) INFORMATION FOR EMPLOYEES USING RESPIRATORS WHEN NOT REQUIRED UNDER THE STANDARD

Appendix D to Sec. 1910.134 (Mandatory) Information for Employees Using Respirators When Not Required Under the Standard

Respirators are an effective method of protection against designated hazards when properly selected and worn. Respirator use is encouraged, even when exposures are below the exposure limit, to provide an additional level of comfort and protection for workers. However, if a respirator is used improperly or not kept clean, the respirator itself can become a hazard to the worker. Sometimes, workers may wear respirators to avoid exposures to hazards, even if the amount of hazardous substance does not exceed the limits set by OSHA standards. If your employer provides respirators for your voluntary use, or if you provide your own respirator, you need to take certain precautions to be sure that the respirator itself does not present a hazard. You should do the following:

1. Read and heed all instructions provided by the manufacturer on use, maintenance, cleaning and care, and warnings regarding the respirators limitations.
2. Choose respirators certified for use to protect against the contaminant of concern. NIOSH, the National Institute for Occupational Safety and Health of the U.S. Department of Health and Human Services, certifies respirators. A label or statement of certification should appear on the respirator or respirator packaging. It will tell you what the respirator is designed for and how much it will protect you.
3. Do not wear your respirator into atmospheres containing contaminants for which your respirator is not designed to protect against. For example, a respirator designed to filter dust particles will not protect you against gases, vapors, or very small solid particles of fumes or smoke.
4. Keep track of your respirator so that you do not mistakenly use someone else's respirator. [63 FR

APPENDIX E - FIT FACTOR VS. PROTECTION FACTOR

Fit Factor vs. Protection Factor

Fit Factor (FF)

$$FF = \frac{\text{Measured Concentration Outside the Respirator}}{\text{Measured Concentration Inside the Respirator}}$$

- Fit Factor applies only to quantitative fit testing conducted on a given day with a given respirator on a given individual.
- Fit Factor is a quantitative measure of the match between the respirator and the user: the higher the Fit Factor, the better the match.
- Fit Factors are to be used to select the best fitting make and size for a given individual from a pre-determined type of respirator (e.g., half-mask air-purifying respirator).

Protection Factor (PF)

$$PF = \frac{\text{Measured Concentration Outside the Respirator}}{\text{Expected Concentration Inside the Respirator}}$$

- Protection Factors have been assigned to various types of respirators by ANSI, OSHA, and NIOSH.
- Protection Factor applies to all trained workers on all days of use for all makes of a given type of respirator.
- Protection Factor is a quantitative measure of the protection the workers can expect from a given type of respirator. The higher the Protection Factor, the better.
- Protection Factors are to be used to select an appropriate type of respirator for a specific workplace exposure.

•

APPENDIX F - SPECIAL PROBLEMS

The following are special problems that may be encountered in the wearing and use of respiratory protective equipment:

(1) Facial Hair

Facial hair, including beards, sideburns, moustaches, or even a few days growth of stubble, is not permitted on employees who are required to wear respirators that rely on a tight facepiece fit to achieve maximum protection. Facial hair between the wearer's skin and the sealing surfaces of the respirator will prevent a good seal. A respirator that permits negative air pressure inside the facepiece during inhalation may allow leakage and, in the case of positive pressure devices, will either reduce service time or waste breathing air. A worker should not enter a contaminated work area when conditions prevent a good seal of the respirator facepiece to the face.

(2) Eye Glasses

Ordinary eyeglasses should not be used with full facepiece respirators. Eyeglasses with temple bars or straps that pass between the sealing surface of a full facepiece respirator and the worker's face will prevent a good seal, and should not be used. Special corrective lenses can be permanently mounted inside a full facepiece respirator and are available from all manufacturers. To ensure good vision, comfort, and proper sealing of the facepiece, an individual designated by the manufacturer as qualified to install accessory items should mount these corrective lenses.

Eyeglasses or goggles may interfere with the half facepiece. When interference occurs, a full facepiece with special corrective lenses should be provided and worn.

(3) Facial Deformities

Facial deformities, such as scars, deep skin creases, prominent cheekbones, severe acne, and the lack of teeth or dentures, can prevent a respirator from sealing properly.

(4) Communications

Talking while wearing a respirator equipped with a facepiece can break the seal of the facepiece. Workers who must speak should keep jaw movement to a minimum. When communication is necessary within a contaminated area, it should be done with the help of special communicating equipment obtained from the manufacturer of the respirator.

(5) Temperature Extremes

In low temperatures, respirator lenses can become fogged. Coating the inner surface of the lens with an anti-fogging compound can reduce fogging. Satisfactory vision can be provided at temperatures down to –30°F by supplying a full facepiece respirator with a nose cup that directs the warm, moist exhaled air through the exhalation valve without touching the lens. Airline respirators should provide dry, respirable air to the worker in cold temperatures.

High or low temperatures can make wearing a respirator uncomfortable. Under temperature extremes, a supplied air respirator may be equipped with a vortex tube to either warm or cool the air supply as needed, if such a device has been approved for use with the respirator. Also, air supply systems are now available which heat or cool the air supplied to the respirator facepiece or air hood.

APPENDIX G

Generic Community Air Monitoring Plan (CAMP)

APPENDIX I

New York State Department of Health
Generic Community Air Monitoring Plan

Overview

A Community Air Monitoring Plan (CAMP) requires real-time monitoring for volatile organic compounds (VOCs) and particulates (i.e., dust) at the downwind perimeter of each designated work area when certain activities are in progress at contaminated sites. The CAMP is not intended for use in establishing action levels for worker respiratory protection. Rather, its intent is to provide a measure of protection for the downwind community (i.e., off-site receptors including residences and businesses and on-site workers not directly involved with the subject work activities) from potential airborne contaminant releases as a direct result of investigative and remedial work activities. The action levels specified herein require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP helps to confirm that work activities did not spread contamination off-site through the air.

The generic CAMP presented below will be sufficient to cover many, if not most sites. Specific requirements should be reviewed for each situation in consultation with NYSDOH to ensure proper applicability. In some cases, a separate site-specific CAMP or supplement may be required. Depending upon the nature of contamination, chemical-specific monitoring with appropriately sensitive methods may be required. Depending upon the proximity of potentially exposed individuals, more stringent monitoring or response levels than those presented below may be required. Special requirements will be necessary for work within 20 feet of potentially exposed individuals or structures and for indoor work with co-located residences or facilities. These requirements should be determined in consultation with NYSDOH.

Reliance on the CAMP should not preclude simple, common-sense measures to keep VOCs, dust, and odors at a minimum around the work areas.

Community Air Monitoring Plan

Depending upon the nature of known or potential contaminants at each site, real-time air monitoring for VOCs and/or particulate levels at the perimeter of the exclusion zone or work area will be necessary. Most sites will involve VOC and particulate monitoring; sites known to be contaminated with heavy metals alone may only require particulate monitoring. If radiological contamination is a concern, additional monitoring requirements may be necessary per consultation with appropriate DEC/NYSDOH staff.

Continuous monitoring will be required for all ground intrusive activities and during the demolition of contaminated or potentially contaminated structures. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pitting or trenching, and the installation of soil borings or monitoring wells.

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

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) must be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis or as otherwise specified. Upwind concentrations should be measured at the start of each workday and periodically thereafter to establish background conditions, particularly if wind direction changes. The monitoring work should be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment should be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment should be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

1. If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.

2. If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities can resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less - but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.

3. If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown.

4. All 15-minute readings must be recorded and be available for State (DEC and NYSDOH) personnel to review. Instantaneous readings, if any, used for decision purposes should also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations should be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations. The particulate monitoring should be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment must be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration should be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 mcg/m^3 above the upwind level and provided that no visible dust is migrating from the work area.

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

3. All readings must be recorded and be available for State (DEC and NYSDOH) and County Health personnel to review.

APPENDIX H

Health and Safety Briefing/ Daily Meeting Log

HEALTH AND SAFETY BRIEFING / TAILGATE MEETING FORM

Site Name / Location _____

Date: _____ Weather Forecast: _____

Names of Personnel Attending Briefing

_____ _____ _____

_____ _____ _____

_____ _____ _____

Planned Work

_____

_____

_____

Instrument Calibration: Instrument/Time/Cal. Gas/Cal. Concentration/Actual Concentration

_____

_____

_____

Items Discussed

_____

_____

_____

_____

_____

Work Permit Type and Applicable Restrictions

_____

_____

_____

Signatures of Attending Personnel

_____ _____ _____

_____ _____ _____

_____ _____ _____

APPENDIX I

Heavy Equipment Exclusion Zone Management Program

HEAVY EQUIPMENT EXCLUSION ZONE MANAGEMENT PROGRAM

CORPORATE HEALTH AND SAFETY MANAGER	:	**Brian Hobbs, CIH, CSP**
EFFECTIVE DATE	:	**01/2019**
REVISION NUMBER	:	**1**

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1. PURPOSE

The purpose of the Exclusion Zone Management Program is to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or equipment entering the Exclusion Zone while the equipment is in operation or moving to ensure that Roux and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment.

2. SCOPE AND APPLICABILITY

This Management Program applies to all Roux Associates, Inc. and its affiliated companies, Roux Environmental Engineering and Geology, D.P.C, and Remedial Engineering (collectively, "Roux") employees and their subcontractors who are performing field work and are potentially exposed to heavy equipment. For the purpose of this program, heavy equipment includes, but is not necessarily limited to: excavation equipment, drill rigs, vacuum trucks, forklifts, lull telehandlers, man lifts, bobcats, delivery trucks, etc.

3. PROCEDURES

As specified in the following sections of this Program, an Exclusion Zones must be established and maintained during activities involving the movement/operation of heavy equipment. The Exclusion Zone requirements apply to all personnel on the site but are primarily focused on those personnel who are required to be working in the vicinity of the equipment. The exclusion zone is in effect when heavy equipment is moving or engaged (ex. movement of an arm or bucket of an excavator, rotation of an auger, lifting of a load with a forklift, raising/lowering of a man lift, etc.).

1. The Exclusion Zone must meet the following minimum requirements:
   - A minimum distance of 10 feet from all heavy equipment and loads being moved by the equipment;
   - Greater than the swing/reach radius of any moving part on the heavy equipment (i.e., for large equipment this may mean an exclusion zone distance larger than 20 feet);
   - Greater than the tip-over distance of the heavy equipment; and
   - Greater than the radius of blind spots.

   The size of the Exclusion Zone will need to be determined on a task-specific basis considering the size of the heavy equipment in use and the task being performed. Prior to all heavy equipment operations, the Exclusion Zone(s) distance must be specifically identified in the Job Safety Analysis (JSA).
2. The spotter (or another individual) should be assigned responsibility for enforcing the Exclusion Zone. The spotter should be positioned immediately outside of the Exclusion Zone within a clear line of sight of the equipment operator. The spotter must signal the operator to stop work if anyone or anything has the potential to enter or compromise the Exclusion Zone. The operator should stop work if the spotter is not within his/her line of sight. If multiple pieces of equipment are being used, each piece of equipment must have its own Exclusion Zone and spotter. For large excavation and demolition projects the spotter should be in constant radio contact (not cell phone) with the machine driver.
3. If an individual must enter the Exclusion Zone, the designated Spotter must signal the Equipment Operator to stop the equipment. Once the equipment is no longer moving (ex. movement of an arm of an excavator is STOPPED, lifting of a load with a forklift STOPPED, raising/lowering of a man lift is

STOPPED, etc.), the operator must DISENGAGE THE CONTROLS and STOP and SIGNAL BY "SHOWING HIS HANDS". This signal will indicate that it is safe for the personnel to enter the limits of the Exclusion Zone to perform the required activity. The equipment must remain completely stopped/disengaged until all personnel have exited the limits of the Exclusion Zone and the designated Spotter has signaled by "SHOWING HIS HANDS" to the Equipment Operator that it is safe to resume operations.

4. When entering the limits of the Exclusion Zone, personnel must at a minimum:
   - Establish eye contact with the operator and approach the heavy equipment in a manner that is in direct line of sight to the Equipment Operator;
   - Never walk under any suspended loads or raised booms/arms of the heavy equipment; and
   - Identify a travel path that is free of Slip/Trip/Fall hazards.
5. The Exclusion Zone should be delineated using cones with orange snow fence or solid poles between the cones, barrels, tape or other measures. For work in rights-of-way rigid barriers, such as Jersey barriers or temporary chain link fence should be used. For certain types of wide-spread or moving/mobile equipment operations, such delineation may not be practicable around pieces of equipment or individual work areas. In such instances, it is expected that the entire operation will be within a larger secure work area or that additional means will be utilized to ensure security of the work zone.

All subcontractors who provide heavy equipment operations to field projects must implement a program that meets or exceeds the expectations described above as well as any additional requirements that may be required on a client or site-specific basis.

3.1 Exceptions

It is recognized that certain heavy equipment activities may require personnel to work within the limits of the Exclusion Zone as specified in this program. Such activities may include certain excavation clearance tasks, drill crew activities or construction tasks. However, any such activity must be pre-planned with emphasis on limiting the amount and potential exposure of any activity required within the zone. The critical safety steps to mitigate the hazards associated with working within the Exclusion Zone must be defined in the JSA and potentially other project-specific plans (i.e., critical lift plans, etc.), and approved by the Roux Project Principal and client representative, if required, prior to implementation.

4. TRAINING

Many Roux projects have different requirements that are client-specific or site-specific in nature. It is the responsibility of the Project Principal (or Project Manager if delegated this responsibility by the Project Principal) to ensure that the workers assigned to his/her projects are provided orientation and training with respect to these client and/or site-specific requirements.

APPENDIX J

Quality Assurance Project Plan/Field Sampling Plan

Quality Assurance Project Plan/ Field Sampling Plan

Chestnut Commons
NYSDEC BCP #C244236
3629 Atlantic Avenue
Brooklyn, New York

December 10, 2019

Prepared for:

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1. Introduction

Roux Environmental Engineering and Geology, D.P.C. (Roux), on behalf of Chestnut Commons Apartments LLC, has prepared this Quality Assurance Project Plan/Field Sampling Plan (QAPP/FSP) to describe the measures that will be taken to ensure that the data generated during performance of the Remedial Action Work Plan (RAWP) for the Chestnut Commons Atlantic Avenue Site (Site), located in Brooklyn, are of quality sufficient to meet project-specific data quality objectives (DQOs). The Site is comprised of Block 4412 Lot 34 of the New York City Tax Map and bounded by Dinsmore Street to the north, South Conduit Avenue to the south, Chestnut Street to the east, and Logan Street to the west. This QAPP/FSP also includes field sampling procedures.

Chestnut Commons Apartments LLC is a Volunteer in the Brownfield Cleanup Program (BCP). RI activities will be conducted under the New York State Department of Environmental Conservation (NYSDEC) BCP (Site #C244236). This QAPP/FSP was prepared in accordance with the guidance provided in NYSDEC Technical Guidance DER-10 Technical Guidance for Site Investigation and Remediation (DER-10), the NYSDEC BCP Guide, and the United States Environmental Protection Agency's (USEPA's) Guidance for the Data Quality Objectives Process (EPA QA/G 4).

1.1 Purpose

The QAPP/FSP describes in detail the field sampling and quality assurance/quality control (QA/QC) methods to be used during soil sampling tasks performed during the Remedial Action.

This QAPP/FSP was prepared in accordance with the NYSDEC's DER-10 and provides guidelines and procedures to be followed by field personnel during performance of sampling during the RAWP implementation. Information contained in this QAPP/FSP relates to:

- sampling objectives (Section 2);
- project organization (Section 3);
- sample media, sampling locations, analytical suites, sampling frequencies and analytical laboratory (Section 4);
- field sampling procedures (Section 5);
- sample handling, sample analysis, and quality assurance/quality control (Section 6); and
- site control procedures and decontamination (Section 7).

2. Sampling Objectives

The objective of the sampling program is designed to meet the DQOs set forth in DER-10. Specifically, analytical parameters selected for each sample, as described in Section 4, are comprehensive, and are intended to meet the following objectives:

- Analyze endpoint documentation and confirmation soil samples;
- As part of the Pre-Design Investigation (PDI), the collection of soil samples adjacent to soil borings MW-6 and RX-16; and
- Analyze on-Site reuse soil, if necessary, and offsite backfill to evaluate its suitability for use as backfill that meets the lower of the protection of groundwater or the Unrestricted Use Soil Cleanup Objectives (UUSCOs) Track 1 remedy of the Site.

Sampling procedures are discussed in Section 5 of this QAPP/FSP. A discussion of the DQOs and quality assurance/quality control is provided in Section 6.

3. Project Organization

A general and generic summary of the overall management structure and responsibilities of project team members are presented below. Professional profiles for the team are provided in Attachment 1.

Project Principal

Jessica Taylor, P.G. of Roux will serve as Project Principal. The Project Principal is responsible for defining project objectives and bears ultimate responsibility for the successful completion of the investigation.

Remedial Engineer

The Remedial Engineer for this project will be Brian Morrissey, P.E. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the RI and future remedial program for the Site. The Remedial Engineer will certify in the Remedial Investigation Report (RIR) that the investigation activities were observed by qualified environmental professionals under her supervision as well as any other relevant provisions of ECL 27-1419 have been achieved in full conformance with the RI.

Project Manager

Levi Curnutte of Roux will serve as Project Manager. The Project Manager is responsible for defining project objectives and bears ultimate responsibility for the successful completion of the work. This individual will provide overall management for the implementation of the scope of work and will coordinate all field activities. The Project Manager is also responsible for data review/interpretation and report preparation.

Field Team Leader

The Field Team Leader will be Daniel Miserendino. The Field Team Leader bears the responsibility for the successful execution of the field program. The Field Team Leader will direct the activities of the technical staff in the field, as well as all subcontractors. The Field Team Leader will also assist in the interpretation of data and in report preparation. The Field Team Leader reports to the Project Manager.

Laboratory Project Manager

Laboratory analysis will be completed by TestAmerica Laboratories of Edison, New Jersey, Sacramento, California, and Burlington, Vermont, NYSDOH Environmental Laboratory Accreditation Program (ELAP)-certified laboratories (11452, 11666, and 10391, respectively). The Laboratory Project Manager is Allison Bennett. The Laboratory Project Manager is responsible for sample container preparation, sample custody in the laboratory, and completion of the required analysis through oversight of the laboratory staff. The Laboratory Project Manager will ensure that quality assurance procedures are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Project Manager reports to the Project Principal and Project Manager.

Quality Assurance Officer

David Kaiser, P.E. of Roux will serve as the Quality Assurance Officer (QAO) for this project. The QAO is responsible for conducting reviews, inspections, and audits to ensure that the data collection is conducted in accordance with the FSP and QAPP. The QAO's responsibilities range from ensuring effective field equipment decontamination procedures and proper sample collection to the review of all laboratory analytical data for completeness and usefulness. The QAO reports to the Project Manager and makes independent recommendations to the Field Team Leader.

4. Sample Media, Locations, Analytical Suites, and Frequency

The media to be sampled during the remedial activities include soil and fill materials. A discussion of the sampling schedule for each medium is provided below, while the assumed number of field samples to be collected for each medium, including quality control (QC) samples, is shown in Tables 1 and 2. Specifics regarding the collection of samples at each location and for each task are provided in Section 5 of this QAPP/FSP.

4.1 End-Point Soil Sampling

The documentation samples for the remedial action are described in the Remedial Investigation Report/Remedial Action Work Plan (RIR/RAWP) and include the proposed samples to be collection during the remedial construction. The proposed samples to be collected are described below.

Bottom Sampling

Bottom documentation sampling to represent the quality of soil remaining across the entire Site after excavation is complete will be conducted at a frequency of one sample per approximately 1,000 square feet of excavation area in addition to the eight bottom samples collected as part of the Remedial Investigation. The frequency of bottom sampling proposed for this alternative is less frequent than the guidance provided in NYSDEC DER-10 5.4 for excavations 20 to 300 feet in perimeter since the total excavation area is larger than the referenced excavation and the guidance allows for different sampling frequencies to be negotiated for larger excavations.

The bottom documentation samples will be comprised of a combination of previous RI samples and proposed samples:

- Eight existing samples, which were collected immediately below the proposed excavation depth (18-20 feet below land surface [ft bls]) and are representative of remaining soil conditions (DUSR was already completed for these samples); and
- Twenty one supplemental samples will be collected immediately below the proposed excavation depth to be collected to make up the required frequency across the Site. Samples will be distributed throughout the Site and will be biased toward impacts, if any are observed.

The documentation samples will be tested for the Total Compound List/NYSDEC Part 375 (TCL/Part 375) plus 30/ TAL (TCL + 30/TAL) list of parameters including:

- TCL/Part 375 Volatile organic compounds (VOC) + 10 Tentatively identified compounds (TICs);
- TCL/Part 375 Base neutral acids (BNA)/ semivolatile organic comounds (SVOCs) + 20 TICs;
- TCL/Part 375 Pesticides;
- TCL/Part 375 Herbicides;
- TCL/Part 375 Polychlorinated Biphenyls (PCBs);
- Total Analyte List (TAL)/Part 375 Metals (including hexavalent chromium and total cyanide); and
- Emerging Contaminants* (ECs).

*ECs list includes 1,4-Dioxane and the 21 Per- and Polyfluoroalkyl Substances (PFAS) which include the 21 compounds listed in the NYSDEC June 2019 Sampling for 1,4-Dioxane and PFAS Under DEC's Part 375 Remedial Programs (NYSDEC June 2019 Guidance). The NYSDEC June 2019 Guidance is provided in Attachment 2. PFAS in soil will be analyzed by USEPA Method 537 Modified and 1,4-Dioxane in soil will be analyzed by USEPA Method 8270D. Soil samples placed on hold at the laboratory will not be analyzed for ECs. The reporting limit for 1,4-dioxane in soil is 0.1 milligram per kilogram (mg/kg) and the reporting limit for PFAS in soil is 1 microgram per kilogram (ug/kg). The 21 PFAS are:

- Perfluorobutanesulfonic acid
- Perfluorohexanesulfonic acid
- Perfluoroheptanesulfonic acid
- Perfluorooctancessulfonic acid
- Perfluorodecanesulfonic acid
- Perfluorobutanoics acid
- Perfluoropentanoic acid
- Perfluorohexanoic acid
- Perfluoroheptanoic acid
- Perfluorooctanoic acid
- Perfluorononanoic acid
- Perfluorodecanoic acid
- Perfluoroundecanoic acid
- Perfluorododecanoic acid
- Perfluorotridecanoic acid
- Perfluorotetradecanoic acid
- 6:2 Fluorotelomer sulfonate
- 8:2 Fluorotelomer sulfonate
- Perfluroroctanesulfonamide
- N-methyl perfluorooctanesulfonamidoacetic acid
- N-ethyl perfluorooctanesulfonamidoacetic acid

Sidewall Sampling

Sidewall documentation sampling will not be required where excavation extends to the property line. Excavation extends to the property line across the entire Site; therefore, no sidewall samples are planned. If excavation does not extend to the property line, sidewall documentation sampling around the interior sidewalls of the excavation areas will be conducted at a frequency of one sample per 30 linear feet of sidewall.

The sidewall documentation samples will be analyzed for the TCL + 30/TAL list of parameters including ECs.

4.2 PDI Confirmation Soil Sampling

To further investigate the soil quality of the deeper soils onsite and whether previous soil sample results are representative, Roux proposes to return to two soil boring locations that were completed during the RI (MW-6 and RX-16) to resample the soil at a depth of 30-32 ft bls at the respective adjacent locations. Roux will advance soil borings and collect two soil samples, one from each boring, and analyzed for the TCL + 30/TAL and ECs list of parameters.

4.3 Offsite Backfill/On-Site Reuse Soil Sampling

For offsite fill/on-Site reuse soil materials requiring chemical testing, the following samples shall be collected:

- One sample for pre-qualification chemical testing at the source location, including the following:
  1. Backfill/on-Site reuse soil materials excluding those materials that do not require sampling as described below, shall meet criteria presented in Section 2.0.
  2. Backfill/on-Site reuse soil materials that exceed the criteria presented in Section 2.0 shall not be imported to the Site without prior approval of the NYSDEC.
  3. The backfill/on-Site reuse soil material will be free of extraneous debris or solid waste.
  4. If the NYSDEC agrees that the material originated from a virgin source, then a minimum of one sample (i.e., the pre-qualification sample) will be collected and analyzed per source.
- If the source is not virgin, the sampling frequency will comply with DER-10 Table 5.4(e)10 shown below:

Table 5.4(e)10
Recommended Number of Soil Samples for Soil Imported To or Exported From a Site

Contaminant	VOCs	SVOCs, Inorganics & PCBs/Pesticides	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite**	**Discrete Samples/Composite**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1000	7	2	
➢ 1000	Add an additional 2 VOC and 1 composite for each additional 1000 Cubic yards or consult with DER		

The source of the offsite fill/on-Site reuse soil must be documented by the supplier, including the location where the fill/on-Site reuse soil was obtained and a brief history of the site that is the source of the fill.

Samples of offsite backfill/on-Site reuse soil will be analyzed for the following parameters list:

- TCL/Part 375 VOCs;

- TCL/Part 375 SVOCs;
- TAL/Part 375 Metals (including hexavalent chromium and total cyanide);
- TCL/Part 375 Herbicides;
- TCL/Part 375 Pesticides;
- TCL PCBs; and
- ECs.

The parameters to be sampled are listed on Table 375-6.8(b) of the latest revision of Part 375. QA/QC samples are not required for backfill/on-Site reuse soil samples.

The following materials may be imported, without chemical testing, to be used as backfill beneath pavement, buildings or as part of the site cover, provided that it contains less than 10 percent by weight material that would pass through a size 80 sieve and consists of:

- gravel, rock or stone, consisting of virgin material from a permitted mine or quarry; or
- recycled concrete or brick from a NYSDEC registered construction and demolition debris processing facility if the material conforms to the requirements of Section 304 of the 2002 New York State Department of Transportation Standard Construction and Materials Volume 1.

5. Field Sampling Procedures

This section provides a detailed discussion of the field procedures to be used during soil sampling being completed as part of the remedial activities. The documentation and PDI sample locations are discussed in the RIR/RAWP. Additional details regarding sampling procedures and protocols are described in Roux's relevant Standard Operating Procedures (SOPs), which are provided in Attachment 3.

5.1 Soil Sampling

Details for the collection of soil samples is provided below.

