ARCH STREET YARD

LONG ISLAND CITY, NEW YORK

Remedial Action Work Plan

NYSDEC Site Number: 241222

TRC Project Number: 343576

Prepared for:

METROPOLITAN TRANSPORTATION AUTHORITY

LONG ISLAND RAIL ROAD

Prepared by:

TRC ENGINEERS, INC.

NEW YORK, NY 10018

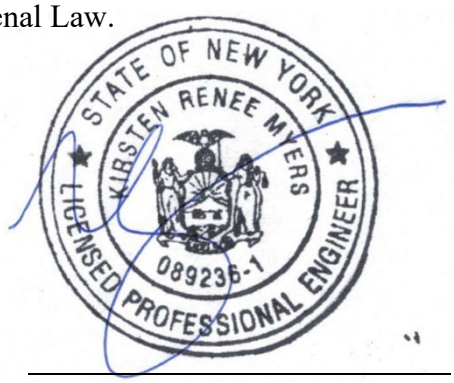
(212) 227-7822

SEPTEMBER 2023

CERTIFICATIONS

I, Kirsten Myers, P.E., 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.



Kirsten Myers, P.E.	9/7/2023	
NYS Professional Engineer No. 089236-1	Date	Signature

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LIST OF ACRONYMS

Acronym	Definition
µg/kg	Microgram per kilogram
µg/L	Microgram per liter
µg/m^3	Microgram per cubic meter
1,2-DCE	Cis-1,2-dichloroethene
AGV	Air Guideline Value
bgs	Below ground surface
CAMP	Community Air Monitoring Plan
COC	Certificate of Completion
COC	Contaminant of concern
COPC	Contaminant of potential concern
CQAP	Construction Quality Assurance Plan
D&B	D&B Engineers and Architects, P.C.
EC/IC	Engineering and Institutional Control
EISB	Enhanced in-situ bioremediation
ESA	East Side Access Department
ESI	Environmental Site Investigation
FER	Final Engineering Report
GPR	Ground penetrating radar
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
ISCR	In-situ chemical reduction
LIRR	Long Island Rail Road
mg/kg	Milligram per kilogram
MNR	Metro North Railroad
MPA	Material processing area
MSA	Material support area
msl	Mean sea level
MTBE	Methyl-tert-butyl ether
ng/L	Nanogram per liter

Acronym	Definition
NYCDOT	New York City Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
OSHA	Occupational Safety and Health Administration
PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
PCE	Tetrachloroethene
PFAS	Per- and polyfluoroalkyl substances
QAPP	Quality Assurance Plan
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RI	Remedial Investigation
SCG	Standard, criteria, and guidance
SCO	Soil Cleanup Objective
SEQRA	State Environmental Quality Review Act
SMP	Site Management Plan
SoMP	Soil Management Plan
SRI	Supplemental Remedial Investigation
SVOC	Semivolatile organic compound
TAL	Target analyte list
TCE	Trichloroethylene
TCL	Target compound list
TOGS	Technical and Operational Guidance Series
UIC	Underground injection control
USEPA	United States Environmental Protection Agency
USGS	Unites States Geologic Survey
VC	Vinyl chloride
VCA	Voluntary Cleanup Agreement
VOC	Volatile organic compound

EXECUTIVE SUMMARY

Site Description/Physical Setting/Site History

The Arch Street Yard (Yard) is located south of Jackson Avenue, under the 21st Street Bridge at 49th Avenue, in Long Island City, Queens, New York. A site location map is provided as **Figure 1**. The Yard is currently owned by MTA Long Island Rail Road (LIRR) and is approximately eight acres in size. The area of the Yard that is subject to the Order on Consent and Administrative Settlement and this Remedial Action Work Plan (RAWP), is an approximate 0.3-acre portion of the Yard designated as New York Department of Environmental Conservation (NYSDEC) Site No. 241222 (herein referred to as "the Site"). The Site was formerly a 2.7-acre area portion of the Yard (herein referred to as "the Former Site". The Site boundary was redefined to the current 0.3-acre portion of the Yard where chlorinated volatile organic compounds (VOC) impact to soil and groundwater have been identified. The defined boundaries of the Site and the Former Site are depicted on the Site Map/Boundary Map, provided as **Figure 2**. The Yard was previously utilized by LIRR to perform maintenance on passenger rail cars, however, these activities ceased in December 2009. Between September 2016 and December 2018, the Maintenance Facility located east of the Site was leased to Metro North Railroad (MNR) and Bombardier to install Positive Train Control in their trains. LIRR currently leases the Maintenance Facility to Kawasaki Rail Car to perform maintenance on rail cars. In addition, the LIRR uses the Yard for storage, and operation of an electric substation located east of the Site, which is not regularly occupied.

As depicted on **Figure 2**, buildings currently located at the Former Site include a Maintenance of Equipment building on the northeast of the Site near the entrance to the Former Site, and an Engineering Support Building east of the Site. The Engineering Support Building is utilized for storage and is not occupied on a regular basis. The Maintenance of Equipment building is leased and utilized by Kawasaki for maintenance of LIRR train cars. A security booth is also located on the northern end of the Yard, which is occupied during regular business hours. In addition, several sets of train tracks traverse the Yard and under the 21st Street Bridge. These tracks are currently active since the Maintenance of Equipment building was leased to Kawasaki for maintenance of LIRR train cars.

In December 2003, a LIRR contractor discovered contaminated soil while excavating a utility trench under the 21st Street Bridge at the Yard. The NYSDEC was notified and NYSDEC Spill No. 0310802 was opened. In April 2004, the LIRR's East Side Access Department (ESA) performed an environmental investigation of the impacted area in an attempt to delineate the extent

of contamination. Based on the results of this investigation, it was determined that the majority of the impacted surface/shallow subsurface soil had been excavated and removed during the utility trenching. Note there are no records available concerning the details of the utility trenching such as the quantities of soil excavated or the limits of excavation. However, additional follow-up investigations were completed in the vicinity of the excavation.

In 2005, ESA installed four groundwater monitoring wells, which were sampled three to four times per year during the time period from 2005 through 2009. In 2009, ESA advanced seven groundwater probes throughout the impacted area, in order to further define the extent of the contamination. Based on the investigation findings, it was determined that further horizontal and vertical delineation of groundwater contamination was required. In September 2011, the LIRR requested to add the 2.7-acre parcel of the Yard (i.e., the Former Site) to an existing Voluntary Cleanup Agreement (VCA) with the LIRR. The NYSDEC approved the addition of the Former Site to the existing VCA Index Nos. W1-0993-04-04 and W2-0994-04-04. Under this VCA, the Former Site as shown on **Figure 2**, was designated as NYSDEC Site No. V00733. As a result of the termination of the Voluntary Cleanup Program, NYSDEC entered into an Order on Consent and Administrative Settlement with LIRR to address the remaining remedial actions for the Former Site and NYSDEC Site No. 241222 was assigned. The Site boundary was redefined to the current 0.3-acre portion of the Yard where chlorinated VOCs impact to soil and groundwater have been identified. A summary of the previously completed investigations is presented in Section 2.2.2.

The most notable investigation with respect to the conditions of the Former Site was a Remedial Investigation (RI) completed by D&B Engineers and Architects, P.C. (D&B) between October 2015 and August 2016. D&B completed the RI field activities in four phases, in accordance with the July 2015 NYSDEC-approved Remedial Investigation Work Plan (RIWP) and subsequent work plan modifications and NYSDEC directives. In addition, TRC completed a Supplemental Remedial Investigation (SRI) in accordance with the NYSDEC-approved SRI Work Plan dated October 15, 2021 to characterize surface soil conditions and document the depth of bluestone ballast cover within the Site.