5.1.1 Documentation Soil Sampling

Documentation soil samples will be collected from the interval beneath the terminal extent of the remedial excavation. The soil will be observed for lithology and evidence of contamination (e.g., staining, odors, and/or visible free product) and placed immediately thereafter into large Zip-loc™ bags for ecording headspace using a photo-ionization detector (PID). After a minimum of 15 minutes for equilibration with the headspace in the Zip-loc™ bag, each sample will be screened for organic vapors using a PID equipped with a 10.6 eV lamp. Samples for possible VOC analysis will be placed in a laboratory-supplied jar or encore sampler prior to screening, due to the potential for loss of VOCs through volatilization, before the remainig sample jars are filled. These samples will be placed in the laboratory-supplied containers and shipped to the laboratory under chain of custody procedures in accordance with Roux's SOPs in Attachment 3.

5.1.2 PDI Confirmation Soil Sampling

Soil borings will be advanced using a GeoProbe® Direct-Push drill rig. Samples of the soil profile will be collected from depth of approximately 30-32 feet below land surface (ft bls).

The soil from the 30-32 ft bls interval will be observed for lithology and evidence of contamination (e.g., staining, odors, and/or visible free product) and placed immediately thereafter into large Zip-loc™ bags for ecording headspace using a PID. After a minimum of 15 minutes for equilibration with the headspace in the Zip-loc™ bag, each sample will be screened for organic vapors using a PID equipped with a 10.6 eV lamp. Samples for possible VOC analysis will be placed in a laboratory-supplied jar or encore sampler prior to screening, due to the potential for loss of VOCs through volatilization. More information regarding the PDI can be found in the RIR/RAWP. These samples will be placed in the laboratory-supplied containers and shipped to the laboratory under chain of custody procedures in accordance with Roux's SOPs in Attachment 3.

Contaminated soil cuttings, if encountered, will be placed in sealed and labeled U.S. Department of Transportation (DOT) approved 55-gallon drums pending characterization and off-site disposal at a permitted facility.

5.1.3 Offsite Backfill/On-Site Reuse Sampling

All imported fill/on-Site reuse soil material samples will be collected using laboratory supplied containers and analyzed for the applicable parameters listed above in Section 4.3.

6. Sample Handling and Analysis

To ensure quality data acquisition and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples, as well as sample packaging, shipping procedures, and QA/QC.

6.1 Field Sample Handling

A discussion of the proposed number and types of samples to be collected during each task, as well as the analyses to be performed, can be found in Section 4.0 of this QAPP/FSP. The types of containers, volumes, and preservation techniques for the aforementioned testing parameters are presented in Table 3.

6.1.1 PFAS Sampling Procedures

All soil sampled for PFAS will be handled with precautions to prevent cross-contamination in accordance with PFAS Field Sampling Guidelines provided in Attachment 4. No clothing or equipment containing Teflon will be utilized. Sample containers will be made of HDPE or polypropylene. Blue ice or freezer packs will not be used when shipping sampling to be analyzed for PFAS. PFAS-free water and only Alconox or Liquinox will be used to decontaminate reusable field sampling equipment.

6.2 Sample Custody Documentation

The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable).

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre printed or filled out using waterproof ink. The technical staff will review all field activities with the Field Team Leader to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

All samples being shipped offsite for analysis must be accompanied by a properly completed chain of custody form. The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the

6.3 Sample Shipment

Laboratory analysis will be completed by either TestAmerica Laboratories of Edison, New Jersey, Sacramento, California, and Burlington, Vermont, NYSDOH Environmental Laboratory Accreditation Program (ELAP)-certified laboratories (11452, 11666, and 10391, respectively). Sample packaging and shipping procedures are based upon USEPA specifications, as well as DOT regulations. The procedures vary according to potential sample analytes, concentration, and matrix and are designed to provide optimum

protection for the samples and the public. Sample packaging and shipment must be performed using the general outline described below.

All samples will be shipped within 24 hours of collection and will be preserved appropriately from the time of sample collection. A description of the sample packing and shipping procedures is presented below:

- Prepare cooler(s) for shipment:
    - tape drain(s) of cooler shut;
    - affix “This Side Up” arrow labels and “Fragile” labels on each cooler; and
    - place mailing label with laboratory address on top of cooler(s).
- Arrange sample containers in groups by sample number.
- Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
- Arrange containers in front of assigned coolers.
- Place packaging material approximately at the bottom of the cooler to act as a cushion for the sample containers.
- Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
- Fill remaining spaces with packaging material.
- Ensure all containers are firmly packed in packaging material.
- If needed, loose ice cubes should be repackaged in Zip-lock™ bags and placed on top of the packaging material. Blue ice or freezer packs will not be used when shipping sampling to be analyzed for PFAS.
- Sign chain of custody form (or obtain signature) and indicate the time and date it was relinquished to courier as appropriate.
- Separate chain of custody forms. Seal proper copies within a large Zip-loc™ bag and tape to inside cover of cooler. Retain copies of all forms.
- Close lid and latch.
- Secure each cooler using custody seals.
- Tape cooler shut on both ends.
- Relinquish to overnight delivery service as appropriate. Retain air bill receipt for project records. (Note: All samples will be shipped for “NEXT A.M.” delivery).

6.4 Quality Assurance / Quality Control

Joshua Cope of Roux Associates, Inc. will review the analytical data for QA/QC and prepare the DUSR in accordance with NYSDEC standards. The professional profile for Joshua Cope is provided in Attachment 1. A laboratory SOP for analysis of PFAS is included in Attachment 2.

The primary DQO of the soil, groundwater, and soil vapor programs, therefore, is that data be accurate and precise, and hence representative of the actual Site conditions. Accuracy refers to the ability of the laboratory to obtain a true value (i.e., compared to a standard) and is assessed through the use of laboratory quality control (QC) samples, including laboratory control samples and matrix spike samples, as well as through the use of surrogates, which are compounds not typically found in the environment that are injected

into the samples prior to analysis. Precision refers to the ability to replicate a value and is assessed through both field and laboratory duplicate samples.

Sensitivity is also a critical issue in generating representative data. Laboratory equipment must be of sufficient sensitivity to detect target compounds and analytes at levels below NYSDEC standards and guidelines whenever possible. Equipment sensitivity can be decreased by field or laboratory contamination of samples, and by sample matrix effects. Assessment of instrument sensitivity is performed through the analysis of reagent blanks, near-detection-limit standards, and response factors. Potential field and/or laboratory contamination is assessed through use of trip blanks, method blanks, and equipment rinse blanks (also called "field blanks"). Field blanks for PFAS will be collected at a minimum frequency of one per day.

Table 1 lists the requirements for field and laboratory QC samples that will be analyzed to assess data accuracy and precision, as well as to determine if equipment sensitivity has been compromised. Table 2 lists the number/type of field and QA/QC samples that will be collected during the RI. Table 3 lists the preservation, holding times and sample container information.

All "assessment" analyses (i.e., TCL plus 30/ TAL and ECs) will be performed in accordance with the NYSDEC Analytical Services Protocol (ASP), using USEPA SW 846 methods.

All laboratory data are to be reported in NYSDEC ASP Category B deliverables and will be delivered to NYSDEC in electronic data deliverable (EDD) format as described on NYSDEC's website (http://www.dec.ny.gov/chemical/62440.html). A Data Usability Report will be prepared meeting the requirements in Section 2.2(a)1.ii and Appendix 2B of DER-10 for all data packages generated for the RI.

7. Site Control Procedures

Site control procedures, including decontamination and waste handling and disposal, are discussed below. Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities at the Site. All personnel who come into designated work areas, including contractors and observers, will be required to adhere strictly to the conditions imposed herein and to the provisions of a Site-Specific Health and Safety Plan (HASP). The HASP is included as Appendix I to the RIR/RAWP.

7.1 Decontamination

In an attempt to avoid the spread of contamination, all drilling and sampling equipment must be decontaminated at a reasonable frequency in a properly designed and located decontamination area. Detailed procedures for the decontamination of field and sampling equipment are included in Roux's SOPs for the Decontamination of Field Equipment located in Attachment 3. The location of the decontamination area will be determined prior to the start of field operations. The decontamination area will be constructed to ensure that all wash water generated during decontamination can be collected and containerized for proper disposal.

7.2 Waste Handling and Disposal

All waste materials (drill cuttings, decontamination water, etc.) generated during the RI will be consolidated, and stored in appropriate labeled bulk containers (drums, etc.), and temporarily staged at an investigation derived waste storage area onsite. Roux will then coordinate waste characterization and disposal by appropriate means.

TABLES

1. Field and Laboratory QC Summary
2. Remedial Investigation Sampling Summary
3. Preservation, Holding Times, and Sample Containers

Table 1. Field and Laboratory QC Summary

QC Check Type	Minimum Frequency	Use
Field QC		
Duplicate	1 per matrix per 20 samples or SI	Precision
Trip Blank	1 per VOC cooler	Sensitivity
Field Blank (non-PFAS)	1 per matrix per 20 samples	Sensitivity
Field Blank (PFAS)	1 per matrix per 20 samples	Sensitivity
Laboratory QC		
Laboratory Control Sample	1 per matrix per SDG	Accuracy
Matrix Spike/Matrix Spike Duplicate/Matrix Duplicate**	1 per matrix per SDG	Accuracy/Precision
Surrogate Spike	All organics samples	Accuracy
Laboratory Duplicate	1 per matrix per SDG	Precision
Method Blank	1 per matrix per SDG	Sensitivity

Notes:
* SDG - Sample Delivery Group - Assumes a single extraction or preparation
** Provided to lab by field sampling personnel
PFAS - Per- and Polyfluoroalkyl Substances

Table 2. Remedial Action Sampling Summary

Sample Medium	Target Analytes	Field Samples	Replicates[1]	Trip Blanks[2]	Field Blanks[1]	Matrix Spikes[1]	Spike Duplicates[1]	Total No. of Samples
Documentation Soil Samples	TCL/Part 375 VOCs +10	21	2	0	2	2	2	29
	TCL/Part 375 SVOCs +20	21	2	0	2	2	2	29
	TCL/Part 375 Pesticides	21	2	0	2	2	2	29
	TCL/Part 375 Herbicides	21	2	0	2	2	2	29
	TCL/Part 375 PCBs	21	2	0	2	2	2	29
	TAL Metals	21	2	0	2	2	2	29
	Total Cyanide	21	2	0	2	2	2	29
	Hexavalent Chromium	21	2	0	2	2	2	29
	PFAS, 1,4-dioxane	21	2	0	2	2	2	29
PDI Confirmation Soil Sampling	TCL/Part 375 VOCs +10	2	0	1	0	0	0	3
	TCL/Part 375 SVOCs +20	2	0	0	0	0	0	2
	TCL/Part 375 Pesticides	2	0	0	0	0	0	2
	TCL/Part 375 Herbicides	2	0	0	0	0	0	2
	TCL/Part 375 PCBs	2	0	0	0	0	0	2
	TAL Metals	2	0	0	0	0	0	2
	Total Cyanide	2	0	0	0	0	0	2
	Hexavalent Chromium	2	0	0	0	0	0	2
	PFAS, 1,4-dioxane	2	0	0	0	0	0	2
Soil (Import for Backfill/On-Site Reuse)[3]	TCL/Part 375 VOCs	-	-	-	-	-	-	-
	TCL/Part 375 SVOCs	-	-	0	-	-	-	-
	TAL/Part 375 Metals	-	-	0	-	-	-	-
	TCL/Part 375 Pesticides	-	-	0	-	-	-	-
	TCL/Part 375 Herbicides	-	-	0	-	-	-	-
	Total Cyanide	-	-	0	-	-	-	-
	Hexavalent Chromium	-	-	0	-	-	-	-
	TCL PCBs	-	-	0	-	-	-	-
	PFAS, 1,4-dioxane	-	-	0	-	-	-	-

Totals are estimated based on scope of work as written, actual sample quantities may vary based on field conditions. QA/QC sample quantities will be adjusted accordingly.

[1] Based on 1 per 20 samples or 1 per Sample Delivery Group (3 days max)

[2] Based on 1 cooler per day

[3] Estimated quantity of soil to be imported into the Site for backfill and cover soil is undetermined at this time.

TCL - USEPA Contract Laboratory Program Target Compound List
USEPA - United States Environmental Protection Agency
VOCs - Volatile Organic Compounds
SVOCs - Semivolatile Organic Compounds
PCBs - Polychlorinated Biphenyls
PFAS - Per- and Polyfluoroalkyl Substances
TAL - USEPA Contract Laboratory Program Target Analyte List

Table 3. Preservation, Holding Times and Sample Containers

Analysis	Matrix	Bottle Type	Preservation(a)	Holding Time(b)
TAL/Part 375 Metals (total), SW-846 6010/7471	Soil	8 oz wide mouth glass, teflon lined cap	Cool to 4°C	180 days, Hg 28 days
Hexavalent Chromium, SW-846 7196A	Soil	2 oz wide mouth glass, teflon lined cap	Cool to 4°C	30 days from sample collection to extraction; 7 days following extraction
Total Cyanide, SW-846 9021B	Soil	4 oz wide mouth glass, teflon lined cap	Cool to 4°C	14 days to extract, 40 days to analysis
PFAS via USEPA 537(M)-Isotope Dilution	Soil	Three 250 mL HDPE bottles	Cool to 4°C	14 days to extract, 40 days to analysis
Target Compound List (TCL)/Part 375				
TCL/Part 375 Volatile Organic Compounds (VOCs), SW-846 8260B	Soil	Encore	Cool to 4°C	48 hours from sample collection, 14 days if frozen to -7°C or extruded into methanol
TCL/Part 375 Semivolatile Organic Compounds (SVOCs), SW-846 8270C	Soil	8 oz wide mouth glass, teflon lined cap	Cool to 4°C	14 days to extract, 40 days to analysis
TCL/Part 375 Pesticides, SW-846 8081A	Soil	8 oz wide mouth glass, teflon lined cap	Cool to 4°C	14 days to extract, 40 days to analysis
TCL/Part 375 Herbicides, SW-846 8051A	Soil	8 oz wide mouth glass, teflon lined cap	Cool to 4°C	14 days to extract, 40 days to analysis
TCL/Part 375 Polychlorinated biphenyls (PCBs), SW-846 8082	Soil	8 oz wide mouth glass, teflon lined cap	Cool to 4°C	14 days to extract, 40 days to analysis

(a) All soil and groundwater samples to be preserved in ice during collection and transport
(b) Days from date of sample collection.
TAL - Target Analyte List
PFAS - Per- and Polyfluoroalkyl Substances
TCL - USEPA Contract Laboratory Program Target Compound List
USEPA - United States Environmental Protection Agency

ATTACHMENTS

1. Professional Profiles
2. NYSDEC PFAS Guidance
3. Roux ‘s Standard Operating Procedures
4. PFAS Field Sampling Guidelines

ATTACHMENT 1

Professional Profiles

ROUX

PROFESSIONAL PROFILE

Jessica L. Taylor, P.G.
Principal Hydrogeologist

TECHNICAL SPECIALTIES

Project Management and Field Management for large-scale soil excavation and remediation projects, including site assessment, remediation implementation, and construction activities. Coordination and management of large-scale demolition and renovation support. Performance of sampling and direction of field sampling teams for the following media: soil, groundwater, surface water, soil vapor, sludge, and sediment. Excavation sampling and oversight and waste tracking.

EXPERIENCE SUMMARY

Fourteen years of experience: Senior, Project and Staff Hydrogeologist, Roux Environmental Engineering and Geology, D.P.C., Islandia, New York; Staff Hydrogeologist and Intern at GSC|Kleinfelder.

CREDENTIALS

B.S. Geology, Binghamton University, 2005
Professional Geologist, New York, 2017
OSHA 40-Hour HAZWOPER Training, 2005
OSHA 10-Hour Construction Safety Training, 2008
NJDEP UST Subsurface Evaluator Certification, 2009

KEY PROJECTS

- Senior Project Manager for a large ongoing redevelopment project in Brooklyn, New York. Project includes coordination and oversight of *in situ* waste characterization sampling, excavation, and proper disposal of soil. Coordination of pre-demolition asbestos and hazardous materials surveys. Construction management and support for excavation of 600,000 tons of soil; environmental support for demolition and relocating of an active nine-acre 100-year old rail yard. Responsible for implementing and managing remediation work at several NYSDEC spill sites within the project footprint, including *in situ* chemical oxidation, UST removal, and soil excavation. Agency support for NYSDEC, NYCDEP, NYCOER, MTA (LIRR/NYCT), and ESDC. The project will encompass 336,000 square feet of office space, 6.4 million square feet of residential space, an 18,000 seat sports and entertainment venue – the Barclays Center (home of the Nets professional basketball team) – 247,000 square feet of retail space, a 165,000 square-foot hotel, and over 8 acres of intricately designed publicly accessible open space.
- Senior Project Manager for two parcels in Queens as part of NYSDEC Brownfield Cleanup Program. This project included due-diligence environmental assessment and investigation, development of NYSDEC-approved Remedial Investigation Work Plans, and future remediation during construction of two mixed-use, affordable housing developments. Also required coordination with NYCHPD and NYCDEP to meet regulatory requirements for funding.
- Senior Project Manager for the environmental management of asbestos remediation during the renovation of Nassau Coliseum. Responsible for coordinating inspections and delineation of ACM, preparing budgetary estimates, and bid support for full abatement. Also includes management of decommissioning and replacement of existing emergency generator UST.
- Project Manager for redevelopment of four properties in Brooklyn, with NYCOER to address NYCDEP "E" designations. Coordination with NYCOER to implement remedial investigation and develop RAP as part of the NYC VCP.
- Project Manager for commercial redevelopment site in the Bronx, including *in situ* waste characterization, management and coordination of excavation, community air monitoring, and development of NYCDEP-approved RAP.
- Project Manager for petroleum spill closure at active retail gasoline service station in Brooklyn, NY. Included remedial investigation and coordination with NYSDEC for spill closure.
- Project Manager for design, implementation, and reporting of *in situ* waste characterization for the largest retail developer in the world as part of new construction at a premier shopping center on Long Island.
- Client liaison and full-time onsite construction manager at redevelopment site in Rego Park, New York. Collection of 500 *in situ* waste characterization soil samples, oversight of 250,000 cubic yards of soil excavation and remediation, development of post-remediation sampling plan, organization of waste manifests and hazardous waste documents to ensure proper disposal. Coordination of daily site activities with multiple construction contractors and other involved parties on behalf of client. Oversight and confirmatory soil sampling for on-site treatment of 75,000 cubic yards of hazardous lead contaminated soil.
- Field Manager for *in situ* soil characterization as part of RAP implementation for a one-acre brownfield site containing chlorinated solvents, heavy metals and petroleum compounds in soil, soil vapor and groundwater over one city block in Manhattan, New York. This project is part of the NYSDEC BCP.
- Project and Field Manager for multiple Phase I and Phase II ESAs of retail gasoline stations in New York and New Jersey. This includes drilling and sampling oversight and health and safety management, as well as writing Phase II ESA reports for over 40 sites.

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ROUX

PROFESSIONAL PROFILE

Brian P. Morrissey, P.E., BCEE

Principal Engineer

TECHNICAL SPECIALTIES

Development, design and implementation of soil and groundwater remediation systems.

Optimization of ongoing remedial operations.

Cold eye design review and evaluation of process safety.

Management, support, and oversight of large inter-disciplinary teams for site remediation.

Preparation of feasibility studies, engineer's reports, design drawings, specifications, contract documents, permit applications, cost estimates, operations and maintenance plans and construction management for the following:

- Industrial and sanitary wastewater treatment systems
- *In situ* groundwater remedial technologies
- Sub-slab depressurization systems
- Floating product recovery systems
- Ground water pumping and treatment facilities
- Water supply, treatment, and distribution
- Underground storage tank (UST) systems
- Containment systems
- Air sparging, soil vapor extraction and vapor collection and treatment systems
- Building decontamination and decommissioning
- Landfill cap design and permitting
- Hazardous waste soils removal, transportation, and disposal

EXPERIENCE SUMMARY

More than 30 years of experience working in many areas of the environmental industry under a variety of regulatory programs such as Federal and State Superfund, SPDES, SEQRA, New Jersey ECRA/ISRA, NYSDEC Voluntary Cleanup, Petroleum and Chemical Bulk Storage, and NYC Brownfields.

Principal Engineer and Office Manager at Roux; Senior Engineer and Senior Project Manager at ERM

CREDENTIALS

B.E., Civil Engineering, Cooper Union, 1980

M.S., Civil and Environmental Engineering, NYU Tandon School of Engineering (former Polytechnic), 1985

Professional Engineer: New York (1986), New Jersey (2003), and Virginia (2010)

OSHA 40-hour Health and Safety Training

ExxonMobil Loss Prevention System certified

NYCOER Gold Certified Professional

Board Certified Environmental Engineer (BCEE) of the American Academy of Environmental Engineers and Scientists (AAEES) - Specialty Certification in Hazardous Waste Management, 1995

PROFESSIONAL AFFILIATIONS

Water Environment Federation

KEY PROJECTS

- Project Manager for the design of wastewater treatment plant (WWTP) upgrades at three (3) separate facilities under the program to protect New York City's watershed. The work included preparing conceptual upgrade plans, facility plans, detailed cost estimates, design drawings and specifications, startup plans, O&M plans, and oversight of construction. Design at one facility included replacement of secondary treatment components and the addition of recirculating sand filters, microfiltration units, emergency generator and telemetry systems.
- Principal Engineer and P.E. of Record for the design and construction of a storm drainage and sanitary sewer project located adjacent to a former petroleum terminal in Brooklyn, New York. Worked on several design modifications to obtain NYCDEP approvals. Work included construction of 1,600 linear feet of RCP storm sewer and 1,000 feet of ductile iron sanitary sewer. Construction required vibration monitoring during sheeting and operation and maintenance of a temporary dewatering treatment system.
- Project Engineer for environmental audits at more than 20 commercial and manufacturing facilities to evaluate compliance with federal, state, and local air, wastewater, and hazardous waste regulations. Audits addressed regulatory areas including RCRA, SARA, CWA, CAA, TSCA, and OSHA.
- Principal Engineer for conducting detailed evaluation of problematic groundwater treatment system in Rensselaer, New York. Primary constituents of concern include heavy metals, chlorinated solvents, and BTEX compounds. Developed performance testing program, diagnosed causes of problems and presented several recommendations for upgrading systems and improving personnel health and safety. Prepared engineering report with key recommendations that included modifying equipment layout, injecting iron deposition and calcium scale control agents into water stream, and upgrading the system instrumentation and controls.
- Principal Engineer and Project Manager for the remediation and monitoring of over 100 vehicle fueling sites in New York City with UST petroleum releases. The remediation systems at the various sites include multi-phase extraction, soil vapor extraction, air sparging, groundwater recovery and treatment, and product-only recovery systems. Priorities on this multi-year contract included expediting remedial progress, increasing the effectiveness of operating systems, achieving NFA status, and reducing NYC's overall program costs. Work included conducting soil vapor studies at 9 sites to assess vapor intrusion concerns. Also implemented *in situ* injections at 14 sites to cost-effectively achieve site closure. The *in situ* injections used chemical oxidation and bioremediation products including sodium percarbonate, oxygen generating compounds, hydrogen peroxide, petroleum-degrading bacteria, and nutrient/enzyme complexes.

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Brian P. Morrissey, P.E., BCEE
Principal Engineer

- Senior Manager for remedial design and construction oversight at federal Superfund site in Elmira, New York. The 33-acre site included several areas of concern where soil/groundwater were contaminated by several types of hazardous wastes. Managed preparation of design submittals to EPA Region II in accordance with CERCLA guidelines. The soil-sediment remediation design included requirements for materials handling, dewatering and disposal. PCB wastes were segregated and disposed of at TSCA-permitted facility. The design required stabilization of wastes and installation of a RCRA cap. Groundwater remediation system includes 12 recovery wells, filtration and two air strippers.
- Project Manager for upgrading industrial process wastewater treatment system at medical products manufacturing facility in Hancock, New York. The upgraded system removes VOCs and metals, including lead, zinc, and copper, from highly variable waste streams generated by the manufacture of surgical instruments. Prepared design documents for automated system that allows for expected future increase in plant manufacturing capabilities.
- Principal Engineer for design upgrades and expansion of the groundwater depression and separate phase product recovery systems at former petroleum refinery in Brooklyn, NY. Site encompasses one of the nation's largest petroleum releases (18 million gallons). Key components included installation of 10 remote dual-pump free-phase product recovery wells, and modifications to groundwater treatment facilities to optimize performance and system runtime. Redesigned building with new mezzanine and equipment layout to improve flow of the process treatment train.
- Senior Manager for remediation of industrial airport site in Millville, New Jersey under ECRA/ISRA programs. Managed planning, detailed design and permitting activities required to replace 1,000-gpm public supply well impacted by chlorinated solvent plume. Also managed final design of the 200-gpm groundwater recovery, treatment and recharge system that includes ultraviolet light/hydrogen peroxide system controlled by PLCs. This project won the annual Honor Award granted by AAEES.
- Design Manager for evaluation and upgrade of industrial wastewater treatment system for golf shaft manufacturer in Connecticut in accordance with CT DEEP requirements. Options evaluated included assessment of source reduction opportunities, flow segregation, and additional treatment equipment. Inspected the construction and coordinated start-up and testing of the upgraded system which included new tanks, piping, chemical metering pumps, mixers, a continuous flow sludge thickener; and enhanced instrumentation and controls.
- Project Manager for the planning and design of irrigation system using treated wastewater in the Catskills area. Conducted study on acceptable uses of wastewater treated by tertiary methods in accordance with federal and New York State guidance.
- Project Manager for evaluation of wellhead treatment alternative for 1,100-gpm public water supply well in Mineola, NY. Conducted well efficiency tests and investigated existing conditions and future requirements. Prepared design of activated carbon treatment system including building modifications and requirements for well development and replacement of the well pump and controls.
- Design Manager for groundwater recovery and treatment system at a former manufactured gas plant (MGP) in Atlantic Highlands, New Jersey. Developed specification to implement directional drilling under state highway to expand recovery system to capture off-site contamination. System design included PLC-based control software that significantly reduced on-site staffing needs. Also managed construction phase, negotiated/reduced change orders and worked with subcontractors to meet tight regulatory schedule for system start-up. System removes cyanide, metals, VOCs, and free-phase product.
- Senior Engineer for preparing and certifying Spill Prevention Control and Countermeasure (SPCC) Plans for 25 U.S. Postal Service facilities.
- Principal Engineer for the design of modifications to an active sub-slab depressurization system (SSDS) to mitigate chlorinated solvent soil vapor contamination beneath an existing occupied shopping mall in the Bronx, New York. Worked on the coordination and troubleshooting of construction issues. Managed the system testing and start-up and provided recommendations to improve system operation.
- Project Manager for planning, permitting, design and construction oversight of 12,000-foot sewer system for the collection of sanitary and industrial wastewater in Melville, New York. Sewer design included route selection, sizing of gravity sewers, provisions for utility crossings, solar-powered flow meters, grease interceptor, pump station for one branch line, and proper abandonment of leaching facilities. Project included design of two 20,000-gallon underground storage tanks and a tanker truck fill area with secondary containment. Final phase of the project implemented an industrial waste pretreatment system utilizing pH adjustment, filtration, and a bioreactor tank. This project provided a safe and reliable wastewater disposal system and eliminated a costly 40,000-gallon per day hold and haul system.
- Principal Engineer for development of innovative approach for remediation and reuse of federal Superfund site in Plaistow, New Hampshire. Prepared cost estimates for approaches aimed at reducing project costs by utilizing alternate treatment technologies and maximizing efficiency of existing system. Phased approach for site includes hot spot soil removal, enhancements of existing remedial system, implementing air sparging with SVE and follow with polishing step of in situ bioremediation. This alternative plan will achieve environmental restoration of site and is tailored to anticipated re-development of land.