Summary of the Remedial Investigation

As discussed in the final NYSDEC-approved RI Report written by D&B, a localized source area or “hot-spot” of chlorinated VOCs contamination is present in a discrete area south of the tracks within the Site, at a depth of approximately 8 to 16 feet below ground surface (bgs) immediately above and within the uppermost portion of the clay-rich unit. Based on the results of the RI and previous investigations, this “hot spot” encompasses approximately 680 square feet and is not

migrating. Chlorinated VOCs at concentrations exceeding the NYSDEC Technical and Operational Guidance Series (TOGS) (1.1.1) Class GA Ambient Water Quality Standards and Guidance Values (herein referred to as Class GA Standards) in groundwater are consistent with the discrete residual source area or "hot-spot".

Due to its discrete location under the bridge and the fact that there is no evidence that the LIRR has utilized, disposed or accidentally spilled chlorinated VOCs at the Yard, the chlorinated VOCs may have been dumped onto the Site by an outside party during a "onetime event" or over a limited period of time. In addition, the results of the RI showing the presence of fill material and limited shallow impacts by chlorinated VOCs are consistent with previous reports indicating that the majority of impacted surface/shallow subsurface soil was excavated and removed during utility trenching conducted in 2003.

It should be noted that an investigation conducted in 2000 identified elevated levels of polychlorinated biphenyls (PCBs) at the Former Site; however, the RI results did not confirm the presence of PCB contamination within surface and shallow subsurface soil in the track area to the northwest of the Former Site. Given that the tracks and the approximately one to two feet of bluestone now present in the area were installed following the initial discovery of the elevated PCB concentrations in 2000, it is presumed that the majority of the PCB contaminated soil was removed previously.

During the SRI, metals (copper, lead, and mercury) and indeno(1,2,3-cd)pyrene were detected in surface soil at concentrations exceeding Restricted Residential Use SCOs and/or Protection of Groundwater Use SCOs.

Qualitative Human Health Exposure Assessment

Exposure to contaminants in subsurface soil does not represent a significant potential route of exposure to site workers during routine site operations. However, exposure to contamination in subsurface soil during excavation activities is a potential route of exposure. Given that groundwater chlorinated VOC contamination appears limited to the residual source area and does not appear to have migrated downgradient in groundwater, and that shallow groundwater is not utilized as a potable water source, the use of groundwater is not considered a potential exposure pathway.

Summary of the Remedy

Based on the remedial action objectives (RAOs) defined for the source area, five different potential remedial alternatives were evaluated against the nine remedy selection factors presented in NYSDEC DER-10 Guidance. The five remedial alternatives developed for consideration included the following:

- Alternative 1: No Action
- Alternative 2: In-Situ Chemical Reduction (ISCR) of Soil and Groundwater
- Alternative 3: ISCR and Enhanced In-Situ Bioremediation (EISB) of Soil and Groundwater
- Alternative 4: Limited Soil Excavation and Removal with ISCR and EISB of Groundwater
- Alternative 5: Soil Excavation and Removal

Based on the evaluation of the above-listed remedial alternatives, Alternative 3 is the recommended remedial alternative for the Site. Alternative 3 will consist of:

1. **Remedial Design**

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and

- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. In-Situ Chemical Reduction

In-situ chemical reduction (ISCR) will be implemented to treat chlorinated VOCs in soil and groundwater. Zero valent iron (or similar) will be injected into the subsurface to promote abiotic destruction of contaminants. A Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and a laboratory-scale treatability study of In-Situ Chemical Reduction (ISCR) will be conducted prior to the full implementation of this technology. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared, and USEPA UIC Program permitting would be acquired.

3. Enhanced Bioremediation

In-situ enhanced biodegradation will be employed to treat chlorinated VOCs in soil and groundwater in the area depicted on figure. The biological breakdown of contaminants through anaerobic reductive dechlorination will be enhanced by injection of controlled-release carbon source (e.g., guar, emulsified vegetable oil, etc.) and bioaugmentation cultures (i.e., Dehalococcoides spp.) to promote biological reduction of chlorinated ethenes. A Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and a laboratory-scale treatability study of Enhanced Bioremediation will be conducted prior to the full implementation of this technology. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared.

4. Groundwater Monitoring

Monitoring will be required up-gradient, down-gradient and within the treatment zone. Monitoring will be conducted for chlorinated VOCs and field parameters to determine the effectiveness of the groundwater treatment remedies.

5. Cover System

A site cover currently exists in areas not occupied by buildings and will be maintained to allow for industrial use of the site. Any site redevelopment will maintain the existing site cover. The site cover may include paved surface parking areas, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable soil cleanup objectives (SCOs) for industrial use. Any

fill material brought to the site will meet the requirements for the identified site use as set forth in 6NYCRR part 375-6.7(d).

Exposure to residual contaminated soils and groundwater will be prevented by maintaining the existing blue stone surface cover at the Site. A map showing the aerial distribution of the cover is included in Figure 12.

6. Institutional Control

Imposition of an institutional control in the form of an environmental easement for the controlled property which will:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional controls in accordance with Part 375-1.8 (h)(3);
- allow the use and development of the controlled property for industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOH; and
- require compliance with the Department approved Site Management Plan.

7. Site Management Plan

A Site Management Plan is required, which includes the following:

a. An Institutional Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional controls remain in place and effective:

   – Institutional Controls: The Environmental Easement discussed above.
   – Engineering Control: The Cover System discussed above.

   This plan includes, but may not be limited to:

   - an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
   - a provision for evaluation of the potential for soil vapor intrusion for any occupied buildings on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;

- descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional controls.

b. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- monitoring of groundwater to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department; and
- monitoring for vapor intrusion for any buildings on the site, as may be required by the Institutional and Engineering Control Plan discussed above.

1.0 INTRODUCTION

The MTA Long Island Rail Road (LIRR) amended an existing a Voluntary Cleanup Agreement with the New York State Department of Environmental Conservation (NYSDEC) in September 2011 to include the Former Site. Subsequently, NYSDEC entered into an Order on Consent and Administrative Settlement with LIRR in July 2018. When remediation is completed, the Site will not be redeveloped and will remain an industrial facility.

This Remedial Action Work Plan (RAWP) summarizes the nature and extent of contamination as determined from data gathered during the Remedial Investigation (RI), dated October 2016 and revised May 2017. It provides an evaluation of a Track 1 cleanup and other applicable 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 that this Site does not pose a significant threat to human health and the environment. The RI for this Site did not identify fish and wildlife resources.

The Site is located in an urban area, is not located in close proximity to a surface water body, wetland, or other ecologically significant area. There are no redevelopment plans for the Site that would include inclusion of ecological resources on the Site. Therefore, in accordance with DER-10 Section 3.10.1(b), further evaluation related to the Fish and Wildlife Resources Impact is not warranted.

Per DER-10 Section 3.10, a Fish and Wildlife Resources Impact Analysis (FWRIA) has been performed and can be found in Section 2.5.2. This RAWP includes appropriate measures for delineating and protecting the identified resource and for monitoring construction related impacts consistent with DER-10 FWRIA Part 3. These resources are identified on remedial drawings. The NYSDEC Regional Division of Fish and Wildlife and Marine Resources and the NYS Natural Heritage Program will be contacted, as defined in DER-10, and, at a minimum, all substantive technical requirements for applicable resource related permits (e.g. 6 NYCRR Parts 608, 661, 663) will be met.