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ROUX

PROFESSIONAL PROFILE

Levi Curnutte
Project Scientist

TECHNICAL SPECIALTIES

Project Management and Field Management of Phase II environmental site assessments/investigations, remedial implementations, and soil excavation/redevelopment projects. New York State Brownfields Cleanup Program (BCP); New York City Office of Environmental Remediation (NYCOER) E-Designation and Voluntary Cleanup Programs; New York State Spills Program. Additional technical skills include waterproofing, vapor barrier, sub-slab depressurization system (SSDS) inspections along with soil, groundwater, and soil vapor sampling.

EXPERIENCE SUMMARY

Five years' experience at Roux Environmental Engineering and Geology, D.P.C., Islandia, New York; Biological Science Technician at USDA-ARS, Charleston, South Carolina.

CREDENTIALS

B.S. Marine Science, Coastal Carolina University, 2011
M.S. Environmental Studies, College of Charleston, 2013
OSHA 40-hour HAZWOPER Training
OSHA 10-hour Construction Safety Training
NYCOER Gold Certified Professional
ExxonMobil Loss Prevention System-certified
MTA LIRR Roadway Worker Protection Training

PUBLICATIONS

Climate Change and Bemisia tabaci (Hemiptera: Aleyrodidae): Impacts of Temperature and Carbon Dioxide on Life History. Curnutte, L., Simmons, A. M., and S. Abd-Rabou. Ann. Ent. Soc. Amer. 107(5): 933-943. 2014.

KEY PROJECTS

- Project Manager providing support for all soil and groundwater disturbances during development of Cornell NYCTech campus located on Roosevelt Island, New York, New York. Management tasks include Agency support for NYCDEP and NYSDEC, CAMP and SWPPP implementation, soil characterization for reuse and disposal, UST removal adhering to NYSDEC regulations, asbestos abatement coordination, and preparation of a NYCDEP Remedial Closure Report.
- Project Manager for former Manufactured Gas Plant (MGP) site in Brooklyn, New York. Under NYSDEC regulation, responsibilities include coordination of monitoring of recovery wells known to be former and current producers of coal tar (DNAPL) and DNAPL recovery and disposal.
- Project Manager for an 85-acre commercial site within the NYCOER Voluntary Cleanup Program (VCP) undergoing a 500K sq. ft. mall expansion. Project involved the construction of an adjacent building to the existing mall and a new above-grade parking structure. Manager for remedial action work plan implementation and production of multiple Remedial Action Reports leading to one NYCOER Notice of Satisfaction for the client to date.
- Field Investigation Manager for previously abandoned oil-water separator delineating residual contamination at a NYSDEC-regulated 175-acre former petroleum refinery and terminal in Brooklyn, New York. Responsibilities included the oversight of all field tasks, site management, property owner and tenant coordination, and investigation report.
- Project Manager and Field Manager for the largest on-going redevelopment project in New York City, including the relocation of a nine-acre 100-year old active rail yard. Project includes management of sites with NYCDEP "E" designation and the implementation of *in situ* soil characterization sampling, soil disposal, and NYSDEC spill remediation at multiple sites within the project footprint. Achieved an NYCOER Notice of Satisfaction for one property within the OER VCP. The project will encompass 336,000 sq. ft. of office space, 6.4 million sq. ft. of residential space, an 18,000 seat sports and entertainment venue - the Barclays Center (home of the Nets professional basketball team) - 247,000 sq. ft. of retail space, a 165,000 square-foot hotel, and over 8 acres of intricately designed publicly accessible open space.
- Field Manager at 149 Kent Avenue, a NYSDEC BCP Site, implementing a RAWP requiring extensive remediation of chlorinated VOC-impacted soil and groundwater to accommodate development of a mix-used building and underground parking garage. Primary contaminants of concern were PCE and TCE. Project responsibilities include a 12-month oversight period involving zero-valent iron injections (ZVI) for a permeable reactive barrier (PRB), installation of sub-slab depressurization system (SSDS), Grace® waterproofing inspections, groundwater monitoring/ sampling, CAMP, coordination and tracking of hazardous and non-hazardous waste, and providing contractor work zone health and safety recommendations/oversight in accordance with OSHA guidance. Mr. Curnutte was involved in the submissions of the Periodic, Annual, and Final Engineering Reports submitted to NYSDEC leading to Certificate of Completion. Project received by the NYC Brownfield Partnership's 2017 Big Apple Brownfield Award for Innovation.
- Field Manager of subset of field operations for a large-scale, high profile investigation of 500 residential and sensitive-use properties located throughout Los Angeles County. As a result of lengthy aerial depositions of emissions originating from a former battery recycling facility in Vernon, California, soil was analyzed *in situ* for lead contamination on a real-time basis through the use of X-ray fluorescence (XRF) instruments. Helped coordinate and perform the rapid assessment of soils by multiple teams while under heavy scrutiny by the press, regulators, and home owners.

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ROUX

PROFESSIONAL PROFILE

Daniel Miserendino

Staff Geologist

TECHNICAL SPECIALTIES

Remedial construction and soil excavation oversight, management of waste characterization and removal, environmental site assessments focusing on soil, surface water, porewater, groundwater and soil vapor investigations using multiple sampling techniques, investigative XRF geochemistry of shale/mudstones.

EXPERIENCE SUMMARY

1.5 years of experience: Staff Geologist, Roux Environmental Engineering and Geology, D.P.C., Islandia, NY

CREDENTIALS

B.A. Geology, SUNY Geneseo, 2015
M.S. Geology, Binghamton University, 2017
OSHA 40-Hour HAZWOPER Training, 2017
OSHA 10-hour Construction Safety Training, 2017
New York State Builders Association 4-Hour Stormwater Training, 2018

KEY PROJECTS

- Field Manager for a site in the New York State Brownfields Cleanup Program (BCP), located at Halletts Point, Queens, NY. Responsible for soil trucking and manifesting for proper disposal of over 100,000 cubic yards of soil to multiple offsite disposal facilities. Daily excavation oversight included coordination with the general contractor, groundwater dewatering oversight, Community Air Monitoring Program implementation, and daily reporting of site activity. Identification of petroleum-impacted soil during excavation and coordinating appropriate disposal facilities with the construction manager. Project management duties consisted of staff training, daily reporting to NYS DEC and NYS DOH project managers and communication with both client and contractors.
- Field manager responsible for soil excavation and waste removal oversight for development of institutional buildings at Cornell Tech, Roosevelt Island, New York. Responsibilities included overseeing excavation, soil sampling, organization and proper handling of waste manifests, ensuring compliance with the Site Remedial Action Plan, and weekly (SWPPP) inspections.
- Implemented Community Air Monitoring Programs during excavation and disposal activities at multiple locations in Brooklyn and Queens, New York; and Norwalk, Connecticut. Responsible for monitoring airborne dust and VOCs that are potentially generated by remedial action work activities, reviewing the collected data for exceedances of the New York State Department of Health (NYSDOH) guidelines and for signing manifests for the shipment of soil to approved facilities.
- Field Manager for the annual groundwater monitoring round to monitor the largest subsurface free-product plume in North America at a former fuel and oil distribution terminal in Brooklyn, NY. Responsibilities included the gauging of wells and collection of groundwater samples from on-site and off-site monitoring wells.
- Conducted two one-month long sampling rounds on an EPA Superfund site in Columbia Falls, Montana, including sampling groundwater, porewater, surface water, soil, and stream sediments. Depth/velocity transects, and water chemistry measurements were completed for streams running through the site.
- Field Manager/Site Health and Safety Officer on a Phase II Environmental Site Assessment on Coney Island. Included soil, groundwater, and soil vapor sampling, and oversight of drilling subcontractors.
- Field Manager for a site in the NYS Brownfields Cleanup Program (BCP) in the Bronx, NY. Included soil sampling, oversight of drilling subcontractors and monitoring airborne dust and VOCs that are potentially generated by work activities.

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ROUX

PROFESSIONAL PROFILE

David E. Kaiser, P.E.
Senior Engineer

TECHNICAL SPECIALTIES

Engineering services including development and review of design drawings, implementation of design, development of technical specifications, review of construction submittals, development of SWPPPs, field management and site safety of various heavy construction projects, and civil/remediation engineering construction management. Designs have included stormwater drainage systems, NYCDEP sewer system, NYCDOB/DOT sidewalk project, and remedial system design. Additional services including budget management, permitting, project coordination, project scheduling, development of bid packages and cost estimating.

Field management and construction oversight of heavy equipment construction including sewer construction, drainage construction, crane lift activities and remedial construction activities. Environmental site assessments focusing on soil, soil vapor, groundwater and excavation dewatering investigations.

EXPERIENCE SUMMARY

Twelve years of experience: Project Engineer with Roux Environmental Engineering & Geology, D.P.C.; Design Engineer with Bohler Engineering.

CREDENTIALS

B.E. Civil Engineering, Hofstra University, 2006
Fundamentals of Engineering E.I.T. Certification, 2006
Professional Engineer (NY), 2017
OSHA 40-Hour HAZWOPER Training, 2008
OSHA 30-Hour Construction Safety Training, 2011
OSHA 10-Hour Construction Safety Training, 2018
OSHA 8-Hour Hazardous Waste Refresher Training, 2017
LPS 8-Hour Training Certification, 2008
First Aid and CPR Certified, 2016
DOT Hazardous Materials Awareness Training, 2017
NYSDEC Erosion and Sediment Control Training, 2016
Transportation Worker Identification Credential (TWIC)

KEY PROJECTS

- Land Development Site Plan Preparation – Design Engineer for the design and development of residential, commercial and industrial site plan packages for Suffolk County, Nassau County and New York City Boroughs. Site plan packages for the various municipalities within Suffolk County, Nassau County and New York City included components such as: zoning analysis, site removals plan, site design and construction documents, water and sewer system design (detention and retention systems), site grading and drainage plans, and lighting analysis and design.
- Suffolk County Drywell Closure – Senior Engineer for the planning and coordination of closing existing drywell structures serving as sanitary and industrial retention basins for an industrial facility. The project consisted of developing a sampling plan for the site, coordinating sampling and inspection of existing sanitary and industrial drywells in accordance with Suffolk County Department of Health Services Article 12, SOP No. 9-95 Pumpout and Soil Cleanup Criteria. Following the sampling event, a summary of results was prepared and sent to the SCDHS for review. Due to exceedances that were present within the septic tanks, a remedial action work plan was developed to identify the required steps for successful closure which included coordinating the SCDHS field inspection, extraction of contaminated liquids and solids, and proper disposal of the waste.
- Property Drainage System Design and Construction – Project Engineer for the design and development of a new on-site stormwater treatment system located at a former petroleum terminal in Brooklyn, NY. Design included drainage improvements and modifications for the former petroleum terminal to support ongoing remediation activities that were being conducted to facilitate the future closure of an existing in-ground oil/water separator and removal of associated piping, and to support the anticipated long-term remedy for, and potential future redevelopment of, the subject property. The proposed drainage modifications included the installation of new drainage structures, Contech treatment structures and conveyance piping to collect and treat stormwater runoff within the property, and bypass the existing in-ground oil/water separator, prior to discharging the stormwater via an existing SPDES outfall.
- Oil/Water Separator Closure – Project Engineer for engineering support and review for the closure of an existing in-ground oil/water separator at a former petroleum terminal in Brooklyn, NY. The closure and abandonment of the oil/water separator was deemed the long-term remedy as approved by the NYSDEC. The oil/water separator was originally constructed in the early 1900s and has served the property by providing stormwater runoff treatment. The closure project includes the following tasks: dewatering and treatment of separator water; excavation of existing sludge in separator; dewatering and drying/stabilization of the sludge removed; power washing of interior; backfill and compaction of clean fill inside separator; removal of all existing above grade structures including catwalks, guardrails and piping; proper shipping and disposal of sludge contents; installation of a final cover system consisting of a geosynthetic clay liner (GCL) and filter fabric barrier; and final site grading.
- Utility Tunnel Extension – Project Engineer for construction management of a utility tunnel extension and modification project. The project consisted of installation of a precast concrete stairway access to an existing utility tunnel, installation of a structural slab to span the tunnel extension, installation of a new base slab, installation of cast-in-place concrete walls and top slab, installation of sidewalks and relocation of all existing system piping and conduits. The work was performed in accordance with the requirements of the New York City Department of Buildings (NYCDOB) and the New York City Department of Transportation (NYCDOT).

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Senior Engineer

- Treatment System Building Upgrades – Project Engineer for the review and implementation of engineering drawings for a metals removal system upgrade to an existing 450-gpm groundwater treatment system. The upgrades consisted of: relocating and reinstalling the existing oil/water separator tank on a steel spacer via crane; lifting and installing the existing 10,000 gallon equalization tank to be repurposed as a filter backwash solids removal tank; lifting and installing prefabricated concrete pads with a subbase of Geogrid BX1200 and 6" of aggregate size number 57 (as per NYCDDC Highway Specifications and ASTM C33) compacted to 95% Standard Proctor, under proposed tank locations; locating a new 20,000 gallon equalization/aeration tank on the new pad; installing of new blower motor and enclosure; and installing of new piping and appurtenances.
- Recovery Well Construction – Staff Engineer for the construction of aspects of a dual-phase free-phase petroleum product (free-product) and groundwater recovery well at a former petroleum terminal in Brooklyn, NY. Groundwater extracted from the recovery well would be conveyed through 4-inch diameter high density polyethylene standard dimension ratio 11 (HDPE SDR 11) piping and connected to an existing 6-inch HPDE SDR 11 force main piping network that transports the groundwater to an existing on-site groundwater treatment system. Any free-product recovered would be sent to an existing 2,000 gallon above ground storage tank (AST) via 1-inch double wall product piping. Electrical and signal conduits were routed to an existing well house where the system control components were housed.
- Treatment System Building Roof Rehabilitation and Platform Installation – Project/Staff Engineer for providing engineering design, review and construction management of the rehabilitation of a roof and installation of an internal platform in an existing remediation groundwater treatment system building located at a former petroleum terminal in Brooklyn, NY. The roof rehabilitation project included the replacement of approximately 1,200 square feet of stainless steel decking, insulation and waterproofing. The project also included the construction of three new skylights and access ladders. The platform installation project included the installation of new steel members and fiberglass reinforced polymer (FRP) molded grating within the existing remediation groundwater treatment to provide a working platform for on-site technicians. The new steel members were bolted to existing infrastructure to limit on-site welding and the platform was installed with tubular steel handrails. Responsibilities included: ensuring that the development of the plans and technical specifications were in accordance with the New York City Construction Codes, New York State Building Standards and Codes, various ASTM standards, American Institute of Steel Construction (AISC) "Code of Standard Practice for Steel Buildings and Bridges", and Steel Structures Painting Council (SSPC) Publications.
- NYCDEP Private Storm and Sanitary Sewer System – Project/Staff Engineer for the design and development of a New York City Department of Environmental Protection (NYCDEP) Private Storm and Sanitary Sewer System located at a former petroleum terminal in Brooklyn, NY. The sewer system comprised of over 2,600 LF of sewer in Greenpoint Brooklyn over two phases of construction. During the duration of this project responsibilities included: develop/revise NYCDEP sewer design plans and construction notes, address NYCDEP comments and markups, develop Bill of Materials, develop cost estimates, develop technical specifications, develop bid package, ensure compliance with NYCDEP and NYCDOT specifications and requirements, develop/revise NYCDOT Builder's Pavement Plan (BPP), develop NYCDOT Maintenance and Protection of Traffic plans, conduct/participate in design construction meetings, review subcontractor submittals and cut sheets, address NYCDEP punch list items, management/oversight/coordination of subcontractor construction activities.
- NYCDOB/NYCDOT Sidewalk Installation – Project/Staff Engineer for the design, development, and installation of over 4,000 linear feet of new sidewalks over various phases located at a former petroleum terminal in Brooklyn, NY. The design, development, and installation of these sidewalks were in accordance with the New York City Department of Buildings and New York City Department of Transportation specifications and details of construction. During the duration of these projects my major responsibilities included: develop/revise NYCDOT Builder's Pavement Plans, develop cost estimates, develop technical specifications, develop bid package, ensure compliance with NYCDOB and NYCDOT specifications and requirements, develop NYCDOT Maintenance and Protection of Traffic plans, conduct/participate in design construction meetings, ensure proper installation and testing of sidewalks in accordance with NYCDOB and NYCDOT, management/oversight/coordination of subcontractor construction activities.
- Sub Slab Depressurization System – Staff Engineer for the design and construction of two sub slab depressurization systems (SSDS) located within the footprint of a petroleum remediation site where a new building was proposed to be built. These projects were part of an Interim Remedial Measure (IRM) Action Plan as approved by the NYSDEC to provide a preventative proactive measure to address potential soil vapor issues. The SSDSs were designed to operate passively; however, header piping was installed to allow for the installation of the necessary equipment if an active system was required. The SSDSs consisted of ¾-inch gravel with 4-inch diameter polyvinyl chloride (PVC) schedule 40 well screen used as soil gas collection piping and 6-inch diameter solid PVC used as the header piping. A vapor barrier/waterproofing membrane and nonwoven geotextile fabric were installed between the venting layer and the floor slab.

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David E. Kaiser, P.E.
Senior Engineer

All penetrations through the floor slab were sealed using a silicone based waterproof sealant. The scope of work included, excavation and trench work for the SSDS; placement of pipe bedding; jointing and installation of the pipe fittings, valves and appurtenances; installation of pipe sleeves and mechanical seals; and installation of nonwoven geotextile fabric and silicone based waterproof sealant.

- Remediation System Signal Network Utility Expansion Oversight and Management – Staff Engineer and Field Manager for the completion of a signal communication network expansion as part of a petroleum remediation system. My responsibilities included oversight of a subcontractor while installing level sensors within the product pull boxes to improve the safety of the system operations by continuously monitoring the underground product piping network for potential leaks, and programming, testing and verification of operation of sensors. The scope of work also included the installation of signal and control wiring from recovery well houses to subsurface vaults through existing conduit located beneath New York City streets located in Greenpoint Brooklyn. The signal expansion was part of an effort to integrate the sensor/components within the vaults with the existing remediation system's programmable logic controllers (PLCs). The scope of work also included: development of programming to integrate input infrastructure to existing PLCs, development of human machine interface (HMI) screens to allow for remote viewing at the system control buildings, and installation of power supplies and other apparatuses as required for the operation of the new infrastructure. My responsibilities for this work included: subcontractor management, submittal and cut sheet review, scheduling management, 3rd party coordination, and construction meetings.
- New York City Transit Plan Submission – Staff Engineer for researching, preparing and submitting New York City Transit (NYCT) Plans for various sites to seek approval for drilling and other subsurface activities in proximity to NYC Subways. The scope of work included visiting the Microfilm Room at the NYCT Office to obtain copies of the as-built plans, roof plans, profiles, sections, and alignments adjacent to the properties that our clients were proposing to perform subsurface work. Using these plans, develop proposed boring location plans and cross section plans, overlaying the NYCT plans to determine the proposed distance to adjacent NYCT structures. Ensured that these plans had the most up to date NYCT construction notes since these drawing became part of the projects' contract drawings. Submitted the plans and fees to the NYCT and coordinated with the NYCT inspectors assigned to each project ensuring that all requirements and questions were satisfied. Procured the associated NYCT approvals and distributed to the client so that they may proceed.
- Stormwater Pollution Prevention Plan (SWPPP) Reports – Staff Engineer for preparing and submitting Stormwater Pollution Prevention Plans (SWPPP) for various residential and commercial development sites in New York City and Long Island. The scope of work included preparation of SWPPP Reports in accordance with the most current New York State Department of Environmental Conservation (NYSDEC) regulations at the time including the 'General Permit for Stormwater Discharges from Construction Activity' and the 'New York State Stormwater Management Design Manual'. Preparation of the SWPPP Reports included: summarizing the site history and project description, soil geology, potential pollutants, erosion and sediment control practices, inspection and maintenance procedures, water quantity and water quality control plans, construction sequence scheduling, and the Notice of Intent (NOI) for each project as required by the NYSDEC.
- Former Petroleum Storage Wetland and Canal Remediation Site – Staff Engineer for daily construction oversight of subcontractors as a field manager and implementation of the site-specific health and safety plan as a Community Air Monitoring Program manager. The scope of work included conducting an on-site Community Air Monitoring Program monitoring for airborne dust and VOCs that were potentially generated by remedial and construction work activities. Stopping work and implementing best engineering/control practices if action levels were exceeded. Recording and providing QA/QC analysis of on-site weather and air monitoring data, as well as ensuring the proper operation of all instruments/monitors on a daily basis. Inspections were conducted of three on-site aboveground API concrete oil/water separators. Stormwater Pollution Prevention Plan (SWPPP) inspections were performed, ensuring compliance with NYSDEC State Pollutant Discharge Elimination System (SPDES) General Permit for Stormwater Discharges from Construction Activity and daily reports were generated which would comprehensively document daily work activities and CAMP data and exceedances.

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ROUX

PROFESSIONAL PROFILE

Josh Cope
Senior Scientist

TECHNICAL SPECIALTIES
Fuel oil forensics and age dating, USEPA Superfund, OPA, and NJDEP environmental regulations, Site Assessment and Contractor Oversight, GC/MS Operator, Data Validation, Technical Report preparation and review, Field Chemistry: field screening, HAZCATTING, groundwater and soil sampling, Hazardous Waste Transportation and Disposal

EXPERIENCE SUMMARY
25 years experience; Senior Scientist with Roux Associates, Inc.; Senior Chemist, Project Manager with Tetra Tech, Inc.; Owner of Geodyne Engineering Consultants, Inc.; Quality Assurance Officer, GC/MS Operator, Twenty First Century Environmental, Inc.; Project Manager, Field Technician, Resource Applications, Inc.

CREDENTIALS
B.A., 1991, Chemistry, Haverford College
OSHA 40-Hour Health and Safety Training
Level A Personal Protective Equipment Training
DOT and IATA Hazardous Material Shipping Training
New Jersey Transit (NJT) – Roadway Worker / On Track Protection

FEDERAL PROGRAMS – CLIENT: USEPA
KEY PROJECTS
- Provide technical and project management support to USEPA Removal and Remedial Branches in Regions 2, 3, 4 on Superfund and OPA projects.
- Manage and perform phase I and II site assessments, remedial investigations, removal action oversight, prepare health and safety plans, monitor site health and safety, support USEPA enforcement actions, implementation of Facility Response Plan (FRP) program, emergency response, biowatch exercises, criminal investigation support, contractor oversight, cost tracking, documentation, daily reporting, prepare after action reports, data validation, waste management, and attend public meetings
- Sites include: UST, AST, and pipeline leaks, lead smelter sites, wood treatment facilities, coal to gas plants, dry cleaners, junk yards, federal facilities, unpermitted landfills, drum burial, flood and hurricane clean up, oil refinery inspections, farmland, and historic industrial sites.
- Contaminants include: TCE, PCE, MTBE, BTEX, oil, gasoline, PCP, PAHs, mercury, lead, arsenic, ammonia, acids, bases, pesticides, PCBs, asbestos, and unknowns.
- Participated in the largest USEPA sponsored interagency response emergency response exercise, Liberty Radex, in Philadelphia. Acted as planner prior to the exercise and master controller during the exercise.
- Interface with state and local regulators on sites in Pennsylvania, Delaware, New Jersey, Maryland, Virginia, West Virginia, and Mississippi.

STATE PROGRAMS – CLIENTS: BUSINESSES AND INDIVIDUALS IN NEW JERSEY
- Provide a wide array of environmental services to homeowners, land developers, insurance companies, gas stations, and small industrial companies in New Jersey.
- Manage and/or perform ISRA reporting, phase I and II site assessments, third party investigations, subsurface evaluation, UST removal, air emissions permitting preparation, soil, groundwater, and vapor intrusion investigations, NPDES compliance.
- Manage remedial investigation, design, and execution for LUSTs, and farmland development.
- Manage reporting, deed restriction preparation, CEAs, remedial action permits, and response action outcome preparation (RAO).
- Evaluate environmental costs for insurance claims and litigation cases.
- Prepare and present justification for fine reduction to state regulators for private client.
- Meet with clients, prepare proposals, and negotiate contracts.

DATA VALIDATION/LABORATORY EXPERIENCE
- Perform level 3 and 4 data validation of analytical data packages in accordance with USEPA National Functional Guidelines.
- Quality assurance officer and GC/MS operator for New Jersey certified laboratory.
- Performed analysis of volatile and semi-volatile organics.
- Preformed maintenance and repair of analytical instruments.
- Performed method development and trouble shooting of analytical issues.
- Set up and operated mobile laboratory for organic and inorganic analyses on Superfund site assessments.
- Performed field screening of contaminants using test kits, XRF, radiation meters, and various types of air monitoring equipment.

WASTE MANAGEMENT
- Waste Management Specialist for oil pipeline client in Michigan for largest inland oil spill in United States during August 2010 through October 2011.
- Responsible for compliance, cost tracking, cost estimation, waste tracking and reporting, oil recovery calculation and reporting, contractor oversight.
- Prepared Waste Transportation and Disposal Plans and responses to regulator comments.