1.1 SITE LOCATION AND DESCRIPTION

The Site is located in Long Island City, Queens, New York and is identified as Block 61, Lot 5 and 6, and Block 72, portion of Lot 1, on the New York City Tax Map. A United States Geological Survey (USGS) topographical quadrangle map (**Figure 1**) shows the Site location. The Site (NYSDEC Site No. 241222) is situated within the LIRR's Arch Street Yard (the Yard) and is an approximately 0.3-acre area bounded by Jackson Avenue to the north, 49th Avenue to the south, the former Yard maintenance facility to the east, and 11th Street to the west (see **Figure 2**).

1.2 CONTEMPLATED REDEVELOPMENT PLAN

The Remedial Action to be performed under the RAWP is intended to make the Site protective of human health and the environment consistent with the contemplated end use. Currently, the LIRR does not have any plans to redevelop or change the industrial nature of the Yard. As a result, the Yard will remain an industrial property for the foreseeable future and all future excavations, if any, will be completed under proper health and safety protocols and as per the requirements of the LIRR's EPC-03-001 document entitled Excavating Soils at Railroad Locations, dated August 11, 2003 and revised March 2015. The Site is approximately 10 to 15 feet lower than the surrounding streets, and access is restricted by a retaining wall on the southern side, and a chain link fence with a locked gate on the remaining sides. Access to the remainder of the Yard is restricted by a fence, and an electric gate which requires valid identification to open. A security guard is stationed at the gate during business hours.

The LIRR does not have any plans to construct any structures in the "hot-spot" source area. Therefore, on-site environmental conditions will not change and the potential for on-site receptors to be exposed to on-site contamination will remain very low.

It should be noted that in 2017, the City of New York released the Sunnyside Yard Feasibility Study, which determined that it is technically feasible to create new land in the form of a deck over the yard while continuing rail operations below[1]. A master planning process to develop a vision for the long-term future of the yard is in preparation. These future redevelopment activities, if and when they occur, would be controlled by the Environmental Easement and Site Management Plan (SMP) that will be implemented at the completion of this RAWP.

[1] https://www.sunnysideyard.nyc/why-plan-now

1.3 DESCRIPTION OF SURROUNDING PROPERTY

The Yard is zoned for industrial use and the surrounding properties use is a combination of commercial, light industrial, professional office space, residential, and utility right of ways. The neighborhood includes warehouses, automotive repair shops, taxi garages, apartment buildings, and gasoline stations in the vicinity of the Yard. In addition, below grade subway tunnels (G line) run beneath Jackson Avenue immediately north of the Yard and beneath 49th Avenue immediately south of the Yard for the G and 7 line, respectively.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

The Former Site and Site were investigated in accordance with the scope of work presented in the NYSDEC-approved RI Work Plan dated July 2015 and subsequent RI work plan modifications. A supplemental remedial investigation (SRI) was conducted in December 2021 in accordance with the NYSDEC-approved SRI Work Plan dated October 2021.

2.1 Summary Remedial Investigations Performed

The RI field activities were completed at the Former Site in four (4) phases between October 2015 and December 2018, as detailed below. The original scope (i.e., first and second phases) was completed between October 2015 and August 2016. At the request of the NYSDEC, heating season air samples were collected in February 2017, and additional groundwater samples were collected and analyzed for emerging contaminants in October 2018. The RI Report was submitted to NYSDEC in October 2016, revised May 2017, and approved by NYSDEC on May 17, 2017. Results of the analysis of groundwater samples for emerging contaminants were provided to NYSDEC on December 5, 2018. The SRI field activities were completed in a single fifth phase in December 2021. The purpose of the SRI was to evaluate Site surface soil to determine if a soil cover or cap would be required as part of the remedy. The following activities were performed:

Phasing Schedule of Completed Remedial Investigation

Remedial Investigation Phase	Work Performed	Date(s) Completed	Date of Letter Report/Work Plan Modification to NYSDEC
First Phase	Membrane Interface Probe (MIP) Study	October 2015	December 2, 2015
Second Phase	Deep Soil Boring Installation and Subsurface Soil Sampling	March 2016	August 5, 2016
	Monitoring Well Installation, Development and Sampling	April 2016	
	Shallow PCB Soil Boring Installation and Subsurface Soil Sampling	March 2016	
Second Phase	Tidal Investigation and Collection of Synoptic Water Levels	May 2016	August 5, 2016
Third Phase	Soil Vapor Sampling/Indoor Air Sampling	August 2016 and February 2017	--
Fourth Phase	Groundwater Sampling for Emerging Contaminants	October 2018	December 5, 2018
Fifth Phase	Surface Soil Sampling and Assessment of Bluestone Ballast Thickness	December 2021	October 15, 2021

2.1.1 Samples Collected/Chemical Analytical Work Performed

A table summarizing all samples collected and all analytical work performed is presented as **Table 1**.

2.1.2 Chemical Analytical Work Performed

2.1.2.1 Subsurface Soil

A membrane interface probe (MIP) study was completed as the first phase of the RI in order to define the current limits of volatile organic compound (VOC) contamination in the Former Site and help optimize the selection of soil boring and permanent groundwater monitoring well locations discussed below. The MIP study consisted of the installation of 11 MIP locations (MIP-1 through MIP-11). Two Geoprobe verification borings (VB-01 and VB-02) were completed at MIP locations MIP-2 and MIP-6, respectively, and subsurface soil samples were collected to verify the MIP results. **Figure 3** depicts the location of the completed MIP and verification boring sample locations, as well as other samples collected as part of the RI. MIP logs are presented as **Appendix A**. Soil boring logs are presented as **Appendix B**.

Elevated photoionization detector (PID) readings and a hydrocarbon-like odor from approximately 12 to 13 feet bgs in verification boring VB-01, which was consistent with the findings of the MIP investigation. In addition, subsurface soil sample VB-01 (13 to 15 feet) exhibited a tetrachloroethene (PCE) concentration of 1,160,900 micrograms per kilogram (µg/kg), above the Industrial Use Soil Cleanup Objective (SCO) of 300,000 µg/kg and the Protection of Groundwater SCO of 1,300 µg/kg. The analytical results from verification boring VB-02 were consistent with the MIP findings, with significantly lower chlorinated VOC concentrations (all below SCOs) compared with verification boring VB-01.