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Josh Cope
Senior Scientist

- Prepared waste profiles, negotiated waste removal protocols with USEPA and MDEQ to streamline process of waste handling to realize savings through greater efficiency and lowering sampling requirements.
- Located disposal facilities, negotiated disposal rates.
- Performed cost benefit analysis of various soil dewatering agents and procedures and proposed methods and protocols to client, USEPA, and MDEQ.
- Performed some oversight of removal actions along river.
- Supported submerged oil assessment of river.

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ATTACHMENT 2

NYSDEC PFAS Guidance

June 2019

Sampling for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances (PFAS) Under DEC's Part 375 Remedial Programs

Objective

The Department of Environmental Conservation (DEC) is requiring sampling of all environmental media and subsequent analysis for the emerging contaminants 1,4-Dioxane and PFAS as part of all remedial programs implemented under 6 NYCRR Part 375, as further described in the guidance below.

Sample Planning

The number of samples required for emerging contaminant analyses is to be the same number of samples where "full TAL/TCL sampling" would typically be required in an investigation or remedial action compliance program.

Sampling of all media for ECs is required at all sites coming into or already in an investigative phase of any DER program. In other words, if the sampling outlined in the guidance hasn't already been done or isn't part of an existing work plan to be sampled for in the future, it will be necessary to go back out and perform the sampling prior to approving a SC report or issuing a decision document.

PFAS and 1,4-dioxane shall be incorporated into the investigation of potentially affected media, including soil, groundwater, surface water, and sediment as an addition to the standard "full TAL/TCL sampling." Biota sampling may be necessary based upon the potential for biota to be affected as determined pursuant to a Fish and Wildlife Impact analysis. Soil vapor sampling for PFAS and 1,4-dioxane is not required.

Upon an emerging contaminant being identified as a contaminant of concern (COC) for a site, those compounds must be assessed as part of the remedy selection process in accordance with Part 375 and DER-10 and included as part of the monitoring program upon entering the site management phase.

Special Testing Requirements for Import or Reuse of Soil: Soil imported to a site for use in a soil cap, soil cover, or as backfill must be tested for 1,4-dioxane and PFAS contamination in general conformance with DER-10, Section 5.4(e). Soil samples must be analyzed for 1,4-dioxane using EPA Method 8270, as well as the full list of PFAS compounds (currently 21) using EPA Method 537.1 (modified).

For 1,4-dioxane, soil exceeding the Unrestricted SCO of 0.1 ppm must be rejected per DER 10: Appendix 5 - Allowable Constituent Levels for Imported Fill or Soil, Subdivision 5.4(e).

If PFOA or PFOS is detected in any sample at or above 1 ppb, then a soil sample must be tested by the Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed. If the SPLP results exceed 70 ppt combined PFOA/S, then the source of backfill must be rejected. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays.

The work plan should explicitly describe analysis and reporting requirements, including laboratory analytical procedures for modified methods discussed below.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by an independent 3rd party data validator. QA/QC samples should be collected as required in DER-10, Section 2.3(c). The electronic data submission should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

PFAS analysis and reporting: DEC has developed a *PFAS Analyte List* (below) for remedial programs. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any compounds, the DEC project manager, in consultation with the DEC remedial program chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site.

Currently, ELAP does not offer certification for PFAS compounds in matrices other than finished drinking water. However, laboratories analyzing environmental samples (e.g., soil, sediments, and groundwater) are required by DER to hold ELAP certification for PFOA and PFOS in drinking water by EPA Method 537 or ISO 25101. Labs must also adhere to the requirements and criteria set forth in the Laboratory Guidance for Analysis of PFAS in Non-Potable Water and Solids.

Modified EPA Method 537 is the preferred method to use for environmental samples due to its ability to achieve very low detection limits. Reporting limits for PFAS in groundwater and soil are to be 2 ng/L (ppt) and 1 ug/kg (ppb), respectively. If contract labs or work plans submitted by responsible parties indicate that they are not able to achieve these reporting limits for the entire list of 21 PFAS, site-specific decisions will need to be made by the DEC project manager in consultation with the DEC remedial program chemist. Note: Reporting limits for PFOA and PFOS in groundwater should not exceed 2 ng/L.

Additional laboratory methods for analysis of PFAS may be warranted at a site. These methods include Synthetic Precipitation Leaching Procedure (SPLP) by EPA Method 1312 and Total Oxidizable Precursor Assay (TOP Assay).

SPLP is a technique for determining the potential for chemicals in soil to leach to groundwater and may be helpful in determining the need for addressing PFAS-containing soils or other solid material as part of the remedy. SPLP sampling need not be considered if there are no elevated PFAS levels in groundwater. If elevated levels of PFAS are detected in water, and PFAS are also seen in soil, then an SPLP test should be considered to better understand the relationship between the PFAS in the two media.

The TOP Assay can assist in determining the potential PFAS risk at a site. For example, some polyfluoroalkyl substances may transform to form perfluoroalkyl substances, resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from the site. To conceptualize the amount and type of oxidizable perfluoroalkyl substances which could be liberated in the environment, a “TOP Assay” analysis can be performed, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized.

PFAS-containing materials can be made up of per- and polyfluoroalkyl substances that are not analyzable by routine analytical methodology (LC-MS/MS). The TOP assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by current

analytical methodology. Please note that analysis of highly contaminated samples, such as those from an AFFF site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. Please consult with a DEC remedial program chemist for assistance interpreting the results.

1,4-Dioxane analysis and reporting: The reporting limit for 1,4-dioxane in groundwater should be no higher than 0.35 µg/L (ppb) and no higher than 0.1 mg/kg (ppm) in soil. Although ELAP offers certification for both EPA Method 8260 and EPA Method 8270 for 1,4-dioxane, DER is advising the use of Method 8270 SIM for water samples and EPA Method 8270 for soil samples. EPA Method 8270 SIM is not necessary for soils if the lab can achieve the required reporting limits without the use of SIM. Note: 1,4-dioxane is currently listed as a VOC in the Part 375 SCO tables but will be moved to the SVOC table with the next update to Part 375.

Refinement of sample analyses: As with other contaminants that are analyzed for at a site, the emerging contaminant analyte list may be refined for future sampling events based on investigative findings. Initially, however, sampling using this PFAS Analyte List and 1,4-dioxane is needed to understand the nature of contamination.

PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonates	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluoroalkyl carboxylates	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer Sulfonates	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane-sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-sulfonamidoacetic acids	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

ATTACHMENT 3

Roux ‘s Standard Operating Procedures

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non-acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.

2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.

2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.

2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.

2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.

3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).

3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.

3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.

3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.

3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.

3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)

3.8 Reassemble the cleaned sampler, as necessary.

3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil.

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.

c. Disassemble bailer (if applicable) and discard cord in an appropriate manner and scrub each part of the bailer with a brush and solution.

d. Rinse with potable water and reassemble bailer.

e. Rinse with copious amounts of distilled or deionized water.

f. Air dry.

g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).

h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.

b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.

c. Flush the pump and discharge hose (if not disposable) with the detergent solution and discard disposable tubing and/or cord in an appropriate manner.

d. Flush the pump and discharge hose (if not disposable) with potable water.

e. Place the pump on clear plastic sheeting.

f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.

g. Air dry.

h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6-inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless-steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines soil sampling requirements.

b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.

c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable sampling gloves.

g. Laboratory-supplied sample containers with labels.

h. Cooler with blue or wet ice.

i. Plastic sheeting.

j. Black pen and indelible marker.

k. Zip-lock bags and packing material.

l. Tape measure.

m. Paper towels or clean rags.

n. Masking and packing tape.

o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.

5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.

5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).

5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.

5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.

5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.

5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.

5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.

5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic

container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth, so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

a. Sample bottles are preserved at the laboratory prior to shipment into the field.

b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual Ziploc® bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly

contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

a. Sample bottles of proper size and type with labels.

b. Cooler with ice (wet or blue pack).

c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.

d. Black pen and indelible marker.

e. Packing tape, "bubble wrap," and "zip-lock" bags.

f. Overnight (express) mail forms and laboratory address.

g. Health and safety plan (HASP).

h. Work plan/scope of work.

i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

a. Graduated pipettes.

b. Pipette bulbs.

c. Litmus paper.

d. Glass stirring rods.

e. Protective goggles.

f. Disposable gloves.

g. Lab apron.

h. First aid kit.

i. Portable eye wash station.

j. Water supply for immediate flushing of spillage, if appropriate.

k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.

4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.

4.3 Collect samples in the proper manner (refer to specific sampling SOPs).

4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.

4.5 Conduct QC sampling, as required.

4.6 Seal each container carefully and place in an individual "zip lock" bag.

4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.

4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.

4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure the sample containers and coolers are in compliance and properly labeled.

4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.

4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

a. Bailers (Teflon™ or stainless steel).

b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).

c. Gas-displacement device(s).

d. Air-lift device(s).

e. Teflon™ tape, electrical tape.

f. Appropriate discharge hose.

g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.

h. Appropriate compressed gas if using bladder-type or gas-displacement device.

i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.

j. Non-absorbent cord (e.g., polypropylene, etc.).

k. Plastic sheeting.

l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).

m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/Deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.

s. Well location and site map.

t. Well keys.

u. Stop watch, digital watch with second increments, or watch with a second hand.

v. Water Well Handbook.

w. Calculator.

x. Black pen and water-proof marker.

y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).

z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).

aa. pH meter(s) and buffers.

bb. Conductivity meter(s) and standards.

cc. Thermometer(s).

dd. Extra batteries (meters, thermometers, flashlight).

ee. Filtration apparatus, filters, pre-filters.

ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).

gg. Disposable gloves.

hh. Water jugs.

ii. Laboratory-supplied sample containers with labels.

jj. Cooler(s).

kk. Ice (wet, blue packs).

ll. Masking, duct, and packing tape.

mm. Chain-of-custody form(s) and custody seal(s).

nn. Site sampling and analysis plan (SAP).

oo. Site health and safety plan (HASP).

pp. Packing material (e.g., bubble wrap)

qq. "Zip-lock" plastic bags.

rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.

a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.

b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate

container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.

5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development, and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

5.9 Record the physical appearance of the water (i.e. color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.

5.10 If a bailer is used to collect the sample, then:

a. Flush the decontaminated bailer three times with distilled/deionized water.

b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.

c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.

5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.

5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.

5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in an ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.

5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.

5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.

5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.

5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.

5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.

5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.

5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.

5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

END OF PROCUDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 MATERIALS/EQUIPMENT

a. A work plan which outlines photoionization screening requirements.

b. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents [e.g., acetone, nitric acid, hexane, etc.], aluminum foil, plastic sheeting, etc.).

c. Field notebook, field form(s), maps, chain-of-custody forms.

d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).

e. Stainless steel spoons or spatulas.

f. Disposable plastic spoons.

g. Plastic sheeting.

h. Aluminum foil.

i. Mason jars or driller's jars.

j. Water bath (hot plate, extension cord, water tray, thermometer).

k. Photoionization detector with charging unit.

l. Calibration gases with regulator.

m. Indelible marker.

n. Masking tape.

o. Disposable sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a soap and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the SOP for decontamination of field equipment.

5.0 CALIBRATION

The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted. The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log. If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

6.1 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

6.2 Place the sample in a pre-cleaned glass jar (as quickly as possible to avoid loss of VOCs) filling the jar half full. Place an aluminum foil seal between the glass and metal cap and screw tight.

6.3 Label jars with the boring number, depth of sample, date of collection and blow counts. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the sampler is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.

6.4 Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).

6.5 After the sample has been collected, heat the sample under controlled conditions in a water bath for a 2 minute period.

6.6 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the aluminum foil seal with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

6.7 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate.

6.8 Place any material not representative of the interval sampled in a pile with the other cuttings from the borehole.

6.9 If only photoionization results are to be obtained, then reusable sampling devices may be cleaned with a soap and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidance to obtain accurate and consistent samples of soil gas.

2.0 MATERIALS/EQUIPMENT

- Teflon or Nylaflow tubing, one-quarter or one-eighth inch diameter sample tubing.
- Swagelok® ¼-inch nut and ferrule sets for connecting the probe tubing to the sampling manifold, as appropriate for the collection method
- Helium leak check equipment, as dictated by Site-specific data quality objectives (DQOs), including the enclosure, helium cylinder (high purity helium), and helium detector (Dialectric MGD is preferred). The enclosure and helium detector may be provided by the driller.
- Air pump for purging and electric supply for the pump (either battery, generator, or power inverter with adapter for car battery). Must be capable of a flow of 200 milliliters per minute (mL/min) and a vacuum of 20” Hg.
- Canister, tedlar bag or syringe, as appropriate for the collection method.

3.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves and plastic sheeting will be changed after each use and discarded in an appropriate manner.

4.0. SITE-SPECIFIC CONSIDERATIONS

Prior to attempting soil gas sampling there should be an understanding of subsurface conditions at the Site. Soil gas samples should be collected in the vadose zone and generally, soil gas samples should not be collected at a depth less than above 5 feet below ground surface (bgs), unless sub-slab soil gas samples are needed. It may also not be feasible to collect soil gas from tighter grain soils with little pore volume, such as clays, and these layers should be avoided.

Soil gas sampling should not be performed until 24-hours after a significant rain event (>1/2 inch of rainfall).

5.0 PROCEDURE

5.1 System Set-up

1. Acquire all the necessary hardware and sampling equipment. Be sure to use one-quarter or one-eighth inch diameter Teflon or Nylaflow sample tubing.

2. Assemble or obtain the necessary fittings and vacuum gauge to create a soil gas probe and sampling manifold (vacuum gauge and valving). This manifold must be clean, free of oils, and flushed free of VOCs prior to use. If appropriate, be sure to place the helium leak check enclosure over the probe, and push the sample tubing through the hole in the cap before attaching the sampling manifold.

3. Adjust the purge system evacuation pump sampling rate to achieve the desired flow rate of 200 mL/min. This should be performed at the outlet of the vacuum pump prior to purging, either by using a suitable flow meter, or determining the amount of time required to fill a 1-liter Tedlar bag.

5.2 Shut-In Test

Prior to purging or sampling, a shut-in test should be conducted to check for leaks in the above-ground sampling system.

1. Assemble the above-ground valves, lines and fittings downstream from the top of the probe.

2. Evacuate the system to a minimum measured vacuum of about 100 inches of water using the purge pump.

3. Observe the vacuum gauge for 1-2 minutes. If there is any observable loss of vacuum, adjust the above-ground sampling system until the vacuum is maintained.

5.3 System Leak Checking and Purging

Perform a leak check of the sample manifold system by:

1. Make sure the gas probe valve is off and the sample valves are closed.

2. Open the purge valve and start the purge pump. Verify that the flow is set to 200 mL/min until a vacuum of approximately 15" Hg is achieved.

3. Turn off the purge pump and observe the vacuum gauge for 1-2 minutes. If there is any observable loss of vacuum, the leaks must be fixed prior to sampling.

4. Record the leak check date and time on the field notebook.

5.4 Purge Volume Test (Mobile Laboratory Only)

The purpose of the purge volume test is to ensure that stagnant air is removed from the sampling system and to ensure that samples are representative of subsurface conditions. The test well should be located where soil gas concentrations are anticipated to be elevated, if possible.

Perform a purge test of the test well by:

1. Purge the well one purge volume and collect a sample.

2. Have the mobile laboratory analyze the sample for target compounds. Sample procedures are explained in Section 5.6, below.

3. Purge an additional two purge volumes (for a total of 3 purge volumes), collect a sample and submit to the mobile laboratory for analysis.

    a. One purge volume is equal to the sum of the following volumes:

        - The internal volume of tubing;
        - The void space of the sand pack around the probe tip;
        - The void space of the dry bentonite in the annular space.

4. Repeat for a purge of 10 total purge volumes.

5. The site purge volume will be chosen based on the sample with the highest concentration of target compounds from the purge test. All of other sample locations will utilize this purge volume (either one, three, or ten).

5.5 Helium Leak Check (as dictated by DQOs)

The helium leak check procedure is accomplished by:

1. Start the flow of helium under the leak check enclosure. Position the tube so the helium is directed at the interface of the probe and the ground. Let the helium fill the enclosure for a couple of minutes.

2. Turn the helium leak detector on and make sure that the detector is not reading any helium before proceeding.

3. Verify that the helium concentration inside the leak check enclosure is >10% by placing the probe of the helium detector into the hole where the sample tubing comes out or under the enclosure wall. It is not necessary to verify that the helium concentration is 100% as this is bad for the detector.

4. Purging is carried out by pulling soil gas through the system at a rate of 200 mL/min for a time period sufficient to achieve three purge volumes, equal to the sum of the internal volume of the in-ground annular space, sample line, and sampling manifold system.

   Note: When calculating the purge volume, be sure to take into account the inside diameter and length of the sample tubing, as well as the probe outside diameter and retract distance for the annular space for temporary probes. If during the purge (or sampling) the vacuum exceeds 7 "Hg, then reduce the pump flow rate. The system vacuum must stay below this level at all times.

5. To start the soil gas probe purge, open the gas probe valve and close the sample valve at the same time, and start timing. Verify that the flow rate is still 200 mL/min.

6. During the last 5 minutes of the purge (or the entire purge time if less than 5 minutes), attach a Tedlar bag to the purge pump exhaust and open the bag's valve.

7. At the end of the purge time, close the purge valve, close the valve to the Tedlar bag, and turn off the pump.

8. Attach the Tedlar bag to the helium detector and open the valve. If a helium reading of greater than or equal to 5% of the helium concentration inside the leak check enclosure is observed, then the probe leak check has failed and corrective action should be taken.

9. Record the purge date, time, purge rate, leak check result, and purge volume on the field sampling log.

10. Immediately move on to the sampling phase. Little to no delay should occur between purging and sampling.

5.6 Sample Collection

'Clean' sampling protocols must be followed when handling and collecting samples. This requires care in the shipping, storage, and use of sampling equipment. Sharpie markers should not be used for labeling or note-taking during sampling.

1. Attach the canister, tedlar bag or syringe to the sample tubing.

2. Before taking the sample, confirm that the sampling system valves are set as follows: the purge valve is confirmed to be closed, gas probe valve is open, and the sample valve is open.

3. After sampling for the appropriate amount of time, close the sample valve and the canister/tedlar bag valve. Remove the sample container from the sampling manifold.

4. Record the sampling date, time, canister identification (ID), flow controller ID, and any other observation pertinent to the sampling event on the field sampling log. The temperature and barometric pressure should be recorded.

5. Fill out all appropriate documentation (sampling forms, sample labels, chain of custody, sample tags, etc.).

6. Disassemble the sampling system.

END OF PROCEDURE

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures, and to establish the guidelines for drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. There are several drilling techniques available which include: direct push (Geoprobe® or cone penetrometer testing [CPT]), hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, air rotary, and Sonic. Formation (sediment/soil) sample collection options include: disturbed (drill cuttings), intact (split-spoon or continuous core), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information. Consequently, the lithologic data is essential information that characterizes subsurface conditions and describes geologic coefficients qualitatively and/or quantitatively.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. Complete a drill rig inspection checklist before starting any drilling activities. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter.

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

d. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

Drilling will not commence until the following have been completed:

- Development and approval of a drilling specific job safety analysis (JSA)
- a utility mark-out/one call has been conducted at the drilling location(s); and
- the completion of a subsurface clearance procedure checklist.

3.0 DRILLING TECHNIQUE - DESCRIPTION

3.1 Direct Push – The direct push technology includes several types of drilling rigs and drilling equipment that advances a drill string by pushing or hammering without rotating the drill string. Direct push rigs include both Geoprobe® and CPT rigs. Geoprobe® rigs are typically limited to drilling in unconsolidated soil up to approximately 100 feet below ground surface (bgs) under compatible conditions. Formation samples are collected in acetate/plastic sleeves. Advantages include: access and maneuverability due to the rig's small size; fluids are not introduced into the subsurface during drilling; and sampling is relatively inexpensive. Disadvantages include: limitation to drilling depth; limitation to unconsolidated or soft rock drilling; and limitation to small diameter borings. CPT rigs also provide a continuous profile of the soil strata as the rig's sensing equipment is advanced.

3.2 Hollow-Stem Auger - This drilling method is rapid and extremely effective in most cohesive sediments but less so in loose sandy material. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel/sand packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in.

3.3 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect good, representative formation samples.

3.4 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculated drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the

borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud or polymer) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.5 Cased-Hole Rotary - Several rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method

used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which "pulls" the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide "shoe" to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) "sand heave" when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.6 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

3.7 Sonic - This drilling method uses a rotating bit to drill, and high-frequency resonant vibrations created by a Sonic drill head. The drill head contains the mechanism necessary for rotary motion as well as an oscillator, which causes a high frequency force to be superimposed on the drill string. The frequency can be varied to suit operating conditions and is generally between 50 and 120 hertz (cycles per second). The vibrations are sent down the drill string to the drill bit, magnifying the amplitude of the drill bit, which (in overburden) fluidizes the soil particles at the bit face. The drill bit is physically vibrating up and down in addition to being pushed down and rotated. These three combined forces allow for relatively fast and easy penetration through most geological formations. The oscillator is driven by a hydraulic motor and uses out of balance weights to generate high sinusoidal forces that are transmitted to the drill bit. An internal spring system isolates these vibrational forces from the rest of the drill rig. Typically, Sonic drilling uses a drilling fluid (i.e., potable water) to facilitate the advancement of the drill bit. The amount of drilling fluid used should be limited during soil collection as to minimize wash-out of the sample.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Safety first. Obtain the appropriate work permit, Job Safety Analysis (JSA) and personal protection equipment (PPE), as specified in the site Health and Safety Plan (HASP).

5.2 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.3 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole, as applicable.

5.4 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.5 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.6 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.7 Collect formation samples as described in accordance with the work plan. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.8 Record geologic information in the soil boring log form and in the field notebook.

5.9 Handle and ship split-spoon sample jars carefully to avoid breakage and handle and ship tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Safety first. Obtain the appropriate JSA and PPE, as specified in the site HASP.

6.2 Intact formation sampling will be implemented using continuous core or split-spoon samplers (which are driven), Shelby-tube samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in core barrel liners/tubes or suitable size jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and over-heating/freezing. Intact formation samples will be collected at specified intervals as described in the work plan. Geologic information will be recorded on a geologic log form on the appropriate field form. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.3 Soil cores from the wells drilled at the Site are used for lithologic identification and physical property analysis. Soil core samples will be collected using a direct push continuous core (acetate/PVC liners) or split-spoon sampler (6-inch stainless steel sample containers). The soil core sample intervals will be specified in the work plan.

6.4 Sampling equipment will be decontaminated by steam cleaning and/or a non-phosphate, laboratory-grade and distilled/deionized wash followed by a distilled/deionized water rinse. (Refer to the field equipment decontamination SOP for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 BOREHOLE ABANDONMENT OR CLOSURE

7.1 Safety first. Obtain the appropriate JSA and PPE, as specified in the site HASP.

7.2 Upon the completion of the investigation, boreholes will be abandoned as specified in the workplan.

7.3 For each abandoned borehole, the procedure will be documented in the field notebook.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures for constructing ground-water monitoring or observation wells in unconsolidated (e.g., gravel, sand, silt, and clay) formations. Well development and well abandonment (closure) procedures will also be addressed in this SOP. The United States Environmental Protection Agency (USEPA), the United States Geological Survey (USGS), and state regulatory agency procedures will be reviewed and considered in conjunction with the extensive experience of Roux Associates, Inc. (Roux Associates) to determine appropriate well construction and abandonment procedures. Discussions will be held with appropriate agencies to resolve conflicting procedures and finalize well construction or abandonment methods. The well construction plan and, if necessary, abandonment will be detailed in the work plan.

Monitoring wells will be completed in unconsolidated formations for the purposes of measuring ground-water levels and collecting ground-water samples. Ground-water level data will be used to calculate ground-water elevations which will be used, to construct water-level elevation and ground-water flow direction maps to illustrate head and flow relationships. Ground-water samples will be used to quantify water-quality conditions.

Observations wells will be completed in unconsolidated formations for the purpose of collecting water-level data from aquifer tests. Slug tests, step-drawdown tests, and constant-rate pumping tests (refer to the respective SOPs) may be conducted to qualitatively or quantitatively characterize flow system hydraulic parameters and/or intra-aquifer and inter-aquifer hydraulic connection.

2.0 PROCEDURE FOR WELL CONSTRUCTION

The installation of each unconsolidated well will begin immediately after borehole completion (and geophysical logging, if implemented). Once well installation has begun, no breaks in the process will be made until the well has been completed and secured against unauthorized access. In cases of unscheduled delays, such as personal injury, equipment breakdowns or sudden inclement weather, installation will be resumed as soon as practical.

2.1 The well will be constructed of appropriate type and diameter casing and screen (stainless steel and/or PVC) and will be at least 2 inches in diameter to accommodate most water-sampling and water-level measuring devices. However, if the well's purpose is multiple (pumping tests, remote sensing, water-level recorder station, etc.), a larger diameter monitoring well (4 inches, 6 inches, or greater) may be needed to accommodate pumps, floats, or sensors. The preferred minimum diameter for a well is 4 inches because larger diameter wells (greater

than 2 inches) facilitate well purging and sampling procedures (e.g., they can accommodate pumps which 2-inch diameter wells may not).

2.2 Fittings (couplings) will not restrict the inside well diameter, as stainless steel casing will be welded and/or flush-joint threaded, and PVC joints will be internally threaded. Glues, solvents, or chemical cleaners will not be used in the construction of the wells. All casings, fittings, and screens will be new material. The well screens will be fabricated and have an inside diameter equal to the well casing. The lengths of casing and screen will be measured and recorded on an appropriate field form and in the field notebook by the field hydrogeologist prior to installation.

2.3 Wells in unconsolidated formations will be installed as described below unless depth to water or total depth require modifying the thickness of emplaced materials.

a. The screen and casing will be lowered into the borehole to the appropriate depth. Screen and casing materials may be either stainless steel or PVC. A bottom plug, well cap, and flush-joint sections will be used.

b. A gravel pack (quartz sand or pea gravel) will be filled in around the screen from a few feet below the bottom of the screen to several feet (approximately 5) above the screen to avoid applying the weight of the casing on the screen. The size of the uniformly graded gravel pack will be selected based on the grain size of the formation material in the screened interval. The placement of the gravel pack may require the use of a tremie pipe.

c. A 1-foot to 3-foot layer of clean, fine-grained silica sand may be placed above the selected gravel pack to isolate the coarse-grained gravel pack (below) from the fine-grained bentonite seal (above). Again, a tremie pipe may be used in the placement of the sand layer.

d. Several feet (approximately 1-3) of bentonite (powder or pellets) will be placed on top of the sand layer to seal the top of the gravel-packed screen zone.

e. The remainder of the annulus will be grouted to within a few feet of land surface. If PVC casing is used for the construction of deep wells, then extreme care must be taken in grouting the annular space in lifts (specified lengths) to avoid deformation of the PVC casing by the heat of curing and/or the weight of the grout. This is especially important if there are large voids which will serve as reservoirs for the grout.

f. A locking steel protective casing or curb box will be set over the well and cemented in place or welded to the steel casing to prevent water from ponding at the top of the well or directly entering the well, and safeguard the well from accidental damage or vandalism.