The soil investigation completed as part of the RI included the installation and sampling of eight deep soil borings (SB-01 through SB-08) to depths ranging from 25 feet to 29 feet bgs in order to define the limits of VOC contamination identified by the MIP study, specifically at the location of MIP-2. Soil samples collected from soil borings SB-05 and SB-06 exhibited several VOCs at concentrations exceeding the Protection of Groundwater SCOs (cis-1,2-dichloroethene, PCE, trichloroethylene [TCE] and vinyl chloride [VC] in SB-05 and cis-1,2-dichloroethene and VC in SB-06); however, detections of VOCs above Restricted-Residential SCOs were limited to soil boring SB-05 (PCE, TCE and VC). The only sample that exhibited VOCs at concentrations exceeding the Industrial Use SCO was collected from verification VB-01 (13 to 15 feet bgs), with PCE detected at 1,160,900 µg/kg, exceeding the Industrial Use SCO of 300,000 µg/kg. SB-05 was completed in the area where VOC contamination was documented during previous investigations. Semivolatile organic compounds (SVOCs) were not detected at concentrations exceeding the Restricted-Residential SCOs in the collected soil samples with the exception of several polycyclic

aromatic hydrocarbons (PAHs) in SB-04 (3 to 5 feet) and one PAH (indeno(1,2,3-cd)pyrene) in GW-04 (2 to 3 feet). However, all SVOC concentrations were below Industrial Use SCOs, with the exception of benzo(a)pyrene in SB-04 (3 to 5 feet) at 2,900 µg/kg, above the SCO of 1,100 µg/kg. Polychlorinated biphenyls (PCBs) and pesticides were not detected in any of the collected subsurface soil. In addition, metals were detected at concentrations below Restricted-Residential Use SCOs, except for lead detected at a concentration of 483 milligram per kilogram (mg/kg) in subsurface soil sample SB-06 (8 to 10 feet) above the Restricted-Residential Use SCO of 400 mg/kg, and mercury detected at 0.949 mg/kg in SB-07 (12 to 14 feet) above the Restricted-Residential Use SCO of 0.81 mg/kg. All metals concentrations were below Industrial Use SCOs. The completed soil boring locations as well as a summary of contaminants detected above their respective SCOs is provided on **Figure 8**.

In addition, a total of nine shallow soil borings (SB-09 through SB-17) were completed to depths ranging from 6 feet to 8 feet bgs as part of a PCB field investigation during the RI, in order to confirm and define the limits of the PCB contamination previously identified at the Yard in 2000, discussed in Section 2.3.2.1. The area of previously-identified PCB-impacted soil is shown on **Figures 2 and 4** and is located adjacent to the northwest of, but does not overlap with, the area of CVOC impacts to soil and groundwater subject to this RAWP. PCBs were detected in 5 of the 30 subsurface soil samples collected from the shallow PCB borings, but at concentrations below Restricted-Residential Use SCOs. The RI concluded that PCB-impacted soil had likely been removed from the Yard during the installation of new tracks. Table 2-1 of the RI Report indicates that the depth of bluestone was between 0.25 and 2 feet at soil borings SB-09 through SB-17. Considering that 1) concentrations of PCBs detected in all soil samples collected during the RI were below Restricted-Residential Use SCOs, 2) it was determined that previously-identified PCB-impacted soil had been removed from the Yard during construction of new tracks, 3) the ground surface in the vicinity of previously-identified PCB-impacted soils is covered with bluestone, and 4) previously-identified PCB-impacted soils were not co-located with CVOC-impacted soil and groundwater, the RI Report concluded that further investigation or remediation of previously-impacted PCB impacts to soil were not necessary.

A summary of Former Site investigations conducted between 2000 and 2009 and prior to Remedial Investigations discussed in this section can be found in Section 2.3.2.

2.1.2.2 Groundwater

The groundwater investigation completed as part of the RI consisted of the installation and sampling of two shallow groundwater monitoring wells (GW-02S and GW-04S) and four deep groundwater monitoring wells (GW-01, GW-02D, GW-03 and GW-04D), as well as the collection of groundwater samples from three remaining existing groundwater monitoring wells (MW-1, MW-2 and MW-3). The locations of these groundwater monitoring wells as well as a summary of where Class GA Values were exceeded is provided on **Figure 9**. Groundwater monitoring well construction logs are presented as **Appendix C**. Based on the results of the MIP study, deep groundwater monitoring wells were screened below the water table interface at certain intervals in order to intercept the highest concentrations of chlorinated VOCs observed during the MIP study at MIP-2/VB-01. VOCs were detected in all 9 groundwater samples. However, VOC concentrations were generally detected below Class GA Values. Detections of VOCs above Class GA Values in the groundwater monitoring wells were limited to 1,1-dichlorothene, cis-1,2-dichlorothene, trans-1,2-dichloroethene, PCE, TCE, VC, and methyl-tert-butyl ether (MTBE). SVOCs were either not detected or were detected below Class GA Values. PCBs and pesticides were not detected in any groundwater sample. Several metals were detected at concentrations exceeding Class GA Values in the total (unfiltered) groundwater samples, including iron in GW-02D and MW-3, manganese in GW-02D, and sodium in GW 02D and MW-3. However, these metals are typically present in urban settings. Note that monitoring wells GW-02S, GW-02D, and MW-3, which exhibited chlorinated VOC concentrations above Class GA Values, are located in an area where VOC contamination was documented during previous investigations, and where chlorinated VOCs were detected during the MIP study and soil boring program as part of the RI. Neither the upgradient well GW-01 nor any of the downgradient wells exhibited chlorinated VOCs above Class GA Values.

Groundwater samples collected from verification boring location VB-01 (15 to 16 feet bgs) and (26 to 27 feet bgs) exhibited PCE, TCE, 1,2-DCE and VC at concentrations well above Class GA Values. The highest concentrations of VOCs were detected in groundwater sample VB-01 (15 to 16 feet bgs), with PCE exhibiting the maximum individual concentration of 17,600 micrograms per liter (µg/L), above the Class GA Value of 5 µg/L

2.1.2.3 Soil Vapor

A soil vapor sampling/indoor air sampling investigation was completed in August 2016 as a component of the RI and additional sampling was conducted during the heating season in February

2017. The soil vapor sampling/indoor air sampling consisted of the installation of five temporary soil vapor probes (SV-01 through SV-05), one sub-slab soil vapor sample (SV-06), one indoor air sample (IA-01), and one outdoor ambient air sample (AA-01) to determine if soil vapor intrusion is a potential exposure pathway. The location of the soil vapor samples is provided on **Figure 3**. Chlorinated VOCs were detected in all 5 soil vapor probes, with PCE and TCE detected above their respective Air Guideline Values (AGVs) at all locations except SV-03. The highest PCE and TCE concentrations of 881 micrograms per cubic meter (µg/m^3) and 859 µg/m^3, respectively, were detected at soil vapor probe SV-02, located in the area where VOC contamination was documented during previous investigations, and where chlorinated VOCs were detected in soil and groundwater during the RI. The second highest VOC concentrations were detected at soil vapor probe SV-01, located approximately 50 feet to the west and downgradient of the SV-02 location with respect to groundwater flow direction. Soil vapor probe SV-03 exhibited the lowest VOC concentrations, with only TCE detected marginally above the AGV. SV-03 is located to the east and upgradient of SV-02, between SV-02 and the closest structure (the LIRR Engineering Support Building).

The sub-slab soil vapor sample (SV-06) collected from the LIRR Engineering Support Building in August 2016 exhibited VOCs at concentrations below the AGVs, except for TCE detected at a concentration of 5 µg/m^3. During the February 2017 resample, no VOCs were detected above AGVs in SV-06, including TCE.

For the August 2016 results, the outdoor ambient air sample exhibited VOC concentrations that were comparable or above the indoor air sample concentrations, and all concentrations were below AGVs. In addition, a comparison of the results for the sub-slab soil vapor sample and the indoor air sample from August 2016 using the New York State Department of Health (NYSDOH) decision matrices suggest that sub-slab soil vapor is not expected to significantly affect indoor air quality, and no further action is needed to address human exposures. Similar results were found for the February 2017 heating season data, with all concentrations below AGVs. Note that the indoor air sample was collected in the office area of the Engineering Support Building, in the same vicinity of the sub-slab sample.