2.4 Each well will be properly identified with the appropriate information (e.g., local well number, state permit number [if applicable], etc.). The top of the well casing will serve as the measuring point (MP) for ground-water level measurements. The measuring point will be surveyed to the nearest 0.01 foot relative to a common datum (e.g., mean sea level) by trained Roux Associates personnel or a professional, state-licensed surveyor as defined in the work plan.

2.5 If required, well clusters will be constructed. A well cluster is defined as a group of two or more wells, located adjacent to or very near each other, which penetrate different depths of the aquifer or formation. Each well is screened at a different depth to obtain data defining the vertical distribution of water levels and quality in the aquifer or formation. In the event that a well cluster is drilled, then one large-diameter (e.g., 6-inch, 8-inch, 10-inch, etc.) borehole may be drilled and each well in the cluster will be individually cased within that one borehole; however, the preferred method is to drill individual boreholes for each well in the cluster.

2.6 Each well will have a location sketch, a well construction log, and a geologic log showing the casing placement and materials used to fill the annular space between the well casing and borehole. The appropriate log will show the depths of each casing material and discuss the geologic variability at the site. A description of the surface soils and unsaturated zone materials down to and including the water table is required.

The following information, if applicable, will be included on the well log:

a. Project number.

b. Date and initials of scientist documenting the well information.

c. Date and time of construction.

d. Well location.

e. Well and permit numbers.

f. Borehole diameter.

g. Well depth.

h. Casing material.

i. Screen material.

j. Screen slot size and length.

k. Gravel pack type and size (depths from _____ to _____).

l. Sand pack (depths from _____ to _____).

m. Bentonite pellets (depths from _____ to _____).

n. Bentonite grout (depths from _____ to _____).

o. Cement grout (depths from _____ to _____).

p. Ground-surface elevation.

q. Measuring point elevation.

r. Well height above or depth below land surface.

s. Depth where ground water was encountered.

3.0 DESCRIPTION OF WELL DEVELOPMENT

3.1 Before a newly constructed well can be used for water-quality sampling, measuring water levels, or aquifer testing, it must be developed. Well development refers to the procedure used to clear the well and formation around the screen of fine-grained materials (sands, silts, and clays) produced during drilling or naturally occurring in the formation. Well development continues until the well responds to water-level changes in the formation (i.e, a good hydraulic connection is established between the well and formation) and the well produces clear, sediment-free water to the extent practical.

3.2 Depending on the drilling technique used, composition of the formation screened, and well diameter and construction materials, well development may include one or more of the following techniques.

a. Bailing.

b. Pumping (centrifugal, submersible, or air).

c. Backwashing.

d. Surging (mechanical).

e. Jetting.

f. A combination of the above.

3.3 A 1-pint sample of the last water removed during development will be obtained and inspected by the field hydrogeologist for relative clarity to determine whether development is complete. A turbidimeter may be used to evaluate the clarity of the water removed from the well during development (and its use may also be stipulated by a regulatory agency). Well development procedures will be recorded on the well construction log form and in the field notebook.

3.4 Dispersing agents, acids, disinfectants, or other additives will not be used during development nor will they be introduced into the well at any other time unless specifically stipulated in the work plan. During development, water will be removed from the entire column of water standing in the well by periodically lowering and raising the pump intake. Well development will include the rinsing of the interior well casing above the water column in the well using only water from that well.

4.0 WELL ABANDONMENT OR CLOSURE

4.1 Upon the completion of the investigation, a determination will be made whether to maintain the well or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the well, then the state will be notified and a request will be presented for well abandonment. Upon state approval to seal the well, appropriate state well abandonment forms will be completed. Following state approval, the abandonment of any well will be in accordance with local, state and/or Federal regulations.

4.2 For each abandoned well, the procedure will be documented on an appropriate field form and in the field notebook. Documentation may include, where appropriate, the following:

a. Well designation.

b. Location with respect to the replacement well, if replaced (e.g., 30 ft north and 40 ft west of Monitoring Well MW-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Well casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned well using the well construction log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i The date of grouting.

j. The level of water prior to grouting and the date and time measured.

k. The remaining casing, size, and composition above or below ground surface reported in depths or heights from ground surface.

l. Any other state or local well abandonment reporting requirements.

END OF PROCEDURE

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to provide guidance for the installation of temporary soil gas probes for the collection of shallow soil gas samples. This SOP should be used where its application is consistent with the project's data quality objectives (DQOs) and in conjunction with the SOP for soil gas collection.

2.0 MATERIALS

- 1/8 to 1/4 inch sampling tubing – metal, nylon, PEEK, Teflon
- Appropriate Fittings
- Bentonite Chips
- Water
- Drilling Apparatus

Note: It is necessary to coordinate the hardware (i.e. size of tubing, fittings, sampling interface assembly, etc.) for the soil gas probe sampling line with the sampling system (i.e. Tedlar bags, Summa canisters, etc.). This step is critical to achieve a leak free system.

3.0 PROCEDURE

Temporary soil gas probe installation procedures are described below to ensure that a quality sample is able to be obtained and to minimize ambient air migrating into the sample. Soil gas wells may be installed using various types of drilling methods, however, some drilling methods can disrupt the surrounding soil gas and will require a longer equilibration time prior to sampling. The steps to installing the temporary point are:

1) Drill a borehole to the required depth as shown on the sample plan or scope of work.

2) Install a 6-12 inches sand pack at the bottom and install the probe tip (with attached tubing) approximately 3-4 inches into the sand pack. Use extra tubing so that sufficient amount (1-2 feet) will be left above ground. Plug the exposed end of the tubing.

3) Install 12 inches of dry granular bentonite on top of the sand pack.

4) Fill the remaining annular space with hydrated bentonite in 6" lifts.

   - If multiple probes depths are to be installed at the same location, the hydrated bentonite shall be installed to the top the next testing interval. Sand pack and the dry bentonite will then be installed as normal.

5) Repair the ground surface to original condition.

ATTACHMENT 4

PFAS Field Sampling Guidelines

EPA 537 (PFAS) Field Sampling Guidelines

PLEASE READ INSTRUCTIONS ENTIRELY PRIOR TO SAMPLING EVENT

Sampling for PFAS via EPA 537 can be challenging due to the prevalence of these compounds in consumer products. The following guidelines are strongly recommended when conducting sampling.

Reference-NHDES https://www.des.nh.gov/organization/divisions/waste/hwrb/documents/pfc-stakeholder-notification-20161122.pdf

FIELD CLOTHING and PPE

- No clothing or boots containing Gore-Tex®
- All safety boots made from polyurethane and PVC
- No materials containing Tyvek®
- Do not use fabric softener on clothing to be worn in field
- Do not used cosmetics, moisturizers, hand cream, or other related products the morning of sampling
- Do not use unauthorized sunscreen or insect repellant (see reference above for acceptable products)

FOOD CONSIDERATIONS

No food or drink on-site with exception of bottled water and/or hydration drinks (i.e., Gatorade and Powerade) that is available for consumption only in the staging area

OTHER RECOMMENDATIONS

Sample for PFAS first! Other containers for other methods may have PFAS present on their sampling containers

SAMPLE CONTAINERS

- All sample containers made of HDPE or polypropylene
- Caps are unlined and made of HDPE or polypropylene (no Teflon® -lined caps)

WET WEATHER (AS APPLICABLE)

Wet weather gear made of polyurethane and PVC only

EQUIPMENT DECONTAMINATION

- "PFAS-free" water on-site for decontamination of sample equipment. No other water sources to be used
- Only Alconox and Liquinox can be used as decontamination materials

FIELD EQUIPMENT

- Must not contain Teflon® (aka PTFE) or LDPE materials
- All sampling materials must be made from stainless steel, HDPE, acetate, silicon, or polypropylene
- No waterproof field books can be used
- No plastic clipboards, binders, or spiral hard cover notebooks can be used
- No adhesives (i.e. Post-It® Notes) can be used
- Sharpies and permanent markers not allowed; regular ball point pens are acceptable
- Aluminum foil must not be used
- Keep PFC samples in separate cooler, away from sampling containers that may contain PFAS
- Coolers filled with regular ice only - Do not use chemical (blue) ice packs

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APPENDIX K

Citizen Participation Plan

NEW YORK STATE OF OPPORTUNITY. Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan
for
Chestnut Commons Atlantic Avenue Site

December 2018

C224276
3269 Atlantic Avenue, Brooklyn, NY 11208

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* * * * *

Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: **Chestnut Commons Apartments LLC ("Applicant")**
Site Name: **Chestnut Commons Atlantic Avenue Site ("Site")**
Site Address: **3269 Atlantic Avenue, Brooklyn, NY 11208**
Site County: **Kings County**
Site Number: **C224276**

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at:
http://www.dec.ny.gov/chemical/8450.html .

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision-makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment

- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process

- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process

- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community

- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC website. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods.
The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html .

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The

flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- **Notices and fact sheets** help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.

- **Public forums, comment periods and contact with project managers** provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy.

An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic well-being or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, **the significant threat determination for the site had not yet been made.**

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at
http://www.dec.ny.gov/regulations/2590.html

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)
Application Process:	
• Prepare site contact list • Establish document repository(ies)	At time of preparation of application to participate in the BCP.
• Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period • Publish above ENB content in local newspaper • Mail above ENB content to site contact list • Conduct 30-day public comment period	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.
After Execution of Brownfield Site Cleanup Agreement (BCA):	
• Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation **Note:** Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:	
• Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan • Conduct 30-day public comment period	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.
After Applicant Completes Remedial Investigation:	
• Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report
Before NYSDEC Approves Remedial Work Plan (RWP):	
• Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period • Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) • Conduct 45-day public comment period	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.
Before Applicant Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Applicant Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report • Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC)	At the time the cleanup action has been completed. **Note:** The two fact sheets are combined when possible if there is not a delay in issuing the COC.

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

There will be areas on the Site where soil excavation is necessary. Therefore, once the remediation commences, there may be concerns regarding odors, noise or truck traffic coming from the Site. However, these impacts will be mitigated through implementation of a Health and Safety Plan (HASP) and Soil Management Plan (SMP) approved by the Department, which will be designed to minimize these impacts. A Community Air Monitoring Plan (CAMP) will also be implemented to monitor dust and vapors to ensure the community is not impacted.

Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The Site is located in an area with sizable Hispanic-American and African-American population nearby. Therefore, all future fact sheets will be translated into Spanish.

For additional information, visit: https://statisticalatlas.com/tract/New-York/Kings-County/119000/Race-and-Ethnicity .

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

- **location – 3629 Atlantic Avenue, Brooklyn, NY**
- **setting - Urban**
- **site size – 0.65882 Acres**
- **adjacent properties - Commercial**

History of Site Use, Investigation, and Cleanup

A Phase I was performed in 2015 for the Industrial and Environmental Hygiene Division of the New York City School Construction Authority ("NYCSCA") by TRC Engineers, Inc. when the City was exploring the idea of using Lot 32 (formerly the current Lot 32 and Lot 34) for a proposed public school facility. The Phase I confirmed that Lot 32 was historically used as early as 1887 as a water pump house, with associated railroad tracks, and coal storage yard, and later used from 1980 to 1992 as an automobile, trailer, and heavy equipment sales facility, all of which appear to have led to Site contamination. Since the Site has been vacant since at least 2006 and was previously used as a storage yard, there is also potential for historical dumping.

On February 10, 2017, Lot 32 was subdivided into the current Lot 32 and Lot 34. The NYCSCA and the New York City Department of Education will put a school facility on the current Lot 32. The City transferred jurisdiction of the Site, Lot 34, to HPD to find an affordable housing/mixed use developer. The Requestor was selected by HPD for the project. Prior to entering a License Agreement with HPD in May of 2018, and in coordination with New York City Office of Environmental Remediation (OER) in its Jump Start Program, Roux Associates, Inc. performed a Focused Phase II Environmental Site Assessment. In the Jump Start Program, OER assists City-supported affordable and supportive housing developments enroll in the state Brownfield Cleanup Program. The Focused Phase II performed by Roux confirmed that the past uses of the site led to the contamination located on the Site. Roux suspects that the pump house was a coal operated facility, which historic use links to the presence of the Semi-Volatile Organic Compounds (SVOCs) and heavy metals contamination found on-site to date.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a volunteer. This means that the Applicant was not responsible for the disposal or discharge of the contaminants or whose ownership or operation of the site took place after the discharge or disposal of contaminants. The Volunteer must fully characterize the nature and extent of contamination onsite, and must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish and wildlife to contaminants on the site and to contamination that has migrated from the site.

The Applicant in its Application proposes that the site will be used for unrestricted purposes.

To achieve this goal, the Applicant will conduct investigation activities at the site with

oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant will conduct an investigation of the site officially called a “remedial investigation” (RI). This investigation will be performed with NYSDEC oversight. The Applicant must develop a remedial investigation workplan, which is subject to public comment.

The site investigation has several goals:

1) Define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
2) Identify the source(s) of the contamination;
3) Assess the impact of the contamination on public health and the environment; and
4) Provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

The Applicant submits a draft “Remedial Investigation Work Plan” to NYSDEC for review and approval. NYSDEC makes the draft plan available to the public review during a 30-day public comment period.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a “significant threat,” it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a "Certificate of Completion" (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a "Remedial Work Plan". The Remedial Work Plan describes the Applicant's proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft Remedial Work Plan for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant completes cleanup activities, it will prepare a Final Engineering Report (FER) that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the FER. NYSDEC then will issue a Certificate of

Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan.

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include: caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -
Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Nigel Crawford
Project Manager
NYSDEC Region 2
Division of Environmental Remediation
47-40 21st Street
Long Island City, NY 11101-5401
Nigel.crawford@dec.ny.gov
(718) 482-7778

New York State Department of Health (NYSDOH):

Steven Lawrence
Project Manager
NYSDOH
Empire State Plaza, Corning Tower
Room 1787
Albany, NY 12237
beei@health.ny.gov
(518) 402-7860

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Brooklyn Public Library
Arlington Branch
203 Arlington Avenue
Brooklyn, NY 11207
Attn: Sharon Palmer
Phone: (718) 277-6105
Hours:

Mon, Tues, Friday	10am-6pm
Wednesday	1pm-8pm
Thursday	10am-8pm
Saturday	10am-5pm
Sunday	CLOSED

Brooklyn Community Board No. 5
404 Pine Street, 3rd Floor
Brooklyn, NY 11208
Attn: Melinda Perkins
Phone: (929) 221-8261
Hours:

Mon-Friday	10am-6pm
Saturday	CLOSED
Sunday	CLOSED

Appendix B - Site Contact List

Hon. Charles E. Schumer U.S. Senator 780 Third Avenue Suite 2301 New York, NY 10017	Hon. Kristen Gillibrand U.S. Senator 780 Third Avenue 2601 New York, NY 10017
Marisa Lago City Planning Commissioner Chair 120 Broadway, 31st Floor New York, NY 10271	Hon. Nydia Velazquez U.S. House of Representatives 266 Broadway, Suite 201 Brooklyn, NY 11211
Hon. Eric Adams Kings County Executive (Borough President) Borough Hall 209 Joralemon Street Brooklyn, NY 11201	Hon. Letitia James Public Advocate 1 Centre Street, 15th Floor New York, NY 10007
Hon. Bill De Blasio, Mayor City Hall New York, NY 10007	Melinda Perkins District Manager of Brooklyn Community Board No. 5, Site Repository 404 Pine Street, 3rd Floor Brooklyn, NY 11208
Vince DiMiceli Courier Life's Brooklyn Daily Newspaper One Metrotech Center, Suite 1001 Brooklyn, NY 11201	David Kirschner Brooklyn News 12 Media Outlet 1 Media Crossways Woodbury, NY 11791

Vincent Sapienza New York City Public Water Supply System Department Commissioner 59-17 Junction Blvd. Flushing, NY 11373	Alfonso Carney Chair of the New York City Water Board 59-17 Junction Blvd. Flushing, NY 11373
Marlon Bynum Principal of Transit Tech Career and Technical Education High School K615 1 Wells Street Brooklyn, NY 11208	New York City Department of Education Adjacent Property Owner of 3269 Atlantic Avenue 30-30 Thomson Avenue Long Island City, NY 11101
Capital One, National Association Adjacent Property Owner of 85 Dinsmore Place 275 Broad Hallow Road Brooklyn, NY 11208	Capital One, N.A. Successor by Merger Adjacent Property Owner of 239 Richmond Street 275 Broad Hallow Road Brooklyn, NY 11208
Ez Roll Manufacturing Co. Adjacent Property Operator of 239 Richmond Street 275 Broad Hallow Road Brooklyn, NY 11208	Capital One, National Association Adjacent Property Owner of 99 Dinsmore Place 275 Broad Hallow Road Brooklyn, NY 11208
Capital One, National Association Adjacent Property Owner of 111 Dinsmore Place 275 Broad Hallow Road Brooklyn, NY 11208	Atlantic Chestnut Affordable Housing LLC Adjacent Property Owner of 3301 Atlantic Avenue 902 Broadway, 13th Floor New York, NY 10010
Parks and Recreation Adjacent Property Owner of Atlantic Avenue 16 W 61st Street New York, NY 11023	Parks and Recreation Adjacent Property Owner of 79 Fountain Avenue 16 W 61st Street New York, NY 10023
Hon. Rafael Espinal NYC Councilman 1945 Broadway Brooklyn, NY 11207	Hon. Martin Malave Dilan NYS Senator 3215 Fulton Street Brooklyn, NY 11208
Hon. Erik M. Dilan NYS Assemblyman 366 Cornelia Street Brooklyn, NY 11237	Nancy T. Sunshine Kings County Clerk 360 Adams Street, Room 189 Brooklyn, NY 11201

Community, Civic, Religious and Other Environmental Organizations	
Antonia Yuille - Director Consolidated Edison Corporate Affairs 30 Flatbush Avenue Brooklyn, NY 11217	Hector Lozada - President 75th Police Precinct Council 1000 Sutter Avenue Brooklyn, NY 11208
Engine 236 998 LIBERTY AVENUE Brooklyn, NY 11208	Cypress Hills Fulton St. NBH SR CTZ CTR 3208 Fulton Street Brooklyn, NY 11208
Cypress Hills Local Development Corporation 3214 Fulton St Brooklyn, NY 11208	

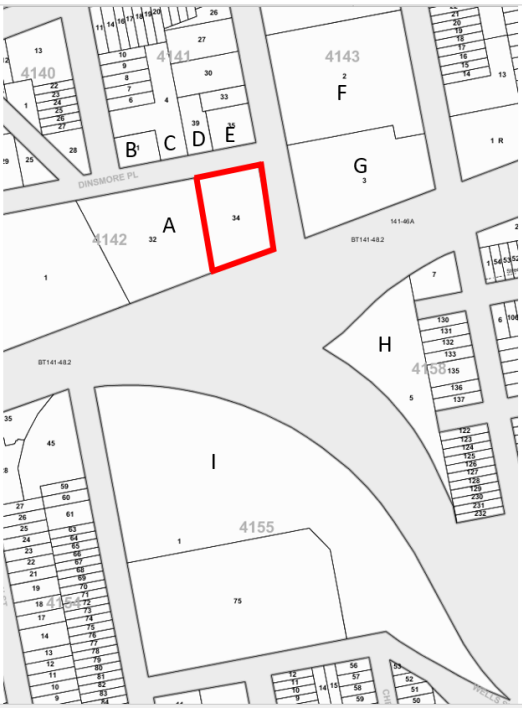
Appendix C - Site Location Map

BASE MAP

Chestnut Commons Atlantic Avenue Site
3269 Atlantic Avenue
Brooklyn, New York 11208
Tax Identification No. Brooklyn-4142-34

Legend:
Site Property Boundary

Corresponding page
lists adjacent property owners by map identification letter A – I

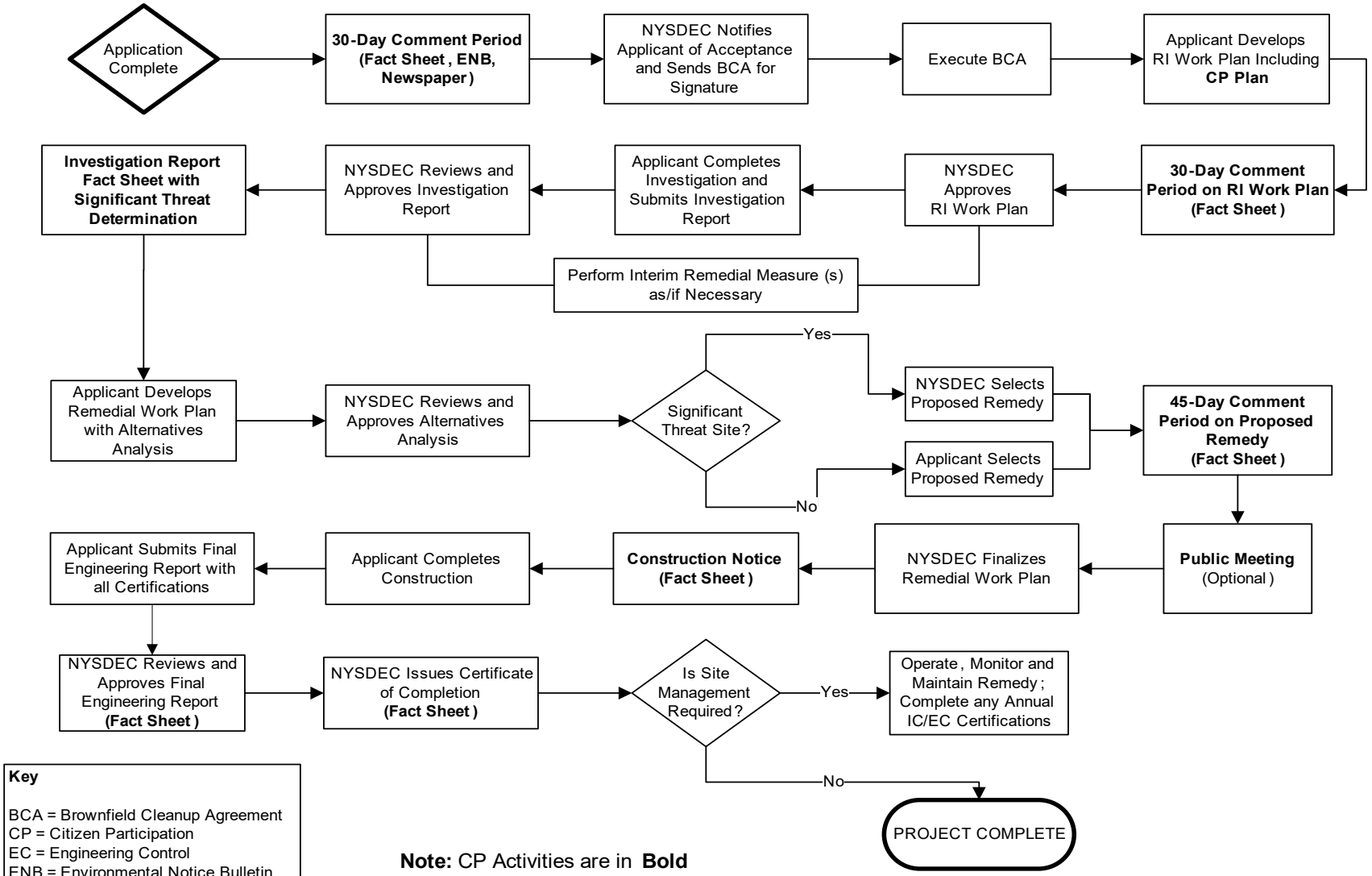


N

All feature locations are approximate. This map is intended as a schematic to be used in conjunction with associated Application and Support Information, and should not be relied upon as a survey for planning and other activities.

March 9, 2018
Source: gis.nyc.gov
Property Information
Scale: 1" = 100' approximately

Appendix D– Brownfield Cleanup Program Process



Key

BCA = Brownfield Cleanup Agreement
CP = Citizen Participation
EC = Engineering Control
ENB = Environmental Notice Bulletin
IC = Institutional Control
RI = Remedial Investigation

Note: CP Activities are in **Bold**

Division of Environmental Remediation

Remedial Programs
Scoping Sheet for Major Issues of Public Concern (see instructions)

Site Name: Chestnut Commons Atlantic Avenue Site

Site Number: C244276

Site Address and County: 3629 Atlantic Avenue, Brooklyn, NY

Remedial Party(ies): Chestnut Commons Apartments LLC

Note: For Parts 1. – 3. the individuals, groups, organizations, businesses and units of government identified should be added to the site contact list as appropriate.

Part 1. List major issues of public concern and information the community wants. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and information needs. **Use this information as an aid to prepare or update the Major Issues of Public Concern section of the site Citizen Participation Plan.**
No known issues to date.

How were these issues and/or information needs identified?
NA

Part 2. List important information needed **from** the community, if applicable. Identify individuals, groups, organizations, businesses and/or units of government related to the information needed.
Click here to enter text.

How were these information needs identified?
NA

Part 3. List major issues and information that need to be communicated **to** the community. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and/or information.
There will be the need to advise neighbors of remediation impacts when it is time for remediation.

How were these issues and/or information needs identified?
Standard impacts will have to be addressed via CAMP, HASP and SMP

Part 4. Identify the following characteristics of the affected/interested community. This knowledge will help to identify and understand issues and information important to the community, and ways to effectively develop and implement the site citizen participation plan (mark all that apply):

a. Land use/zoning at and around site:
☒ **Residential** ☐ **Agricultural** ☐ **Recreational** ☒ **Commercial** ☒ **Industrial**

b. Residential type around site:
☒ **Urban** ☐ **Suburban** ☐ **Rural**

c. Population density around site:
☒ **High** ☐ **Medium** ☐ **Low**

d. Water supply of nearby residences:
☒ **Public** ☐ **Private Wells** ☐ **Mixed**

e. Is part or all of the water supply of the affected/interested community currently impacted by the site?
☐ **Yes** ☒ **No**

Provide details if appropriate:
NA

f. Other environmental issues significantly impacted/impacting the affected community?
☐ **Yes** ☒ **No**

Provide details if appropriate:
Click here to enter text.

g. Is the site and/or the affected/interested community wholly or partly in an Environmental Justice Area?
☒ **Yes** ☐ **No**

h. Special considerations:
☒ **Language** ☐ **Age** ☐ **Transportation** ☐ **Other**

Explain any marked categories in **h:**
Spanish

Part 5. The site contact list must include, at a minimum, the individuals, groups, and organizations identified in Part 2. of the Citizen Participation Plan under 'Site Contact List'. Are *other* individuals, groups, organizations, and units of government affected by, or interested in, the site, or its remedial program? (Mark and identify all that apply, then adjust the site contact list as appropriate.)

☐ **Non-Adjacent Residents/Property Owners:** Click here to enter text.

☒ **Local Officials:** Click here to enter text.

☒ **Media:** Click here to enter text.

☐ **Business/Commercial Interests:** Click here to enter text.

☐ **Labor Group(s)/Employees:** Click here to enter text.

☐ **Indian Nation:** Click here to enter text.

☒ **Citizens/Community Group(s):** Click here to enter text.

☐ **Environmental Justice Group(s):** Click here to enter text.

☐ **Environmental Group(s):** Click here to enter text.

☒ **Civic Group(s):** Click here to enter text.

☐ **Recreational Group(s):** Click here to enter text.

☐ **Other(s):** Click here to enter text.

Prepared/Updated By: Linda Shaw, Esq **Date:** 11/30/18

Reviewed Approved By: Thomas V. Panzone **Date:** 11/14/18

APPENDIX L

Resumes of Key Personnel

ROUX

PROFESSIONAL PROFILE

Jessica L. Taylor, P.G.
Principal Hydrogeologist

TECHNICAL SPECIALTIES

Project Management and Field Management for large-scale soil excavation and remediation projects, including site assessment, remediation implementation, and construction activities. Coordination and management of large-scale demolition and renovation support. Performance of sampling and direction of field sampling teams for the following media: soil, groundwater, surface water, soil vapor, sludge, and sediment. Excavation sampling and oversight and waste tracking.

EXPERIENCE SUMMARY

Fourteen years of experience: Senior, Project and Staff Hydrogeologist, Roux Environmental Engineering and Geology, D.P.C., Islandia, New York; Staff Hydrogeologist and Intern at GSC|Kleinfelder.

CREDENTIALS

B.S. Geology, Binghamton University, 2005
Professional Geologist, New York, 2017
OSHA 40-Hour HAZWOPER Training, 2005
OSHA 10-Hour Construction Safety Training, 2008
NJDEP UST Subsurface Evaluator Certification, 2009

KEY PROJECTS

- Senior Project Manager for a large ongoing redevelopment project in Brooklyn, New York. Project includes coordination and oversight of *in situ* waste characterization sampling, excavation, and proper disposal of soil. Coordination of pre-demolition asbestos and hazardous materials surveys. Construction management and support for excavation of 600,000 tons of soil; environmental support for demolition and relocating of an active nine-acre 100-year old rail yard. Responsible for implementing and managing remediation work at several NYSDEC spill sites within the project footprint, including *in situ* chemical oxidation, UST removal, and soil excavation. Agency support for NYSDEC, NYCDEP, NYCOER, MTA (LIRR/NYCT), and ESDC. The project will encompass 336,000 square feet of office space, 6.4 million square feet of residential space, an 18,000 seat sports and entertainment venue – the Barclays Center (home of the Nets professional basketball team) – 247,000 square feet of retail space, a 165,000 square-foot hotel, and over 8 acres of intricately designed publicly accessible open space.
- Senior Project Manager for two parcels in Queens as part of NYSDEC Brownfield Cleanup Program. This project included due-diligence environmental assessment and investigation, development of NYSDEC-approved Remedial Investigation Work Plans, and future remediation during construction of two mixed-use, affordable housing developments. Also required coordination with NYCHPD and NYCDEP to meet regulatory requirements for funding.
- Senior Project Manager for the environmental management of asbestos remediation during the renovation of Nassau Coliseum. Responsible for coordinating inspections and delineation of ACM, preparing budgetary estimates, and bid support for full abatement. Also includes management of decommissioning and replacement of existing emergency generator UST.
- Project Manager for redevelopment of four properties in Brooklyn, with NYCOER to address NYCDEP "E" designations. Coordination with NYCOER to implement remedial investigation and develop RAP as part of the NYC VCP.
- Project Manager for commercial redevelopment site in the Bronx, including *in situ* waste characterization, management and coordination of excavation, community air monitoring, and development of NYCDEP-approved RAP.
- Project Manager for petroleum spill closure at active retail gasoline service station in Brooklyn, NY. Included remedial investigation and coordination with NYSDEC for spill closure.
- Project Manager for design, implementation, and reporting of *in situ* waste characterization for the largest retail developer in the world as part of new construction at a premier shopping center on Long Island.
- Client liaison and full-time onsite construction manager at redevelopment site in Rego Park, New York. Collection of 500 *in situ* waste characterization soil samples, oversight of 250,000 cubic yards of soil excavation and remediation, development of post-remediation sampling plan, organization of waste manifests and hazardous waste documents to ensure proper disposal. Coordination of daily site activities with multiple construction contractors and other involved parties on behalf of client. Oversight and confirmatory soil sampling for on-site treatment of 75,000 cubic yards of hazardous lead contaminated soil.
- Field Manager for *in situ* soil characterization as part of RAP implementation for a one-acre brownfield site containing chlorinated solvents, heavy metals and petroleum compounds in soil, soil vapor and groundwater over one city block in Manhattan, New York. This project is part of the NYSDEC BCP.
- Project and Field Manager for multiple Phase I and Phase II ESAs of retail gasoline stations in New York and New Jersey. This includes drilling and sampling oversight and health and safety management, as well as writing Phase II ESA reports for over 40 sites.

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ROUX

PROFESSIONAL PROFILE

Brian P. Morrissey, P.E., BCEE

Principal Engineer

TECHNICAL SPECIALTIES

Development, design and implementation of soil and groundwater remediation systems.

Optimization of ongoing remedial operations.

Cold eye design review and evaluation of process safety.

Management, support, and oversight of large inter-disciplinary teams for site remediation.

Preparation of feasibility studies, engineer's reports, design drawings, specifications, contract documents, permit applications, cost estimates, operations and maintenance plans and construction management for the following:

- Industrial and sanitary wastewater treatment systems
- *In situ* groundwater remedial technologies
- Sub-slab depressurization systems
- Floating product recovery systems
- Ground water pumping and treatment facilities
- Water supply, treatment, and distribution
- Underground storage tank (UST) systems
- Containment systems
- Air sparging, soil vapor extraction and vapor collection and treatment systems
- Building decontamination and decommissioning
- Landfill cap design and permitting
- Hazardous waste soils removal, transportation, and disposal

EXPERIENCE SUMMARY

More than 30 years of experience working in many areas of the environmental industry under a variety of regulatory programs such as Federal and State Superfund, SPDES, SEQRA, New Jersey ECRA/ISRA, NYSDEC Voluntary Cleanup, Petroleum and Chemical Bulk Storage, and NYC Brownfields.

Principal Engineer and Office Manager at Roux; Senior Engineer and Senior Project Manager at ERM

CREDENTIALS

B.E., Civil Engineering, Cooper Union, 1980

M.S., Civil and Environmental Engineering, NYU Tandon School of Engineering (former Polytechnic), 1985

Professional Engineer: New York (1986), New Jersey (2003), and Virginia (2010)

OSHA 40-hour Health and Safety Training

ExxonMobil Loss Prevention System certified

NYCOER Gold Certified Professional

Board Certified Environmental Engineer (BCEE) of the American Academy of Environmental Engineers and Scientists (AAEES) - Specialty Certification in Hazardous Waste Management, 1995

PROFESSIONAL AFFILIATIONS

Water Environment Federation

KEY PROJECTS

- Project Manager for the design of wastewater treatment plant (WWTP) upgrades at three (3) separate facilities under the program to protect New York City's watershed. The work included preparing conceptual upgrade plans, facility plans, detailed cost estimates, design drawings and specifications, startup plans, O&M plans, and oversight of construction. Design at one facility included replacement of secondary treatment components and the addition of recirculating sand filters, microfiltration units, emergency generator and telemetry systems.
- Principal Engineer and P.E. of Record for the design and construction of a storm drainage and sanitary sewer project located adjacent to a former petroleum terminal in Brooklyn, New York. Worked on several design modifications to obtain NYCDEP approvals. Work included construction of 1,600 linear feet of RCP storm sewer and 1,000 feet of ductile iron sanitary sewer. Construction required vibration monitoring during sheeting and operation and maintenance of a temporary dewatering treatment system.
- Project Engineer for environmental audits at more than 20 commercial and manufacturing facilities to evaluate compliance with federal, state, and local air, wastewater, and hazardous waste regulations. Audits addressed regulatory areas including RCRA, SARA, CWA, CAA, TSCA, and OSHA.
- Principal Engineer for conducting detailed evaluation of problematic groundwater treatment system in Rensselaer, New York. Primary constituents of concern include heavy metals, chlorinated solvents, and BTEX compounds. Developed performance testing program, diagnosed causes of problems and presented several recommendations for upgrading systems and improving personnel health and safety. Prepared engineering report with key recommendations that included modifying equipment layout, injecting iron deposition and calcium scale control agents into water stream, and upgrading the system instrumentation and controls.
- Principal Engineer and Project Manager for the remediation and monitoring of over 100 vehicle fueling sites in New York City with UST petroleum releases. The remediation systems at the various sites include multi-phase extraction, soil vapor extraction, air sparging, groundwater recovery and treatment, and product-only recovery systems. Priorities on this multi-year contract included expediting remedial progress, increasing the effectiveness of operating systems, achieving NFA status, and reducing NYC's overall program costs. Work included conducting soil vapor studies at 9 sites to assess vapor intrusion concerns. Also implemented *in situ* injections at 14 sites to cost-effectively achieve site closure. The *in situ* injections used chemical oxidation and bioremediation products including sodium percarbonate, oxygen generating compounds, hydrogen peroxide, petroleum-degrading bacteria, and nutrient/enzyme complexes.

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Brian P. Morrissey, P.E., BCEE
Principal Engineer

- Senior Manager for remedial design and construction oversight at federal Superfund site in Elmira, New York. The 33-acre site included several areas of concern where soil/groundwater were contaminated by several types of hazardous wastes. Managed preparation of design submittals to EPA Region II in accordance with CERCLA guidelines. The soil-sediment remediation design included requirements for materials handling, dewatering and disposal. PCB wastes were segregated and disposed of at TSCA-permitted facility. The design required stabilization of wastes and installation of a RCRA cap. Groundwater remediation system includes 12 recovery wells, filtration and two air strippers.
- Project Manager for upgrading industrial process wastewater treatment system at medical products manufacturing facility in Hancock, New York. The upgraded system removes VOCs and metals, including lead, zinc, and copper, from highly variable waste streams generated by the manufacture of surgical instruments. Prepared design documents for automated system that allows for expected future increase in plant manufacturing capabilities.
- Principal Engineer for design upgrades and expansion of the groundwater depression and separate phase product recovery systems at former petroleum refinery in Brooklyn, NY. Site encompasses one of the nation's largest petroleum releases (18 million gallons). Key components included installation of 10 remote dual-pump free-phase product recovery wells, and modifications to groundwater treatment facilities to optimize performance and system runtime. Redesigned building with new mezzanine and equipment layout to improve flow of the process treatment train.
- Senior Manager for remediation of industrial airport site in Millville, New Jersey under ECRA/ISRA programs. Managed planning, detailed design and permitting activities required to replace 1,000-gpm public supply well impacted by chlorinated solvent plume. Also managed final design of the 200-gpm groundwater recovery, treatment and recharge system that includes ultraviolet light/hydrogen peroxide system controlled by PLCs. This project won the annual Honor Award granted by AAEES.
- Design Manager for evaluation and upgrade of industrial wastewater treatment system for golf shaft manufacturer in Connecticut in accordance with CT DEEP requirements. Options evaluated included assessment of source reduction opportunities, flow segregation, and additional treatment equipment. Inspected the construction and coordinated start-up and testing of the upgraded system which included new tanks, piping, chemical metering pumps, mixers, a continuous flow sludge thickener; and enhanced instrumentation and controls.
- Project Manager for the planning and design of irrigation system using treated wastewater in the Catskills area. Conducted study on acceptable uses of wastewater treated by tertiary methods in accordance with federal and New York State guidance.
- Project Manager for evaluation of wellhead treatment alternative for 1,100-gpm public water supply well in Mineola, NY. Conducted well efficiency tests and investigated existing conditions and future requirements. Prepared design of activated carbon treatment system including building modifications and requirements for well development and replacement of the well pump and controls.
- Design Manager for groundwater recovery and treatment system at a former manufactured gas plant (MGP) in Atlantic Highlands, New Jersey. Developed specification to implement directional drilling under state highway to expand recovery system to capture off-site contamination. System design included PLC-based control software that significantly reduced on-site staffing needs. Also managed construction phase, negotiated/reduced change orders and worked with subcontractors to meet tight regulatory schedule for system start-up. System removes cyanide, metals, VOCs, and free-phase product.
- Senior Engineer for preparing and certifying Spill Prevention Control and Countermeasure (SPCC) Plans for 25 U.S. Postal Service facilities.
- Principal Engineer for the design of modifications to an active sub-slab depressurization system (SSDS) to mitigate chlorinated solvent soil vapor contamination beneath an existing occupied shopping mall in the Bronx, New York. Worked on the coordination and troubleshooting of construction issues. Managed the system testing and start-up and provided recommendations to improve system operation.
- Project Manager for planning, permitting, design and construction oversight of 12,000-foot sewer system for the collection of sanitary and industrial wastewater in Melville, New York. Sewer design included route selection, sizing of gravity sewers, provisions for utility crossings, solar-powered flow meters, grease interceptor, pump station for one branch line, and proper abandonment of leaching facilities. Project included design of two 20,000-gallon underground storage tanks and a tanker truck fill area with secondary containment. Final phase of the project implemented an industrial waste pretreatment system utilizing pH adjustment, filtration, and a bioreactor tank. This project provided a safe and reliable wastewater disposal system and eliminated a costly 40,000-gallon per day hold and haul system.
- Principal Engineer for development of innovative approach for remediation and reuse of federal Superfund site in Plaistow, New Hampshire. Prepared cost estimates for approaches aimed at reducing project costs by utilizing alternate treatment technologies and maximizing efficiency of existing system. Phased approach for site includes hot spot soil removal, enhancements of existing remedial system, implementing air sparging with SVE and follow with polishing step of in situ bioremediation. This alternative plan will achieve environmental restoration of site and is tailored to anticipated re-development of land.

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ROUX

PROFESSIONAL PROFILE

Josh Cope
Senior Scientist

TECHNICAL SPECIALTIES
Fuel oil forensics and age dating, USEPA Superfund, OPA, and NJDEP environmental regulations, Site Assessment and Contractor Oversight, GC/MS Operator, Data Validation, Technical Report preparation and review, Field Chemistry: field screening, HAZCATTING, groundwater and soil sampling, Hazardous Waste Transportation and Disposal

EXPERIENCE SUMMARY
25 years experience; Senior Scientist with Roux Associates, Inc.; Senior Chemist, Project Manager with Tetra Tech, Inc.; Owner of Geodyne Engineering Consultants, Inc.; Quality Assurance Officer, GC/MS Operator, Twenty First Century Environmental, Inc.; Project Manager, Field Technician, Resource Applications, Inc.

CREDENTIALS
B.A., 1991, Chemistry, Haverford College
OSHA 40-Hour Health and Safety Training
Level A Personal Protective Equipment Training
DOT and IATA Hazardous Material Shipping Training
New Jersey Transit (NJT) – Roadway Worker / On Track Protection

FEDERAL PROGRAMS – CLIENT: USEPA
KEY PROJECTS
- Provide technical and project management support to USEPA Removal and Remedial Branches in Regions 2, 3, 4 on Superfund and OPA projects.
- Manage and perform phase I and II site assessments, remedial investigations, removal action oversight, prepare health and safety plans, monitor site health and safety, support USEPA enforcement actions, implementation of Facility Response Plan (FRP) program, emergency response, biowatch exercises, criminal investigation support, contractor oversight, cost tracking, documentation, daily reporting, prepare after action reports, data validation, waste management, and attend public meetings
- Sites include: UST, AST, and pipeline leaks, lead smelter sites, wood treatment facilities, coal to gas plants, dry cleaners, junk yards, federal facilities, unpermitted landfills, drum burial, flood and hurricane clean up, oil refinery inspections, farmland, and historic industrial sites.
- Contaminants include: TCE, PCE, MTBE, BTEX, oil, gasoline, PCP, PAHs, mercury, lead, arsenic, ammonia, acids, bases, pesticides, PCBs, asbestos, and unknowns.
- Participated in the largest USEPA sponsored interagency response emergency response exercise, Liberty Radex, in Philadelphia. Acted as planner prior to the exercise and master controller during the exercise.
- Interface with state and local regulators on sites in Pennsylvania, Delaware, New Jersey, Maryland, Virginia, West Virginia, and Mississippi.

STATE PROGRAMS – CLIENTS: BUSINESSES AND INDIVIDUALS IN NEW JERSEY
- Provide a wide array of environmental services to homeowners, land developers, insurance companies, gas stations, and small industrial companies in New Jersey.
- Manage and/or perform ISRA reporting, phase I and II site assessments, third party investigations, subsurface evaluation, UST removal, air emissions permitting preparation, soil, groundwater, and vapor intrusion investigations, NPDES compliance.
- Manage remedial investigation, design, and execution for LUSTs, and farmland development.
- Manage reporting, deed restriction preparation, CEAs, remedial action permits, and response action outcome preparation (RAO).
- Evaluate environmental costs for insurance claims and litigation cases.
- Prepare and present justification for fine reduction to state regulators for private client.
- Meet with clients, prepare proposals, and negotiate contracts.

DATA VALIDATION/LABORATORY EXPERIENCE
- Perform level 3 and 4 data validation of analytical data packages in accordance with USEPA National Functional Guidelines.
- Quality assurance officer and GC/MS operator for New Jersey certified laboratory.
- Performed analysis of volatile and semi-volatile organics.
- Preformed maintenance and repair of analytical instruments.
- Performed method development and trouble shooting of analytical issues.
- Set up and operated mobile laboratory for organic and inorganic analyses on Superfund site assessments.
- Performed field screening of contaminants using test kits, XRF, radiation meters, and various types of air monitoring equipment.

WASTE MANAGEMENT
- Waste Management Specialist for oil pipeline client in Michigan for largest inland oil spill in United States during August 2010 through October 2011.
- Responsible for compliance, cost tracking, cost estimation, waste tracking and reporting, oil recovery calculation and reporting, contractor oversight.
- Prepared Waste Transportation and Disposal Plans and responses to regulator comments.

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Josh Cope
Senior Scientist

- Prepared waste profiles, negotiated waste removal protocols with USEPA and MDEQ to streamline process of waste handling to realize savings through greater efficiency and lowering sampling requirements.
- Located disposal facilities, negotiated disposal rates.
- Performed cost benefit analysis of various soil dewatering agents and procedures and proposed methods and protocols to client, USEPA, and MDEQ.
- Performed some oversight of removal actions along river.
- Supported submerged oil assessment of river.

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APPENDIX M

Vapor Barrier System Specifications

Bituthene® 3000 and Bituthene® Low Temperature — Below-Grade

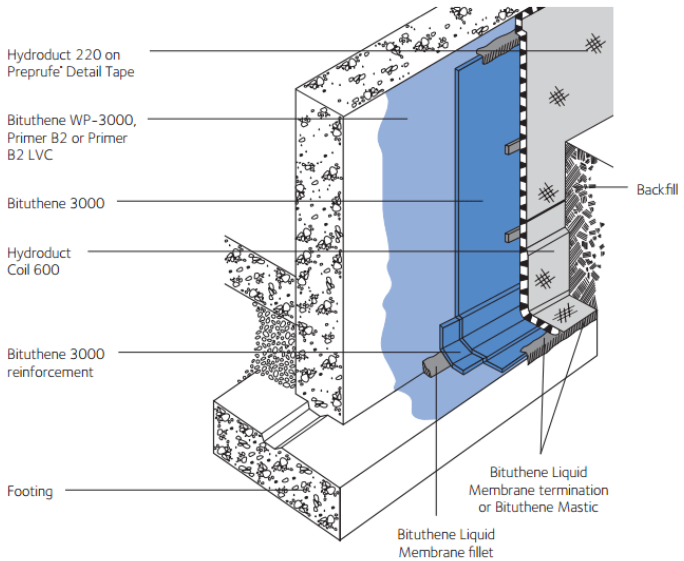
Self-adhesive, rubberized asphalt/polyethylene waterproofing membranes for basements and sub-structures

Product Description

Bituthene® 3000 and Bituthene® Low Temperature are self-adhesive, rubberized asphalt/polyethylene waterproofing membranes used in basements and sub-structures.

Product Advantages

- Waterproof - high hydrostatic head resistance
- Cross laminated film - provides dimensional stability, high tear strength, puncture and impact resistance
- Cold applied - no flame hazard; self-adhesive overlaps ensure continuity
- Chemically resistant - provides effective external protection against aggressive soils and groundwater
- Flexible - accommodates minor settlement and shrinkage movement
- Controlled thickness - factory made sheet ensures constant, non-variable site application
- Wide application window -
  - Bituthene® Low Temperature surface and ambient temperatures between 25 °F (-4 °C) and 60°F (16 °C)
  - Bituthene® 3000 surface and ambient temperatures at 40 °F (5 °C) or above
- Ripcord® split release on demand - faster application in the straight-aways, ease of membrane positioning in detailed areas



Drawings are for illustration purposes only.
Please refer to gcpat.com for specific application details.

Use

Bituthene® is ideal for waterproofing concrete, masonry and wood surfaces where in-service temperatures will not exceed 130 °F (54°C). It can be applied to foundation walls, tunnels, earth sheltered structures and split slab construction, both above and below grade. (For above grade applications, see *Above Grade Waterproofing Bituthene® 3000 and Bituthene® Low Temperature*.)

Bituthene® is 1/16 in. (1.5 mm) thick, 3 ft (0.9 m) wide and 66.7 ft (20 m) long and is supplied in rolls. It is unrolled, sticky side down, onto concrete slabs or applied onto vertical concrete faces primed with Bituthene® Primer WP-3000, Primer B2 or Primer B2 LVC. Continuity is achieved by overlapping a minimum 2 in. (50 mm) and firmly rolling the joint.

Bituthene® is extremely flexible. It is capable of bridging shrinkage cracks in the concrete and will accommodate minor differential movement throughout the service life of the structure.

Application Procedures

Safety, Storage and Handling Information

Bituthene® products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. For these products, the

Membrane Repairs

Patch tears and inadequately lapped seams with membrane. Clean membrane with a damp cloth and dry. Slit fishmouths and repair with a patch extending 6 in. (150 mm) in all directions from the slit and seal edges of the patch with Bituthene® Liquid Membrane. Inspect the membrane thoroughly before covering and make any repairs.

Drainage

Hydroduct® drainage composites are recommended for both active drainage and protection of the membrane. See Hydroduct® product information sheets.

Protection of Membrane

Protect Bituthene® membranes to avoid damage from other trades, construction materials or backfill. Place protection immediately in temperatures above 77°F (25°C) to avoid potential for blisters.

- On vertical applications, use Hydroduct® 220 Drainage Composite. Adhere Hydroduct® 220 Drainage Composite to membrane with Preprufe® Detail Tape. Alternative methods of protection are to use 1/4 in. (6 mm) asphalt impregnated board or 1 in. (25 mm) extruded polystyrene. Such alternatives do not provide positive drainage to the system. Adhere protection board with an adhesive or Preprufe® Detail

best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. SDS (Safety Data Sheet) are available and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the SDS before use.

Surface Preparation

Surfaces should be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Concrete must be properly dried (minimum 7 days for normal structural concrete and 14 days for lightweight structural concrete).

If time is critical, Bituthene® Primer B2 or Bituthene® Primer B2 LVC may be used to allow priming and installation of membrane on damp surfaces or green concrete. Priming may begin in this case as soon as the concrete will maintain structural integrity. Use form release agents which will not transfer to the concrete. Remove forms as soon as possible from below horizontal slabs to prevent entrapment of excess moisture. Excess moisture may lead to blistering of the membrane. Cure concrete with clear, resin-based curing compounds which do not contain oil, wax or pigment. Except with Primer B2 or Primer B2 LVC, allow concrete to thoroughly dry following rain. Do not apply any products to frozen concrete.

Repair defects such as spalled or poorly consolidated areas. Remove sharp protrusions and form match lines. On masonry surfaces, apply a parge coat to rough concrete block and brick walls or trowel cut mortar joints flush to the face of the concrete blocks.

Temperature

- Apply Bituthene® 3000 Membrane only in dry weather and at air and surface temperatures of 40 °F (5 °C) and above.
- Apply Bituthene® Low Temperature Membrane only in dry weather and when air and surface temperatures are between 25 °F (-4 °C) and 60 °F (16 °C).
- Apply Bituthene® Primer WP-3000 in dry weather above 40 °F (5 °C).
- Apply Bituthene® Primer B2 in dry weather above 25 °F (-4 °C). (See separate product information sheet.)

Priming

- Apply Bituthene® Primer WP-3000 by spray or roller at a coverage rate of 500–600 ft^2/gal (12–15 m^2/L). Allow to dry one hour or until concrete returns to original color.
- Apply Bituthene® Primer B2 by a lamb's wool roller at a coverage rate of 250–350 ft^2/gal (6–8 m^2/L). Allow primer to dry one hour or until tack-free.
- Apply Bituthene® Primer B2 LVC by a lamb's wool roller at a coverage rate of 325–425 ft^2/gal (7.5–10 m^2/L). Allow primer to dry one hour or until tack free.
- Dry time may be longer in cold temperatures. Reprime areas if contaminated by dust. If the work area is dusty, apply membrane as soon as the primer is dry.
- **Do not apply any primer to Bituthene® membrane.**

Corner Details

The treatment of corners varies depending on the location of the corner. For detailed information on Bituthene® Liquid Membrane, see separate product information sheet.

Tape.

- In mud slab waterproofing, or other applications where positive drainage is not desired and where reinforced concrete slabs are placed over the membrane, the use of 1/4 in. (6 mm) hardboard or 2 layers of 1/8 in. (3 mm) hardboard is recommended.