2.1.2.4 Surface Soil

A surface soil investigation was completed as part of the SRI in December 2021. The surface soil investigation consisted of the installation of 15 soil borings (TRC-SB-01 through TRC-SB-15) to approximately 2 feet below bottom of encountered bluestone ballast. Surface soil samples were collected for laboratory analysis of VOCs, SVOCs, PCBs, herbicides, pesticides, metals, and

PFAS. **Figure 10** depicts the location of surface soil samples as well as where SCOs were exceeded in the samples.

The SVOC indeno(1,2,3-cd)pyrene was detected at a concentration exceeding Restricted Residential and Protection of Groundwater SCOs in TRC-SB-15. Metals including copper, lead, and mercury were detected at concentrations Restricted Residential and/or Protection of Groundwater SCOs in soil collected from four borings (TRC-SB-09, TRC-SB-13, and TRC-SB-14). No VOCs, PCBs, herbicides, pesticides, or PFAS were detected in the surface soil samples at concentrations exceeding the applicable SCOs. Following the SRI, the horizontal coordinates and ground surface elevation of each surface soil boring location were surveyed by Muñoz Engineering and Land Surveying P.C. (MEPC), a New York State-licensed Land Surveyor, on January 6, 2022.

2.1.3 Geophysical Survey

Prior to undertaking any intrusive activities, a geophysical survey was performed on October 6, 2015 by AGS in an attempt to verify and mark the location of any underground utilities present in the vicinity of drilling locations. As part of this task, AGS utilized terrain conductivity and electromagnetic methods, along with ground penetrating radar (GPR). AGS marked the approximate limits of underground utilities that were able to be identified. Due to the interference of the steel tracks, not all areas were able to be cleared of potential underground utilities. LIRR also marked out all known or suspected underground utilities within their property.

2.1.4 Summary of Remedial Investigation Findings

Below is a summary of RI and SRI findings.

Surface and Subsurface Soil

The Site is covered in bluestone ballast with a measured thickness ranging from 2 to 14 inches bgs. The Site is underlain by a layer of fill with a minimum thickness of 5 feet observed as silty sand and silty sand with gravel. Varying amounts of anthropogenic material were observed in the fill, such as bluestone, concrete and brick, as well as coal, slag, ash, and cinders. A native clay-rich unit was encountered below the fill layer starting at a depth of 10 to 15 feet bgs. During the MIP study completed during the RI, chlorinated VOCs were only detected at location MIP-2, which was completed in the center of the current Site boundary, south of the tracks in the area where chlorinated VOC contamination was identified during previous construction activities and

investigations. The VOC detections at MIP-2 started at a depth of 10 feet below grade and the highest concentrations were found at approximately 12 to 16 feet bgs. The groundwater surface was observed at a depth of approximately 3 to 5 feet bgs. Although generally limited visual evidence of contamination was observed during the soil boring program, elevated PID readings, slight staining and odors were detected in verification boring VB-01 and soil boring SB-05 completed in the vicinity of MIP-2 at a depth of 10 to 13 feet bgs, immediately above the clay-rich unit.

As part of the RI, a total of 2 MIP verification borings, 8 soil borings, and 3 monitoring well soil borings were completed to define the limits of the chlorinated VOC contamination. Four of the 29 subsurface soil samples selected for chemical analysis showed concentrations of chlorinated VOCs exceeding Protection of Groundwater, Restricted- Residential and/or Industrial Use SCOs at depths exceeding 8 feet bgs in the center of the current Site boundary, south of the tracks, including PCE, TCE, 1,2-DCE and VC. The 4 samples were collected from verification boring VB-01 and soil borings SB-05 and SB-06. However, concentrations of chlorinated VOCs Industrial Use SCOs was restricted to PCE at VB-01.

Lead and mercury were also detected slightly above Restricted-Residential Use SCOs in one sample each in this area at similar depths to the chlorinated VOCs. Several PAHs were detected at concentrations above their respective Restricted-Residential Use SCOs at shallower depths of 2 to 5 feet bgs. Benzo(a)pyrene also exceeded its Industrial Use SCO in subsurface soil sample SB-04 (3 to 5 feet bgs).

In addition to the chlorinated VOC investigation, a total of 9 soil borings were completed to confirm and define the limits of the previously identified surface and shallow subsurface soil PCB contamination in the track area. All PCB concentrations were either not detected or were detected below Restricted-Residential SCOs.

As part of the SRI, a total of 15 surface soil samples were collected at the Site. Metals (copper, lead, and mercury) and one SVOC (indeno[1,2,3-cd]pyrene) were detected in surface soil at concentrations above the Restricted-Residential Use SCOs and/or Protection of Groundwater SCOs. One of the 15 surface soil samples had SVOCs above Restricted-Residential Use and Protection of Groundwater SCOs. No exceedances of SCOs by VOCs, PCBs, Herbicides, or Pesticides were detected, and no Industrial Use SCOs were exceeded in any of the samples. PFAS were not detected at concentrations greater than the proposed Protection of Groundwater WSCOs, Restricted Residential SCOs, or Industrial Use SCOs.

Groundwater

Clay and silt with peat and organic material was observed throughout the Former Site and Site starting at a depth of approximately 10 to 15 feet below grade. Deep wells screened within or below this material, such as GW-02D, GW-03 and GW-04D, exhibited apparent confined groundwater conditions with the water level depressed approximately 4 to 5 feet as compared with unconfined, water table conditions. Groundwater flow was determined to be in a west-northwesterly direction for both the shallow and deep groundwater zones. There was no evidence of tidal influence on groundwater elevation or flow direction on-site.

Three of the 9 groundwater samples (GW-02S, GW-02D, and MW-3) collected and analyzed during the RI exhibited chlorinated VOCs at concentrations exceeding Class GA Values. These three groundwater monitoring wells are located in the area where chlorinated VOC contamination was identified during previous investigations and during RI activities, including the MIP study, and soil boring program. The highest concentrations were detected at deep monitoring well GW-02D, screened from 10 to 20 feet bgs, where PCE, TCE, 1,2-DCE, 1,1-dichloroethene, trans-1,2- dichloroethane, and VC were detected above Class GA Values. Groundwater samples from verification boring VB-01 also exhibited chlorinated VOCs at concentrations well above Class GA Values. However, neither the upgradient well GW-01 nor any of the downgradient wells exhibited chlorinated VOCs above Class GA Values. Note that MTBE was also detected above Class GA Value in existing groundwater monitoring well MW-1. Non-aqueous phase liquid (NAPL) was not identified in any of the groundwater monitoring wells.

SVOCs were either not detected or were detected below Class GA Values in the groundwater samples selected for analysis. Pesticides and PCBs were not detected in any of the groundwater samples. Total metals exceeding Class GA Values included iron, manganese, and sodium. These metals are typically detected at elevated concentrations in urban settings and are assumed to be naturally occurring.

Air

Soil vapor sampling results suggest that the chlorinated VOCs detected in soil and groundwater at the Site have volatilized into the soil gas at concentrations above AGVs, including PCE and TCE. However, soil vapor concentrations were lowest to the east and upgradient of the residual source area, in the direction of the closest structure (the LIRR Engineering Support Building) to the Site. Indoor air sampling completed within the LIRR Engineering Support Building exhibited VOC concentrations below AGVs and were similar to outdoor concentrations.

Emerging Contaminants

Three groundwater monitoring wells (MW-1, MW-2, and MW-3) were sampled for emerging contaminants as directed by NYSDEC in November 2018. The groundwater samples did not contain detectable levels of 1,4-dioxane. Per- and polyfluoroalkyl substances (PFAS) compounds were detected in all 3 groundwater samples. A combined concentration of perfluorooctanoic acid (PFOA) and perfluorooctanesulfonic acid (PFOS) of 260 nanograms per liter (ng/L) was detected in the groundwater sample collected from monitoring well MW-2, which is above the EPA-issued drinking water health advisory level of 70 ng/L. Well MW-2 is not located within the chlorinated VOC "hot-spot" area. The combined PFOA and PFOS concentrations detected in groundwater samples collected from monitoring wells MW-1 and MW-3 were below the advisory level. Note that groundwater monitoring well MW-3 is located within the chlorinated VOC "hot-spot" area. The groundwater in this portion of Queens is not used as a source of drinking water.

Fifteen (15) surface soil samples were analyzed for PFAS. PFAS were not detected at concentrations greater than the proposed Restricted Residential Use, Industrial Use, and/or Protection of Groundwater Use SCOs.

2.1.5 Identification of Contaminants of Concern

Based on the findings of remedial investigations conducted on the Site, the following chlorinated VOCs have been identified as Contaminants of Concern (COCs):

- 1,1-Dichloroethene
- Cis-1,2-DCE
- PCE
- TCE
- Trans-1,2-dichloroethene
- VC

2.2 Significant Threat

NYSDEC and NYSDOH have determined that the Site does not pose a significant threat to human health and the environment.

2.3 SITE HISTORY

2.3.1 Past Uses and Ownership

The Yard has been utilized as railroad maintenance and track yard since its acquirement by LIRR in 1966.

2.3.2 Previous Investigations

The following environmental investigations were completed:

- Initial Environmental Site Investigation – 2000
- Supplemental Environmental Site Investigation – 2001
- Groundwater Monitoring – 2005-2009
- Spill Investigation – 2009

A brief summary of the relevant findings of the available historical reports is provided below. Historical soil data is compared to the SCOs for Restricted-Residential and Industrial Use as defined in NYSDEC 6 NYCRR Part 375. Historical groundwater data is compared to Class GA Values.

2.3.2.1 Soil

As part of the overall east side access construction project, an initial Environmental Site Investigation (ESI) was completed in October 2000 within the defined Former Site that detected elevated levels of PCBs and pesticides in soil. Subsequently, a Supplemental ESI included the collection of 26 soil samples from 13 soil borings (SE-AR-101 through SE-AR-113) for analysis of PCBs and pesticides to delineate the extent of the contamination and to provide an estimate of the volume of contaminated soil that would need to be removed for off-site disposal. **Figure 4** depicts the approximate locations of the borings, as well as detected PCB concentrations during the ESI. Soil samples were collected for analysis at a depth of 0 to 0.5 feet bgs and at 2.5 to 3.0 feet bgs at the 13 soil borings. In addition, one (1) soil sample was collected from soil boring SE-AR-113 at 5.5 to 6.0 feet bgs.

PCBs were detected in 21 of the 26 soil samples collected during the Supplemental ESI, ranging from 28.6 µg/kg to a maximum of 547 µg/kg at SE-AR-113 (2.5 to 3 feet) which is below the

Restricted-Residential Use SCO of 1,000 µg/kg. Soil boring SE-AR-113 was completed in the location of soil boring SE-AR-04, where the maximum PCB concentration of 320,000 µg/kg was detected during the initial ESI at a depth of 0 to 0.5 feet bgs. Pesticides were detected in 24 of the 26 soil samples collected as part of the supplemental ESI. All concentrations of pesticides were below Restricted-Residential Use SCOs.

In February 2009, subsurface soil samples were collected at seven boring locations (P-1 to P-7) to the southeast of the area investigated during the ESI as part of a separate spill investigation. The approximate locations of these borings and a summary of the results are provided on **Figure 5**. The highest concentrations of chlorinated VOCs in subsurface soil were detected at boring P-2 and lower concentrations detected at borings P-3, P-4, and P-7. PCE and VC were detected at concentrations of 89 mg/kg and 1.6 mg/kg, respectively. Both concentrations were above the respective Restricted-Residential Use SCOs of 19 mg/kg and 0.9 mg/kg, but below the Industrial Use SCOs. No other VOCs were detected at concentrations above Restricted-Residential or Industrial Use SCOs.

PAHs were detected at concentrations exceeding Restricted-Residential Use SCOs in subsurface soil samples collected from borings P-2, P-3, and P-4. In addition, benzo(a)pyrene was detected at concentrations of 1.5 mg/kg and 2.1 mg/kg in the soil samples collected from borings P-2 and P-3, respectively, above the Industrial Use SCO of 1.1 mg/kg.

2.3.2.2 Groundwater

Four groundwater monitoring wells (MW-1 through MW-4) were installed in 2005 to the southeast of the area investigated during the ESI as part of a separate spill investigation. Based on the review of the available data, there were 15 sampling events conducted during the time period from March 24, 2005 through April 17, 2009. The approximate locations of the wells are shown on **Figure 5**. PCE, TCE, cis-1,2-dichloroethene (1,2-DCE), trans-1,2-dichloroethene, and VC were consistently detected at levels exceeding Class GA Values in samples collected from MW-3. Groundwater samples collected from MW-2 also detected the same VOCs exceeding Class GA Values, but at lower concentrations. The greatest concentrations in µg/L of chlorinated VOCs at MW-2 and MW-3 are tabulated below.

Greatest Values of VOCs at MW-2 and MW-3 Detected Between March 2005 and April 2009

Monitoring Well ID	PCE (µg/L)	TCE (µg/L)	1,2-DCE (µg/L)	trans-1,2-dichloroethene (µg/L)	VC (µg/L)
Class GA Value (µg/L)	5	5	5	5	2
MW-2	16	20	28	5.6	14
MW-3	5,200	1,500	17,000	230	4,200

The results of the analysis of groundwater samples collected from MW-1 and MW-4 detected elevated levels of PAHs and MTBE.

In February 2009, groundwater samples were also collected at seven boring locations with temporary groundwater wells (P-1 to P-7) as part of the spill investigation in the same area as the groundwater monitoring wells. The approximate locations of these borings and temporary groundwater wells and a summary of the results are included on **Figure 5**. The highest concentrations of chlorinated VOCs in groundwater were detected at boring P-2 which is located to the east of MW-3. Concentrations of chlorinated VOCs detected in P-2 exceeding Class GA Values included: PCE at 14,000 µg/L; TCE at 1,600 µg/L, 1,2-DCE at 6,000 µg/L; and VC at 1,100 µg/L. These VOCs were also detected at lower concentrations at borings P-3, P-4, P-6, and P-7. Other exceedances of Class GA Values included MTBE at borings P-1 and P-6, and benzene, cyclohexane, and xylenes at boring P-1.

2.4 GEOLOGICAL CONDITIONS

2.4.1 GEOLOGY

As is typical for most highly industrialized areas such as Queens, New York, the Yard property was likely filled and reworked to allow for development. Based on boring logs and consistent with previous investigations, a layer of urban fill material was observed immediately below the ground surface with a minimum thickness of 5 feet. The fill material is generally described as a dark

brown to gray and black, sand and gravel mix with some silt. Varying amounts of anthropogenic material were observed in the fill, such as bluestone, concrete and brick, as well as coal, slag, ash, and cinders. The groundwater surface was observed within this fill material at a depth of approximately 3 to 5 feet bgs.