Insulation

Always apply Bituthene® membrane directly to primed or conditioned structural substrates. Insulation, if used, must be applied over the membrane. Do not apply Bituthene® membranes over lightweight insulating concrete.

Backfill

Place backfill as soon as possible. Use care during backfill operation to avoid damage to the waterproofing system. Follow generally accepted practices for backfilling and compaction. Backfill should be added and compacted in 6 in. (150 mm) to 12 in. (300 mm) lifts.

For areas which cannot be fully compacted, a termination bar is recommended across the top termination of the membrane.

Placing Steel

When placing steel over properly protected membrane, use concrete bar supports (dobies) or chairs with plastic tips or rolled feet to prevent damage from sharp edges. Use special care when using wire mesh, especially if the mesh is curled.

Approvals

- City of Los Angeles Research Report RR 24386
- U.S. Department of Housing and Urban Development (HUD) HUD Materials Release 628E

Warranty

Five year material warranties covering Bituthene® and Hydroduct® products are available upon request. Contact your GCP Applied Technologies sales representative for details.

Technical Services

Support is provided by full time, technically trained GCP representatives and technical service personnel, backed by a central research and development staff.

Supply

PRODUCT PROPERTY	TOTAL
Bituthene® 3000 or Bituthene® Low Temperature	3 ft x 66.7 ft roll (200 ft^2) [0.9 m x 20 m (18.6 m^2)]
Roll weight	83 lbs (38 kg) gross
Palletization	25 rolls per pallet
Storage	Store upright in dry conditions below 95 °F (+35 °C).

- At wall to footing inside corners.
  - **Option 1:** Apply membrane to within 1 in. (25 mm) of base of wall. Treat the inside corner by installing a 3/4 in. (20 mm) fillet of Bituthene® Liquid Membrane. Extend Bituthene® Liquid Membrane at least 2 1/2 in. (65 mm) onto footing, and 2 1/2 in. (65 mm) onto wall membrane.
  - **Option 2:** Treat the inside corner by installing a 3/4 in. (20 mm) fillet of Bituthene® Liquid Membrane. Apply 12 in. (300 mm) wide strip of sheet membrane centered over fillet. Apply wall membrane over inside corner and extend 6 in. (150 mm) onto footing. Apply 1 in. (25 mm) wide troweling of Bituthene® Liquid Membrane over all terminations and seams within 12 in. (300 mm) of corner.
- At footings where the elevation of the floor slab is 6 in. (150 mm) or more above the footing, treat the inside corner either by the above two methods or terminate the membrane at the base of the wall. Seal the termination with Bituthene® Liquid Membrane.

Joints

Properly seal all joints with waterstop, joint filler and sealant as required. Bituthene® membranes are not intended to function as the primary joint seal. Allow sealants to fully cure. Pre-strip all slab and wall cracks over 1/16 in. (1.5 mm) wide and all construction and control joints with 9 in. (230 mm) wide sheet membrane strip.

Application on Horizontal Surfaces

(**Note:** Preprufe® pre-applied membranes are strongly recommended for below slab or for any application where the membrane is applied before concreting. See Preprufe® product information sheets.)

Apply membrane from the low point to the high point so that laps shed water. Overlap all seams at least 2 in. (50 mm). Stagger all end laps. Roll the entire membrane firmly and completely as soon as possible. Use a linoleum roller or standard water-filled garden roller less than 30 in. (760 mm) wide, weighing a minimum of 75 lbs (34 kg) when filled. Cover the face of the roller with a resilient material such as a 1/2 in. (13 mm) plastic foam or two wraps of indoor-outdoor carpet to allow the membrane to fully contact the primed substrate. Seal all T-joints and membrane terminations with Bituthene® Liquid Membrane at the end of the day.

Protrusions and Drains

Apply membrane to within 1 in. (25 mm) of the base of the protrusion. Apply Bituthene® Liquid Membrane 0.1 in. (2.5 mm) thick around protrusion. Bituthene® Liquid Membrane should extend over the membrane a minimum of 2 1/2 in. (65 mm) and up the penetration to just below the finished height of the wearing course.

Vertical Surfaces

Apply membrane in lengths up to 8 ft (2.5 m). Overlap all seams at least 2 in. (50 mm). On higher walls apply membrane in two or more sections with the upper overlapping the lower by at least 2 in. (50 mm). Roll all membrane with a hand roller.

Terminate the membrane at grade level. Press the membrane firmly to the wall with the butt end of a hardwood tool such as a hammer handle or secure into a reglet. Failure to use heavy pressure at terminations can result in a poor seal. A termination bar may be used to ensure a tight seal. Terminate the membrane at the base of the wall if the bottom of the interior floor slab is at least 6 in. (150 mm) above the footing. Otherwise,

ANCILLARY PRODUCTS	TOTAL
Bituthene® WP-3000	5 gal (18.9 L) pail/24 pails per pallet
Bituthene® Primer B2	5 gal (18.9 L) pail/48 pails per pallet
Bituthene® Primer B2 LVC	5 gal (18.9 L) pail/48 pails per pallet
Bituthene® Liquid Membrane	1.5 gal (5.7 L) pail/100 pails per pallet or 4 gal (15.1 L) pail/24 pails per pallet
Preprufe® Detail Tape	2 in. x 50 ft (50 mm x15 m) roll/16 rolls per carton
Bituthene® Mastic	Twelve 30 oz (0.9 L) tubes/carton or 5 gal (18.9 L) pail/36 pails per pallet

Equipment by others: Soft broom, utility knife, brush or roller for priming

Physical Properties for Bituthene® Membrane

PROPERTY	TYPICAL VALUE	TEST METHOD
Color	Dark gray-black	
Thickness	1/16 in. (1.5 mm) nominal	ASTM D3767—method A
Flexibility, 180° bend over 1 in. (25 mm) mandrel at -25°F (-32°C)	Unaffected	ASTM D1970
Tensile strength, membrane, die C	325 lbs/in.^{2} (2240 kPa) minimum	ASTM D412 modified[1]
Tensile strength, film	5,000 lbs/in.^{2} (34.5 MPa) minimum	ASTM D882 modified[1]
Elongation, ultimate failure of rubberized asphalt	300% minimum	ASTM D412 modified[1]
Crack cycling at -25°F (-32°C), 100 cycles	Unaffected	ASTM C836
Lap adhesion at minimum application temperature	3000: 4 lbs/in. (700 N/m) Low Temp: 5 lbs/in. (880 N/m)	ASTM D1876 modified[2]
Peel strength	9 lbs/in. (1576 N/m)	ASTM D903 modified[3]
Puncture resistance, membrane	50 lbs (222 N) minimum	ASTM E154

use appropriate inside corner detail where the wall and footing meet.

Resistance to hydrostatic head	200 ft (60 m) of water	ASTM D5385
Permeance	0.05 perms (2.9 ng/m^{2}sPa) maximum	ASTM E96, section 12—water method
Water absorption	0.1% maximum	ASTM D570

Footnotes:

The test is run at a rate of 2 in. (50 mm) per minute.

The test is conducted 15 minutes after the lap is formed and run at a rate of 2 in. (50 mm) per minute at 40°F (5°C).

The 180° peel strength is run at a rate of 12 in. (300 mm) per minute.

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate, and is offered for consideration, investigation and verification by the user, but we do not warrant the results to be obtained. Please read all statements, recommendations and suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation or suggestion is intended for any use that would infringe any patent, copyright or other third-party right.

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GCP0083 BIT-210-1216

Last Updated: 2017-08-18

gcpat.com/solutions/products/bituthene-post-applied-waterproofing/bituthene-3000-and-bituthene-low

Preprufe® 300R & 160R

Pre-applied waterproofing membranes that bond integrally to poured concrete for use below slabs or behind basement walls on confined sites

Product Description

Preprufe® 300R & 160R membranes are unique composite sheets comprised of a thick HDPE film, pressure sensitive adhesive and weather resistant protective coating. Designed with Advanced Bond Technology™, Preprufe® 300R & 160R membranes form a unique, integral bond to poured concrete, preventing both the ingress and lateral migration of water while providing a robust barrier to water, moisture and gas.

The Preprufe R System includes:

- Preprufe® 300R - heavy-duty grade for use below slabs and on rafts (i.e. mud slabs). Designed to accept the placing of heavy reinforcement using conventional concrete spacers
- Preprufe® 160R - thinner grade for blindside, zero property line applications against soil retention systems. Vertical use only
- Preprufe® Tape LT - for covering cut edges, roll ends, penetrations and detailing (temperatures between 25°F (-4°C) and 86°F (+30°C))
- Preprufe® Tape HC - for covering cut edges, roll ends, penetrations and detailing (minimum 50°F (10°C))
- Preprufe® CJ Tape LT - for construction joints and detailing (temperatures between 25°F (-4°C) and 86°F (+30°C))
- Preprufe® CJ Tape HC - for construction joints and detailing (minimum 50°F (10°C))
- Bituthene® Liquid Membrane - for sealing around penetrations, etc.
- Adcor® ES - waterstop for joints in concrete walls and floors
- Preprufe® Tieback Covers - preformed cover for soil retention wall tieback heads
- Preprufe® Preformed Corners - preformed inside and outside corners

Preprufe® 300R & 160R membranes are applied either horizontally to smooth prepared concrete, carton forms or well rolled and compacted earth or crushed stone substrate; or vertically to permanent formwork or adjoining structures. Concrete is then cast directly against the adhesive side of the membranes. The specially developed Preprufe® adhesive layers work together to form a continuous and integral seal to the structure.

Preprufe® products can be returned up the inside face of slab formwork but is not recommended for conventional twin-sided formwork on walls, etc. Use Bituthene® self-adhesive membrane or Procor® fluid-applied membrane to walls after removal of formwork for a fully bonded system to all structural surfaces.

Product Advantages

- Forms a unique continuous adhesive bond to concrete poured against it - prevents water migration and makes it unaffected by ground settlement beneath slabs
- Fully-adhered watertight laps and detailing
- Provides a barrier to water, moisture and gas - physically isolates the structure from the surrounding ground
- BBA Certified for basement Grades 2, 3, & 4 to BS 8102:1990
- Zero permeance to moisture
- Solar reflective - reduced temperature gain
- Simple and quick to install - requiring no priming or fillets
- Can be applied to permanent formwork - allows maximum use of confined sites
- Self protecting - can be trafficked immediately after application and ready for immediate placing of reinforcement
- Unaffected by wet conditions - cannot activate prematurely
- Inherently waterproof, non-reactive system: 1. not reliant on confining pressures or hydration 2. unaffected by wet/dry cycling
- Chemical resistant - effective in most types of soils and waters, protects structure from salt or sulphate attack

Vertical substrates - Mechanically fasten the membrane vertically using fasteners appropriate to the substrate with the the clear plastic release liner facing towards the concrete pour. The membrane may be installed in any convenient length. Fastening can be made through the selvedge using a small and low profile head fastener so that the membrane lays flat and allows firmly rolled overlaps. Immediately remove the plastic release liner.

Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Roll firmly to ensure a watertight seal.

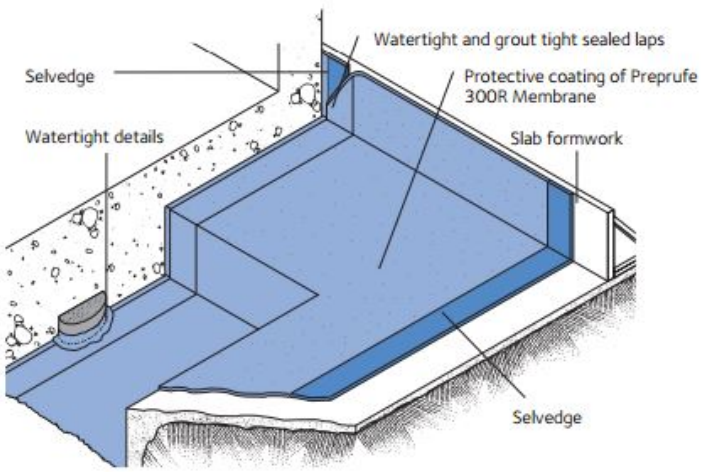
Roll ends and cut edges - Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary. Allow to dry and apply Preprufe Tape LT (or HC in hot climates) centered over the lap edges and roll firmly (see Figure 3). Immediately remove printed plastic release liner from the tape.

Details

Detail drawings are available at gcpat.com.

Membrane Repair

Inspect the membrane before installation of reinforcement steel, formwork and final placement of concrete. The membrane can be easily cleaned by power washing if required. Repair damage by wiping the area with a damp



Installation

The most current application instructions, detail drawings and technical letters can be viewed at gcpat.com. For other technical information contact your local GCP representative.

Preprufe 300R & 160R membranes are supplied in rolls 4 ft (1.2 m) wide, with a selvedge on one side to provide self-adhered laps for continuity between rolls. The rolls of Preprufe Membrane and Preprufe Tape are interwound with a disposable plastic release liner which must be removed before placing reinforcement and concrete.

Substrate Preparation

All surfaces - It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability (see Figure 1).

Figure 1

Horizontal - The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour. The surface does not need to be dry, but standing water must be removed.

Vertical - Use concrete, plywood, insulation or other approved facing to sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment.

cloth to ensure the area is clean and free from dust, and allow to dry. Repair small punctures (0.5 in. (12 mm) or less) and slices by applying Preprufe Tape centered over the damaged area. Repair holes and large punctures by applying a patch of Preprufe membrane, which extends 6 in. (150 mm) beyond the damaged area. Seal all edges of the patch with Preprufe Tape. Any areas of damaged adhesive should be covered with Preprufe Tape. Where exposed selvedge has lost adhesion or laps have not been sealed, ensure the area is clean and dry and cover with fresh Preprufe Tape. All Preprufe Tape must be rolled firmly and the tinted release liner removed. Alternatively, use a hot air gun or similar to activate the adhesive using caution not to damage the membrane and firmly roll lap to achieve continuity.

Pouring of Concrete

Ensure the plastic release liner is removed from all areas of Preprufe membrane and tape.

It is recommended that concrete be poured within 56 days (42 days in hot climates) of application of the membrane. Following proper ACI guidelines, concrete must be placed carefully and consolidated properly to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

Removal of Formwork

Detail Drawings

Details shown are typical illustrations and not working details.For a list of the most current details, visit us at gcpat.com. For technical assistance with detailing and problem solving please call toll free at 866-333-3SBM (3726).

Preprufe membranes can be applied to removable formwork, such as slab perimeters, elevator and lift pits, etc. Once the concrete is poured the formwork must remain in place until the concrete has gained sufficient compressive strength to develop the surface bond. Preprufe membranes are not recommended for conventional twin-sided wall forming systems, see GCP tech letter 13 for information on forming systems used with Preprufe products.

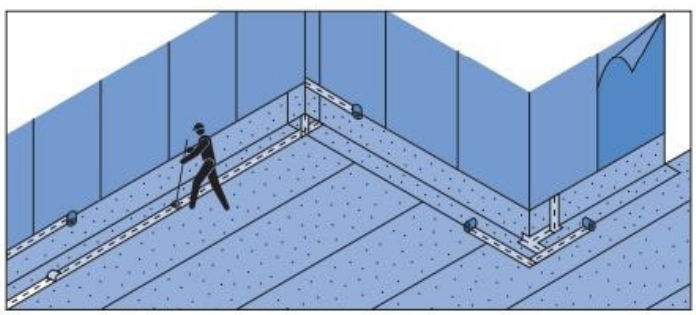
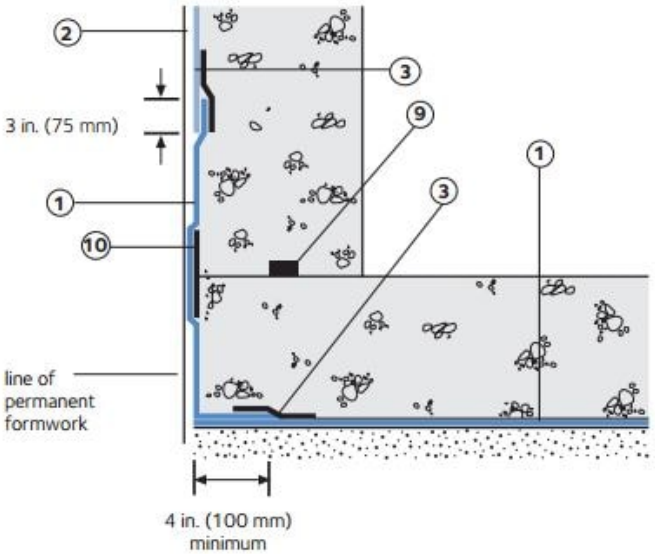


Figure 2



Membrane Installation

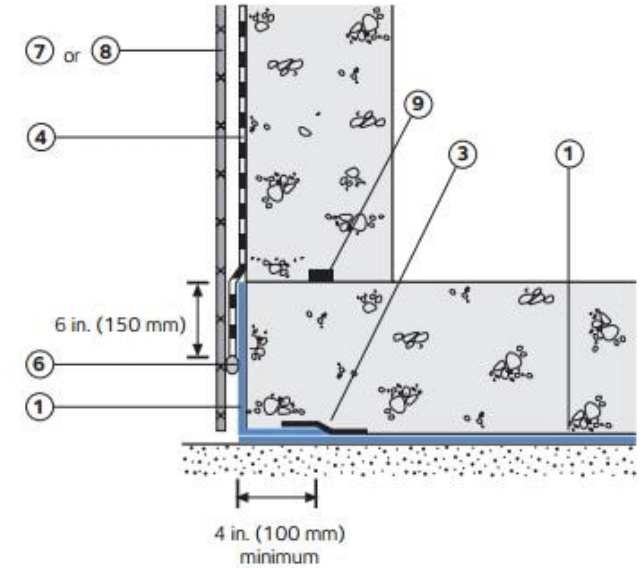
Preprufe membranes can be applied at temperatures of 25°F (-4°C) or above. When installing Preprufe product in cold or marginal weather conditions 55°F (<13°C) the use of Preprufe Tape LT is recommended at all laps and detailing. Preprufe Tape LT should be applied to clean, dry surfaces and the release liner must be removed immediately after application. Alternatively, Preprufe Low Temperature (LT) membrane is available for low temperature condition applications. Refer to Preprufe LT data sheet and GCP tech letter 16 for more information.

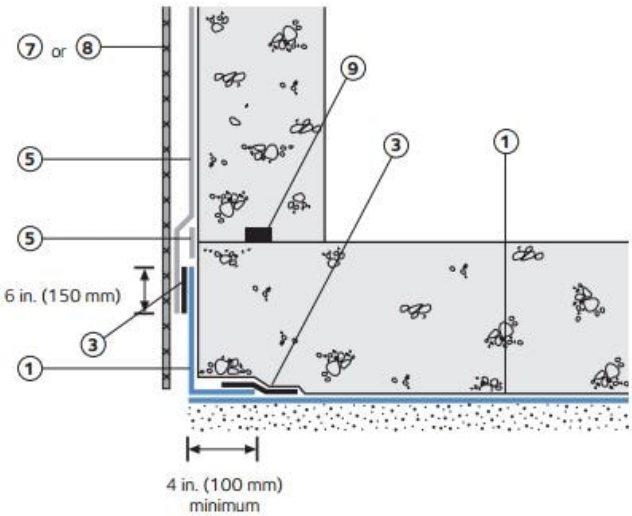
Figure 3

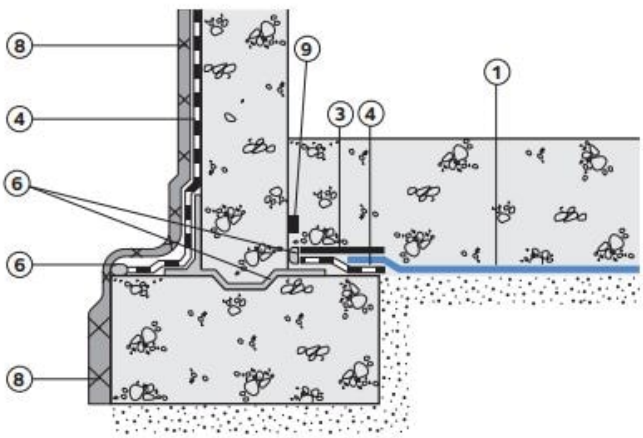
Horizontal substrates - Place the membrane HDPE film side to the substrate with the clear plastic release liner facing towards the concrete pour. End laps should be staggered to avoid a build up of layers. Leave plastic release liner in position until overlap procedure is completed (see Figure 2).

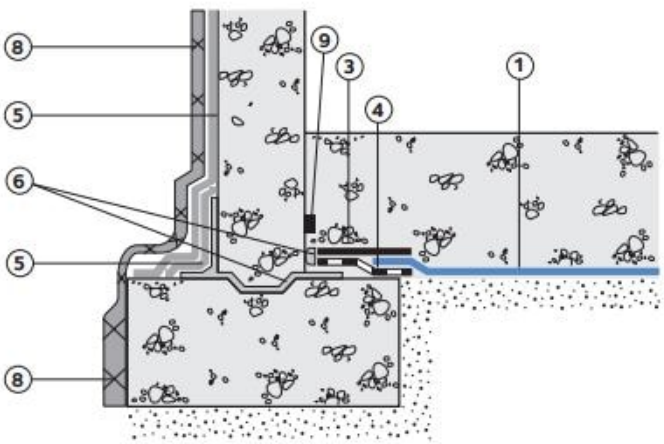
Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Peel back the plastic release liner from between the overlaps as the two layers are bonded together. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear.

Refer to GCP tech letter 15 for information on suitable rebar chairs for Preprufe products.









1 Preprufe® 300R

2 Preprufe® 160R

3 Preprufe® Tape

4 Bituthene®

5 Procor®

6 Bituthene® Liquid Membrane

7 Approved Protection Course

8 Hydroduct®

9 Adcor™ ES

10 Preprufe® CJ Tape

Supply

DIMENSIONS (NOMINAL)	PREPRUFE® 300R MEMBRANE	PREPRUFE® 160R MEMBRANE	PREPRUFE® TAPE (LT OR HC*)
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	
Roll size	4 ft x 98 ft (1.2 m x 30 m)	4 ft x 115 ft (1.2 m x 35 m)	4 in. x 49 ft (100 mm x 15 m)
Roll area	392 ft^2 (36 m^2)	460 ft^2 (42 m^2)	
Roll weight	108 lbs (50 kg)	92 lbs (42 kg)	4.3 lbs (2 kg)

Minimum side/end laps	3 in. (75 mm)	3 in. (75 mm)	3 in. (75 mm)

Physical Properties

PROPERTY	TYPICAL VALUE 300R	TYPICAL VALUE 160R	TEST METHOD
Color	white	white	
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	ASTM D3767
Lateral Water Migration Resistance	Pass at 231 ft (71 m) of hydrostatic head pressure	Pass at 231 ft (71 m) of hydrostatic head pressure	ASTM D5385, modified[1]
Low temperature flexibility	Unaffected at -20°F (-29°C)	Unaffected at -20°F (-29°C)	ASTM D1970
Resistance to hydrostatic head	231 ft (71 m)	231 ft (71 m)	ASTM D5385, modified[2]
Elongation	500%	500%	ASTM D412, modified[3]
Tensile strength, film	4000 psi (27.6 MPa)	4000 psi (27.6 MPa)	ASTM D412
Crack cycling at -9.4°F (-23°C), 100 cycles	Unaffected, Pass	Unaffected, Pass	ASTM C836
Puncture resistance	221 lbs (990 N)	100 lbs (445 N)	ASTM E154
Peel adhesion to concrete	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D903, modified[4]
Lap peel adhesion	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D1876, modified[5]
Permeance to water vapor transmission	0.01 perms (0.6 ng/(Pa x s x m^2))	0.01 perms (0.6 ng/(Pa x s x m^2))	ASTM E96, method B
Water absorptio	0.5%	0.5%	ASTM D570

Footnotes:

1. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the membrane.
2. Hydrostatic head tests of Preprufe Membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125 in. (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to the head indicated.
3. Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
4. Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 2 in. (50 mm) per minute at room temperature.
5. The test is conducted 15 minutes after the lap is formed (per GCP published recommendations) and run at a rate of 2 in. (50 mm) per minute.

Removal of Formwork (continued)

A minimum concrete compressive strength of 3000 psi (20 N/mm^2) is recommended prior to stripping formwork supporting Preprufe membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete.

Refer to GCP Tech Letter 17 for information on removal of formwork for Preprufe products.

Health and Safety

Refer to relevant SDS (Safety Data Sheet). Complete rolls should be

Specification Clauses

Preprufe 300R or 160R membrane shall be applied with its protective coating presented to receive fresh concrete to which it will integrally bond. Only GCP Applied Technologies approved membranes shall be bonded to Preprufe 300R/160R product. All Preprufe 300R/160R system materials shall be supplied by GCP Applied Technologies, and applied strictly in accordance with their instructions. Specimen performance and formatted clauses are also available.

NOTE: Use Preprufe Tape to tie-in Procor® fluid-applied membrane with Preprufe products.

handled by a minimum of two persons.

FLORPRUFE® 120

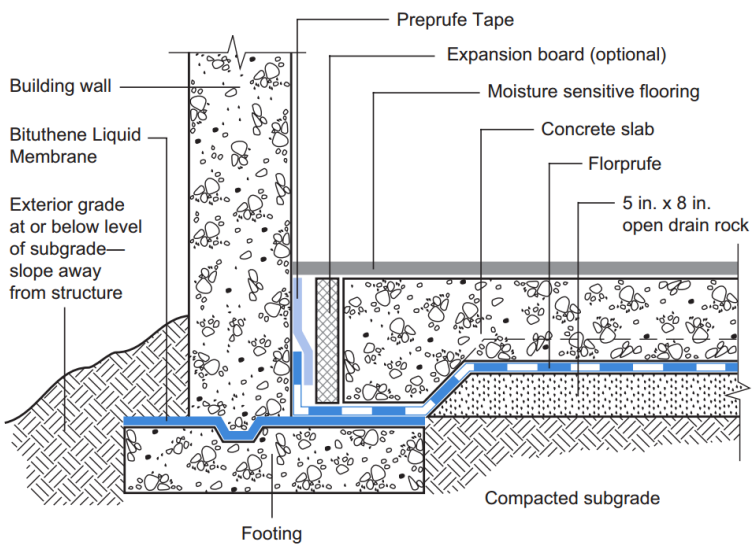
Integrally bonded vapor protection for slabs on grade

Product Description

FLORPRUFE® 120 is a high performance vapor barrier with GCP's Advanced Bond Technology™ that forms a unique seal to the underside of concrete floor slabs. Comprising a highly durable polyolefin sheet and a specially developed, non-tacky adhesive coating, FLORPRUFE® 120 seals to liquid concrete to provide integrally bonded vapor protection. FLORPRUFE® exceeds ASTM E1745 Class A rating.