Based on the absence of anthropogenic materials, native glacial deposits may be present beneath the fill material in some locations that is similar to texture but generally finer and lighter in color. However, at all locations the top of a native clay-rich unit was observed at depths ranging from 10 to 15 feet bgs. The clay-rich unit consists of gray, plastic clay, with some zones of silt or silty sand, and often mixed with significant amounts of organic peat material. It is possible that this clay-rich unit marks the location of a historic wetland area which may have existed prior to filling activities. The clay-rich unit continues to approximately 20 feet bgs, with a thickness ranging from 5 to 10 feet.

The clay-rich unit transitions into a coarser sandy material at depths greater than 20 feet bgs, with refusal generally being encountered at a depth between 25 and 30 feet bgs during the installation of several soil borings during the RI. Based on USGS data for this area of Queens, it is suspected that the refusal is due to encountering the top of bedrock. Bedrock in this area of Queens likely consists of gneiss of the Ravenswood Formation or schist of the Hartland Formation. Material consistent with weathered bedrock was encountered before refusal, including rock fragments. In the track area where the PCB investigation was conducted, refusal was encountered at shallower depths ranging from 15 to 20 feet bgs.

2.4.2 HYDROGEOLOGY

As discussed in the October 2016 and Revised May 2017 RI Report, D&B collected two rounds of synoptic groundwater surface level measurements at the approximate time of low, mid, and high tides in the nearest water bodies (East River and Newtown Creek). The groundwater surface was observed at a depth of 3 to 5 feet bgs, at an elevation ranging from 4.50 feet above mean sea level (amsl) at the easternmost monitoring well GW-01 to 3.65 feet amsl at the westernmost monitoring well GW-04S. As discussed above, clay and silt with peat and organic material were observed throughout the Former Site and Site starting at a depth of approximately 10 to 15 feet bgs. Deep wells screened within or below this material (GW-02D, GW-03 and GW-04D), exhibited apparent confined groundwater conditions with the groundwater surface level measurements depressed approximately 4 to 5 feet as compared with unconfined or shallow groundwater table conditions.

A shallow (water table) groundwater surface elevation contour map is provided as **Figure 6**, and a deep groundwater surface elevation contour map is provided as **Figure 7**. As indicated in **Figure 6**, shallow groundwater generally flows in a west-northwesterly direction, consistent with the reported regional groundwater flow direction towards the East River. The groundwater surface elevation contour map for the deep wells provided on **Figure 7** shows that groundwater generally flows in a westerly direction in this zone, similar to the shallow groundwater.

The synoptic groundwater surface elevation data showed no discernable tidal fluctuation, and the data suggests that groundwater flow remains in a general west-northwesterly direction during all stages of the tidal cycle, which are supported by the findings of the tidal survey completed during the RI. The tidal study results do not show a tidal fluctuation in groundwater at the Yard.

2.5 CONTAMINATION CONDITIONS

2.5.1 CONCEPTUAL MODEL OF SITE CONTAMINATION

Based on the Former Site and Site history, it appears that chlorinated VOCs were spilled in a limited area on-Site under the 21st Street Bridge sometime prior to December 2003 when a LIRR contractor discovered contaminated soil while excavating a utility trench. Due to its discrete location under the bridge and the fact that there is no evidence that the LIRR has utilized, disposed or accidentally spilled chlorinated VOCs at the Yard, it is possible that the chlorinated VOCs were dumped onto the Site by an outside party during a "one-time event" or over a limited period of time. Follow-up investigations found chlorinated VOC contamination in soil, soil vapor, and groundwater, but not in indoor air sampling completed within the LIRR Engineering Support Building. The remedial investigations determined that the majority of impacted surface/shallow subsurface soil had been excavated and removed during utility trenching. However, records of the limits of excavation and soil quantities that were removed during the trenching are not available.

The results of the RI described in this report indicate that the chlorinated VOC contamination is present in a limited area of the Former Site south of the tracks, with the majority of the soil contamination at depths greater than 8 feet bgs. This distribution would be expected if the majority of surface and shallow contamination had previously been removed, leaving only deeper residual contamination. Based on previous investigations and the results of the RI, the approximate remaining residual contamination source area or "hot-spot" is depicted on **Figure 3**.

The deep contamination does not appear to have migrated downgradient to the west with the direction of groundwater flow, possibly due in part to the fine grained nature and high organic content of the soil matrix below a depth of 10 feet bgs. It is likely that the clay-rich unit present throughout the Site helps limit the overall migration of contaminants. Unless actively remediated, the residual contamination will naturally degrade over time with continued localized impacts to soil, groundwater, and soil gas.

Historical data also indicates that surface soil and shallow subsurface soil PCB contamination was previously observed within the track area to the northwest of the chlorinated VOC contamination area. However, the RI sampling program did not detect any PCB concentrations above Restricted-Residential Use SCOs. Given that the tracks were installed following the initial discovery of elevated PCBs in 2000, and the current presence of up to two feet of bluestone in the track area, it is likely that the shallow PCB contaminated soil was excavated during construction activities, similar to the shallow chlorinated VOC contamination.

2.5.2 DESCRIPTION OF AREAS OF CONCERN

As depicted in **Figure 2**, buildings currently located adjacent to the Former Site include a Maintenance of Equipment building on the northern end of the Former Site near the entrance to the Yard, and a Maintenance of Equipment building east of the Former Site near the entrance to the Yard, and an Engineering Support Building on the southern end of the Former Site. The Engineering Support building is utilized for storage and is not occupied on a regular basis. The Maintenance of Equipment building is currently leased and utilized by Kawasaki for maintenance of LIRR train cars. A security booth is also located northeast of the Site, which is occupied during regular business hours. In addition, several sets of train tracks traverse the Former Site and under the 21st Street Bridge. These tracks are currently active and have been since the Maintenance of Equipment building was leased to Kawasaki for maintenance of LIRR train cars.

East of the Former Site and Engineering Support Building are a series of buildings located within the Yard including (from west to east): an open storage shed, a New York City Transit (NYCT) Signals Tower, an electric substation owned by LIRR and Con Edison, and a LIRR electric substation. Second floor office space within the Signals Tower is regularly occupied by NYCT employees during business hours. The remaining buildings are not regularly occupied. Note that a portion of the Yard adjacent to the southern side of the Maintenance Facility building was previously leased to the "Fresh Direct" trucking company from August 2012 through August 2015, which had occasionally washed the cargo areas of their trucks with washing fluid/disinfectant.

When the issue was brought to the LIRR's attention by NYSDEC personnel, LIRR alerted MTA Real Estate to advise Fresh Direct to cease and desist with washing their trucks with a disinfectant over storm drains in the parking lot.

2.5.3 IDENTIFICATION OF STANDARDS, CRITERIA AND GUIDANCE

A criterion for remedy selection is evaluated for conformance with standards, criteria, and guidance (SCGs) that are applicable, relevant, and appropriate. Principal SCGs that are applicable, relevant, and appropriate for evaluating the alternatives for remediation of the Site include the following:

- TOGS - New York State Ambient Water Quality Standards and Guidance Values (referred to as Class GA Values)
- 6 NYCRR Part 364 – Waste Transporter Permits
- 6 NYCRR Part 370 – Hazardous Waste Management System
- 6 NYCRR Part 375 – Environmental Remediation Programs
- 6 NYCRR Part 376 – Land Disposal Restrictions
- 6 NYCRR Parts 700 through 705 – Surface Water and Groundwater Classifications and Standards
- 6 NYCRR Parts 750 through 758 – Implementation of NPDES Program in NYS (SPDES Regulations)
- 29 CFR Part 1926 – Safety and Health Regulations for Construction
- NYSDOH Generic Community Air Monitoring Plan
- NYSDEC DER-10 – Technical Guidance for Site Investigation and Remediation
- NYSDEC DER-31 – Green Remediation

Additional regulations and guidance are applicable, relevant, and appropriate to the remedial alternatives (such as 6 NYCRR Part 360, Solid Waste Management Requirements; 6 NYCRR Part 613, Handling and Storage of Petroleum, etc.), and will be complied with; however, the list above is intended to represent the principal SCGs which should be considered in evaluating the remedial alternatives for the Site.