Product Advantages

- Forms a powerful integral seal to the underside of concrete slabs
- Protects valuable floor finishes such as wood, tiles, carpet and resilient flooring from damage by vapor transmission
- Direct contact with the slab complies with the latest industry recommendations
- Remains sealed to the slab even in cases of ground settlement
- Ultra low vapor permeability
- Durable, chemical resistant polyolefin sheet
- Lightweight, easy to apply, kick out rolls
- Simple lap forming with mechanical fixings or tape



Use

FLORPRUFE® 120 is engineered for use below slabs on grade with moisture-impermeable or moisture-sensitive floor finishes that require the highest level of vapor protection.

FLORPRUFE® complies with the latest recommendations of ACI Committees 302 and 360, i.e. for slabs with vapor sensitive coverings, the location of the vapor barrier should always be in direct contact with the slab1.

The membrane is loose laid onto the prepared sub-base, forming overlaps that can be either mechanically secured or taped. The unique bond of FLORPRUFE® to concrete provides continuity of vapor protection at laps. Alternatively, if a taped system is preferred, self-adhered FLORPRUFE® Tape can be used to overband the laps.

Slab reinforcement and concrete can be placed immediately. Once the concrete is poured, an integral bond develops between the concrete and membrane.

1 ACI 302.1R-96

Installation

Health & Safety

Refer to relevant Safety Data Sheet. Complete rolls should be handled by 2 persons.

FLORPRUFE® 120 can be applied at temperatures of 25ºF (-4ºC) or above. Membrane installation is unaffected by wet weather.

Installation and detailing of FLORPRUFE® 120 are generally in accordance with ASTM E1643-98.

Prepare substrate in accordance with ACI 302.1R Section 4.1. Install FLORPRUFE ® 120 over the leveled and compacted base. Place the membrane with the smooth side down and the plastic release liner side up facing towards the concrete slab. Remove and discard plastic release liner. End laps should be staggered to avoid a build up of layers. Succeeding sheets should be accurately positioned to overlap the previous sheet 2 in. (50 mm) along the marked lap line.

Laps

1. Mechanical fastening method

To prevent the membrane from moving and gaps opening, the laps should be fastened together at 39 in. (1.0 m) maximum centers. Fix through the center of the lap area using 0.5 in.(12 mm) long washer-head, self-tapping, galvanized screws (or similar) and allowing the head of the screw to bed into the adhesive compound to self-seal. It is not necessary to fix the membrane to the substrate, only to itself. Ensure the membrane lays flat and no openings occur. (See Figure 1.) Additional fastening may be required at corners, details, etc. Continuity is achieved once the slab is poured and the bond to concrete develops.

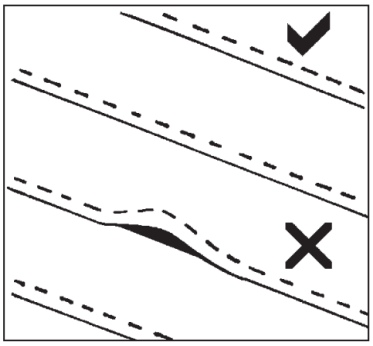


Figure 1

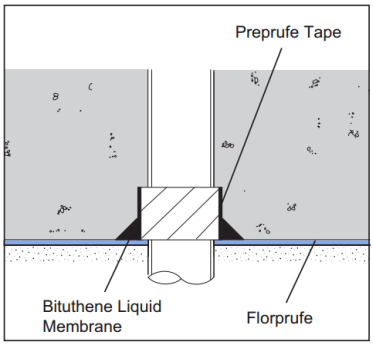


Figure 2

OR

2. Taped lap method

For additional security use PREPRUFE ® Tape to secure and seal the overlaps. Overband the lap with the 4 in. (100 mm) wide PREPRUFE® Tape, using the lap line for alignment. Remove plastic release liner to ensure bond to concrete.

Penetrations

Mix and apply BITUTHENE® Liquid Membrane detail-ing compound to seal around penetrations such as drainage pipes, etc. (See Figure 2 and refer to the BITUTHENE® Liquid Membrane data sheet, BIT-230.)

Concrete Placement

Place concrete within 30 days. Inspect membrane and repair any damage with patches of PREPRUFE ® Tape. Ensure all liner is removed from membrane and tape before concreting.

Supply

FLORPRUFE® 120	
Supplied in rolls	4 ft x 115 ft (1.2 m x 35 m)
Roll area	460 ft^2 (42 m^2)
Roll weight	70 lbs (32 kg) approx.

ANCILLARY PRODUCTS
PREPRUFE® Tape is packaged in cartons containing 4 rolls that are 4 in. x 49 ft (100 mm x 15 m).
BITUTHENE® Liquid Membrane is supplied in 1.5 gal (5.7 L) pails.

Physical Properties: Exceeds ASTM E1745 Class A rating

PROPERTY	TYPICAL VALUE	TEST METHOD
Color	White	
Thickness (nominal)	0.021 in. (0.5 mm)	ASTM D3767—method A
Water vapor permeance	0.03 perms	ASTM E96—method B1
Tensile strength	65 lbs/in.	ASTM E1541
Elongation	300%	ASTM D412
Puncture resistance	3300 gms	ASTM D17091
Peel adhesion to concrete	>4 lbs/in.	ASTM D903

1. Test methods that comprise ASTM E1745 standard for vapor retarders

We hope the information here will be helpful. It is based on data and knowledge considered to be true and accurate, and is offered for consideration, investigation and verification by the user, but we do not warrant the results to be obtained. Please read all statements, recommendations, and suggestions in conjunction with our conditions of sale, which apply to all goods supplied by us. No statement, recommendation, or suggestion is intended for any use that would infringe any patent, copyright, or other third party right.

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Last Updated: 2018-08-24

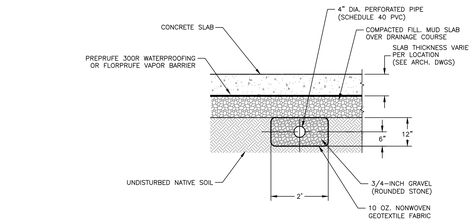
gcpat.com/solutions/products/florprufe-bonded-vapor-barrier/florprufe-120

gcp applied technologies

APPENDIX N

Sub-Slab Depressurization System Specifications

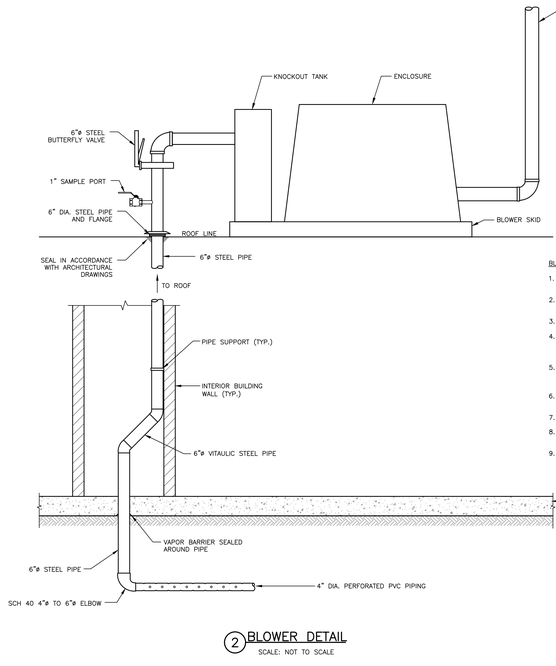
SITE PLAN
SCALE: 1" = 10'



1 SUB-SLAB DEPRESSURIZATION SYSTEM PIPE DETAIL
SCALE: NOT TO SCALE

SUB-SLAB DEPRESSURIZATION SYSTEM NOTES

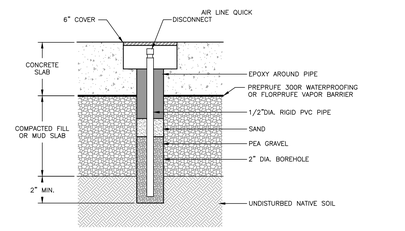
1. CONTRACTOR SHALL COORDINATE WITH PLUMBING, MECHANICAL, CIVIL AND ELECTRICAL CONTRACTORS FOR ALL UTILITY CROSSINGS.
2. THE PERFORATED PIPE MAY BE ROUTED AROUND OR UNDERNEATH ANY UTILITY LINES (SEWER, WATER, GAS), AS REQUIRED AND AS APPROVED BY THE ENGINEER.
3. THE SURFACES TO BE LINED WITH GEOTEXTILE SHALL BE FREE OF ALL ROCKS, STONES, SHARP OBJECTS OR CONSTRUCTION DEBRIS OF ANY KIND.
4. INSTALL GEOTEXTILE NONWOVEN FABRIC DIRECTLY ON FILL. MATERIAL OVERLAPS SHALL BE A MINIMUM OF 12" THE OVERLAPPED SEAMS WILL BE SEALED WITH TAPE.
5. ALL PENETRATIONS THROUGH THE SLAB ON GRADE (SOG) SHALL BE SEALED USING A SILICONE BASED WATERPROOF SEALANT OR EQUIVALENT.



2 BLOWER DETAIL
SCALE: NOT TO SCALE

BLOWER DETAIL NOTES

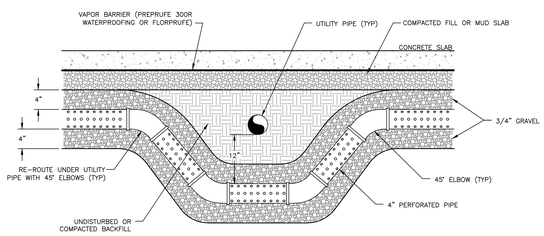
1. PROVIDE ELECTRICAL/CONTROL CONDUIT TO BLOWER. COORDINATE WITH ELECTRICAL CONTRACTOR.
2. ELECTRICAL CONDUIT SHALL BE SIZED APPROPRIATELY IN ACCORDANCE WITH THE ELECTRICAL DESIGNER.
3. THE BLOWER SHALL BE PROVIDED WITH A NOISE REDUCING ENCLOSURE.
4. THE BLOWER SKID SHALL INCLUDE ENCLOSURE, KNOCKOUT TANK (WITH HIGH LEVEL ALARM), VACUUM RELIEF VALVE, GAUGES, AND INTERCONNECTING PIPING/FITTINGS.
5. PROVIDE ALARM LIGHT INDICATING SYSTEM SHUT DOWN IN MANAGER'S OFFICE. SPECIFIC LOCATION TO BE COORDINATED AND CONFIRMED WITH THE CONTRACTOR AND ROUX ASSOCIATES.
6. TREATMENT OF BLOWER DISCHARGE WITH CARBON WILL BE EVALUATED AT SYSTEM START-UP AND ON A PERIODIC BASIS IF NEEDED.
7. PROVIDE ALL NECESSARY PIPE SUPPORTS.
8. THE BLOWER DISCHARGE SHALL BE A MINIMUM OF 10 FEET FROM HVAC AIR INLETS AND PROPERTY LINE.
9. THE BLOWER SHALL BE A 7.5 HP, AMETEK ROTRON MODEL: DR858AY72W OR APPROVED EQUAL.



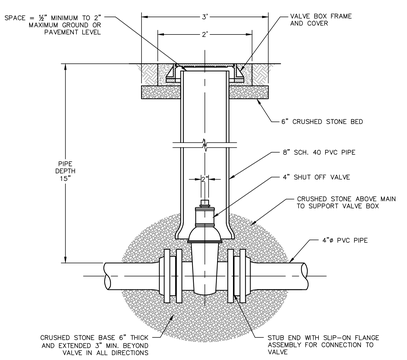
3 SOIL VAPOR MONITORING POINT DETAIL
SCALE: 1" = 4'

SOIL VAPOR MONITORING POINT NOTE

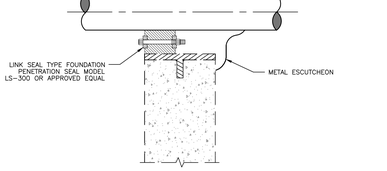
DEPICTED LOCATIONS OF SOIL VAPOR MONITORING POINTS ARE APPROXIMATE AND SHALL BE COORDINATED AND CONFIRMED WITH THE CONTRACTOR AND ROUX ASSOCIATES PRIOR TO CONSTRUCTION.



5 TYPICAL UTILITY PIPE CROSSING
SCALE: NOT TO SCALE



6 TYPICAL UNDERGROUND VALVE DETAIL
SCALE: NOT TO SCALE



4 WALL PIPE PENETRATION DETAIL
SCALE: NOT TO SCALE

NO.	DATE	REVISION DESCRIPTION	INT.

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THESE DOCUMENTS (OR COPIES OF ANY THEREOF) PREPARED BY OR BEARING THE SEAL OF THE ENGINEER, SHALL NOT BE REUSED FOR ANY EXTENSIONS OF THE PROJECT OR ANY OTHER PROJECT WITHOUT THE WRITTEN CONSENT OF THE ENGINEER.

PROJ. ENGINEER:	A.F.	DRAWN BY:	G.M.
DESIGNED BY:	A.F.	CHECKED BY:	B.P.M.
DRAWING SCALE:	AS SHOWN	PLOT SCALE:	1:1
DRAWING DATE:	04JAN18	PRINT TYPE:	B&W
OFFICE:	NY	PAPER SIZE:	ARCH D
PROJECT NO.:	3002.0004Y000		
DRAWING FILE:	3002.0004Y104.01.DWG		

ROUX
Roux Environmental Engineering and Geology, D.P.C.
209 SHAFTER STREET ISLANDIA NEW YORK 11749
(631) 232-2600

PROJECT NAME:
CHESTNUT COMMONS
BLOCK 4142, LOT 34, BROOKLYN, NEW YORK
PROJECT FOR:
MHANY MANAGEMENT, INC URBAN BUILDERS COLLABORATIVE

TITLE:
SUB-SLAB DEPRESSURIZATION PLAN

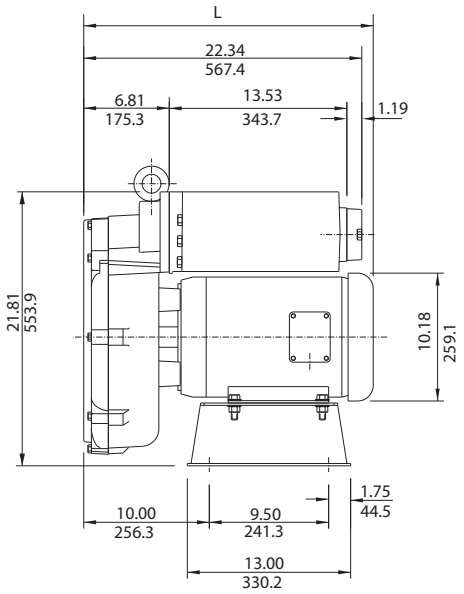
DRAWING NO.
1
DRAWING 1 OF 1

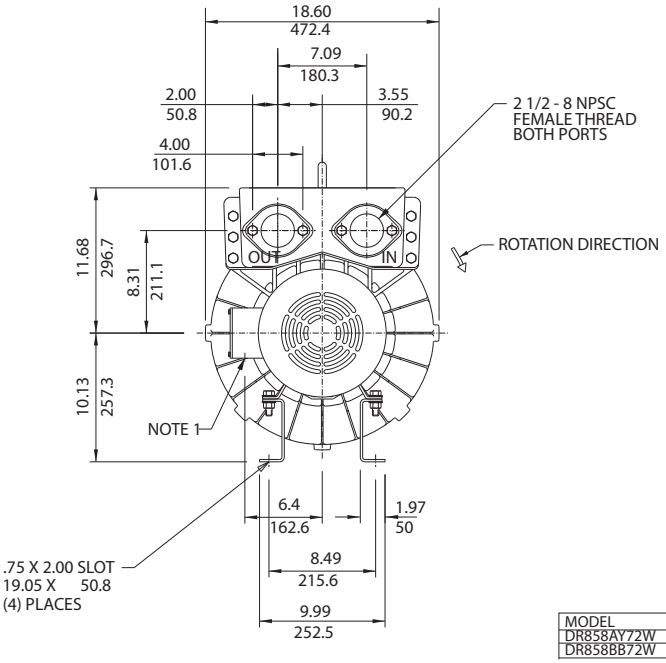
V:\CAD\PROJECTS\3000'S\0004Y\VA\3002.0004Y104.01.DWG

DR 858 & CP 858

ROTRON®

7.5 / 10.0 HP Regenerative Blower





NOTES
1. TERMINAL BOX CONNECTOR HOLE 1.06 (26.9) DIA.
2. DRAWING NOT TO SCALE, CONTACT FACTORY FOR SCALE CAD DRAWING.
3. CONTACT FACTORY FOR BLOWER MODEL LENGTHS NOT SHOWN.

MODEL	L (IN/MM)
DR858AY72W	23.06/585.7
DR858BB72W	23.19/589

		Part/ Model Number				
		DR858BB72W	DR858BB86W	DR858AY72W	CP858FH72WLR	HiE858BB72W
Specification	Units	038740	038742	038738	038749	038743
Motor Enclosure - Shaft Mtl.	-	TEFC-CS	TEFC-CS	TEFC-CS	CHEM TEFC-SS	TEFC-CS
Horsepower	-	10	10	7.5	10	10
Voltage	AC	230/460	575	230/460	230/460	230/460
Phase - Frequency	-	Three-60 hz	Three-60 hz	Three-60 hz	Three-60 hz	Three-60 hz
Insulation Class	-	F	F	F	F	F
NEMA Rated Motor Amps	Amps (A)	26/13	10.5	17.8/8.9	26/13	26/13
Service Factor	-	1.15	1.15	1.15	1.15	1.15
Max. Blower Amps	Amps (A)	28/14	12	28/14	28/14	28/14
Locked Rotor Amps	Amps (A)	162/81	65	120/60	162/81	162/81
NEMA Starter Size	-	2/1	1	1/1	2/1	2/1
Shipping Weight	Lbs	280	280	264	280	280
	Kg	127	127	119.7	127	127
Model (Base Mount)	-	DR858BB72X	DR858BB86X	DR858AY72X		
Part Number (Base Mount)	-	038735	038737	038736		

Voltage - ROTRON motors are designed to handle a broad range of world voltages and power supply variations. Our dual voltage 3 phase motors are factory tested and certified to operate on both: **208-230/415-460 VAC-3 ph-60 Hz** and **190-208/380-415 VAC-3 ph-50 Hz**. Our dual voltage 1 phase motors are factory tested and certified to operate on both: **104-115/208-230 VAC-1 ph-60 Hz** and **100-110/200-220 VAC-1 ph-50 Hz**. All voltages above can handle a ±10% voltage fluctuation. Special wound motors can be ordered for voltages outside our certified range.

Operating Temperatures - Maximum operating temperature: Motor winding temperature (winding rise plus ambient) should not exceed 140°C for Class F rated motors or 120°C for Class B rated motors. Blower outlet air temperature should not exceed 140°C (air temperature rise plus inlet temperature). Performance curve maximum pressure and suction points are based on a 40°C inlet and ambient temperature. Consult factory for inlet or ambient temperatures above 40°C.

Maximum Blower Amps - Corresponds to the performance point at which the motor or blower temperature rise with a 40°C inlet and/or ambient temperature reaches the maximum operating temperature.

This document is for informational purposes only and should not be considered as a binding description of the products or their performance in all applications. The performance data on this page depicts typical performance under controlled laboratory conditions. AMETEK is not responsible for blowers driven beyond factory specified speed, temperature, pressure, flow or without proper alignment. Actual performance will vary depending on the operating environment and application. AMETEK products are not designed for and should not be used in medical life support applications. AMETEK reserves the right to revise its products without notification. The above characteristics represent standard products. For product designed to meet specific applications, contact AMETEK Technical & Industrial Products Sales department.

AMETEK DYNAMIC FLUID SOLUTIONS
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USA: +1 215-256-6601 - Europe: +49 7703 930909 - Asia: +86 21 5763 1258
Customer Service Fax: +1 215.256.1338
www.ametekdfs.com

AMETEK®
PRECISION MOTION CONTROL
DYNAMIC FLUID SOLUTIONS

Industrial / Chemical Processing Blowers

DR 858 & CP 858

ROTRON®

7.5 / 10.0 HP Regenerative Blower

FEATURES

- Manufactured in the USA - ISO 9001 and NAFTA compliant
- CE compliant - Declaration of Conformity on file
- Maximum flow: 380 SCFM
- Maximum pressure: 125 IWG
- Maximum vacuum: 104.8 IWG
- Standard motor: 10 HP, TEFC
- Cast aluminum blower housing, impeller & cover; cast iron flanges (threaded)
- UL & CSA approved motor with permanently sealed ball bearings
- Inlet & outlet internal muffling
- Quiet operation within OSHA standards

MOTOR OPTIONS

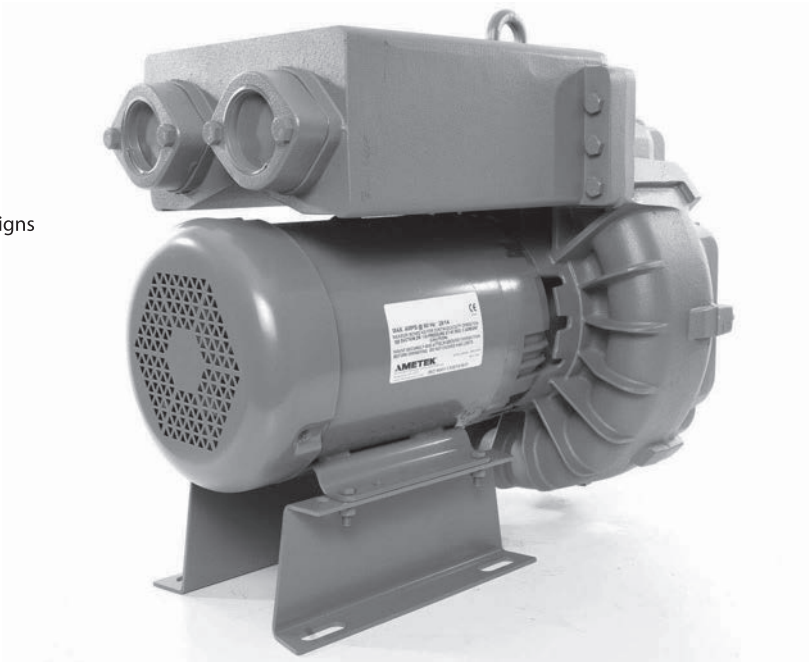
- International voltage & frequency (Hz)
- Chemical duty, high efficiency, inverter duty or industry-specific designs
- Various horsepowers for application-specific needs

BLOWER OPTIONS

- Corrosion resistant surface treatments & sealing options
- Remote drive (motorless) models
- Slip-on or face flanges for application-specific needs

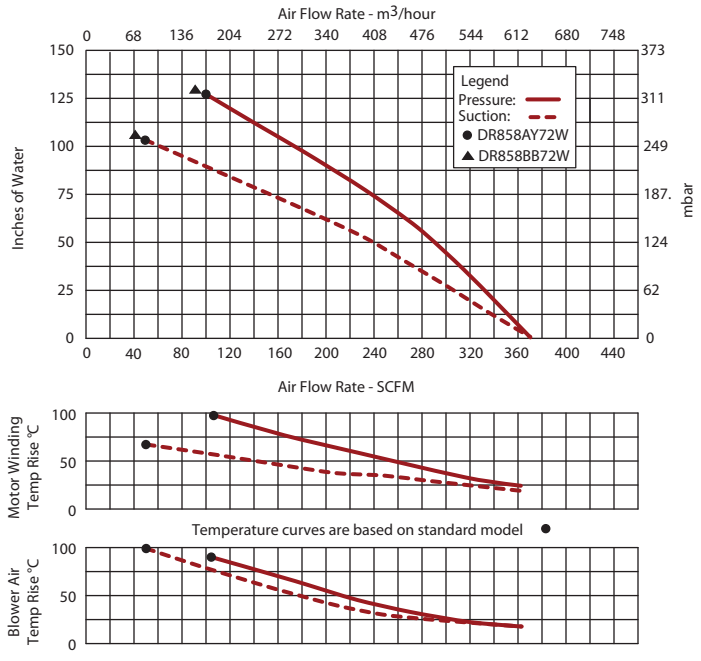
ACCESSORIES

- Flowmeters reading in SCFM
- Filters & moisture separators
- Pressure gauges, vacuum gauges, & relief valves
- Switches - air flow, pressure, vacuum, or temperature
- External mufflers for additional silencing
- Air knives (used on blow-off applications)
- Variable frequency drive package

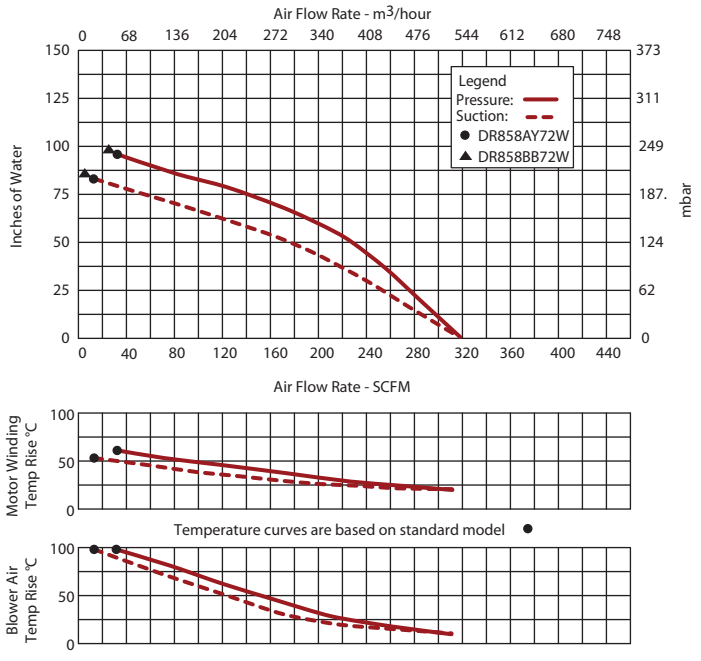


Blower Performance at Standard Conditions

60 Hz



50 Hz



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