Conformance with the appropriate standards for remediation of contaminated soil is an important criteria in evaluating the remedial alternatives for the Site. Presently, in New York State 6 NYCRR Part 375 establishes the primary SCGs associated with remediation of contaminated soil at sites regulated by NYSDEC. If proposing remediation pursuant to a Track other than Track 1 (Unrestricted Use), 6 NYCRR Part 375 requires evaluation of at least one remedial alternative pursuant to Track 1 (Unrestricted Use) and one other alternative developed for the proposed use of the Site. The remedial alternatives analysis presented in Section 3.1 of this RAWP has been prepared in conformance with this requirement.

2.5.4 SOIL/FILL CONTAMINATION

The chemical analysis of the 59 subsurface soil samples found concentrations of chlorinated VOCs exceeding Protection of Groundwater and Restricted-Residential Use SCOs at depths exceeding 8 feet bgs in the Site. Lead and mercury were also detected slightly above Restricted-Residential Use SCOs in one (1) separate sample each in this area at similar depths. Several PAHs were detected at concentration above their respective Restricted-Residential Use SCOs at depths of 2 to 5 feet bgs. Concentrations of contaminants exceeding Industrial Use SCOs were limited to PCE at a depth of 13 to 15 feet bgs, and benzo(a)pyrene at a depth of 3 to 5 feet bgs. In addition, metals (including lead, copper, and mercury) and one SVOC (indeno[1,2,3-cd]-pyrene) were detected in surface soil at concentrations exceeding Restricted Residential and/or Protection of Groundwater Use SCOs.

2.5.4.1 SUMMARY OF SOIL/FILL DATA, AND COMPARISON OF SOIL/FILL WITH SCGS

Tables 2 through 6 and 15 through 21 show exceedances from Track 1 Restricted-Residential Use SCOs for all soil at the Site. **Figures 8 and 10** are spider maps that shows the location and summarizes exceedances from Track 1 Unrestricted SCOs for all subsurface and surface soil/fill respectively.

2.5.5 ON-SITE AND OFF-SITE GROUNDWATER CONTAMINATION

The completed groundwater sampling identified VOCs at concentrations above their respective Class GA Values in verification borings VB-01 and VB-02, and groundwater monitoring wells GW-02S, GW-02D, MW-1, and MW-3. The highest chlorinated VOCs were detected in

verification boring VB-01 and monitoring wells GW-02S and GW-02D, located in the vicinity of soil borings which exhibited chlorinated VOCs in subsurface soil at concentrations above SCOs.

2.5.5.1 COMPARISON OF GROUNDWATER WITH SCGS

A table that shows exceedances of Class GA Values in groundwater samples is shown in **Tables 7 through 11**. A spider map that indicates the locations of and summarizes exceedances of Class GA Values in groundwater samples is shown in **Figure 9**.

2.5.6 ON-SITE SOIL VAPOR CONTAMINATION

Soil vapor sampling results suggest that the chlorinated VOCs detected in soil and groundwater at the Site have volatized into the soil gas at concentrations above AGVs. However, there are no structures built over the area of soil and groundwater contamination, and there is no evidence that downgradient migration of the contamination is occurring.

2.5.6.1 COMPARISON OF SOIL VAPOR WITH SCGS

Tables showing the results of analysis of soil vapor samples is shown in **Tables 12 through 14**.

2.6 ENVIRONMENTAL AND PUBLIC HEALTH ASSESSMENTS

2.6.1 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

The purpose of this exposure assessment is to determine how and when an individual may be exposed to contaminants of potential concern (COPCs) associated with NYSDEC Site No. 241222 at the LIRR Arch Street Yard. A COPC is any chemical detected above the NYSDEC cleanup guidelines in a medium, which could produce adverse health effects under the right conditions of dose and exposure. For exposure to occur there must be a complete "pathway of exposure" where a person can come into contact with COPCs. For a pathway to be complete, there must be: (1) a source or medium containing the COPCs; (2) a location where human contact can take place (i.e., an exposure point); and (3) a feasible means for the COPC to enter the person's body. The person who could come into contact with the COPC at an exposure point is called a "receptor." The ways in which the COPC can enter the body are called "routes of exposure." Ingestion (by mouth), dermal (contact with skin) and inhalation (breathing into the lungs) are the routes of exposure

considered in this and other human health risk assessments. This assessment considers both current and potential future exposures.

As with any exposure assessment, this assessment is not intended to predict disease outcome, but rather, is meant to be used as a tool to make decisions regarding the need for remediation or the institution of precautionary measures, such as limiting the affected area to non-residential land uses. Given the available information for the Site, and keeping the purpose of this assessment in mind, the following evaluation is qualitative in nature. Consistent with the previous presentation of the analytical data, the exposure assessment below is presented by medium of interest.

2.6.1.1 GENERAL SITE CONDITIONS

The Former Site (NYSDEC Site No. 241222) previously investigated is an approximately 2.7-acre portion of the 8-acre LIRR Arch Street Yard. The Site (NYSDEC Site No. 241222) boundary was redefined to the current 0.3-acre portion of the Yard where chlorinated volatile organic compounds (VOC) impact to soil and groundwater have been identified. The Yard was previously utilized to perform maintenance on passenger rail cars until December 2009. Between September 2016 and December 2018, the Maintenance Facility building located east of the Site was leased to MNR and Bombardier to install Positive Train Control in their trains. LIRR currently leases the Maintenance Facility to Kawasaki Rail Car to perform maintenance on LIRR train cars. The southern side of the Maintenance Facility building was previously leased for truck parking from August 2012 through August 2015, located outside of the Site. Other buildings adjacent to the site include a Maintenance of Equipment Building on the northern end of the Former Site and an Engineering Support Building on the southern end of the Former Site. These buildings are utilized for storage and are not occupied on a regular basis. The building north of the Site was leased to MNR and Bombardier between September 2016 and December 2018. Several sets of active train tracks border the Site to the north. The surface is bluestone ballast.

The Site is approximately 10 to 15 feet lower than the surrounding streets, and access is restricted by a retaining wall to the south, and a chain link fence with a locked gate to the east, north, and west. Access to the remainder of the Yard is restricted by a fence, and an electronic gate which requires valid identification to open. A security guard is stationed at the gate during business hours. Concentrations of chlorinated VOCs in soil exceeding Protection of Groundwater, Restricted- Residential, and Industrial Use SCOs at depths exceeding 8 feet bgs, and in groundwater exceeding Class GA Values, have been detected at the Site. The Site is enclosed within a chain link fence, with a locked gate.

Given that access to the Yard is restricted to authorized personnel, the general public does not have the potential to be exposed to on-Site contamination. Since the Site is separately fenced, the only potential receptors of on-Site contamination would be LIRR workers or their contractors who may periodically enter the. However, potential exposure is significantly minimized by the below grade nature of the contamination. In addition, excavations do not routinely take place on-Site and no excavations are currently planned. Any future excavations will be completed under proper health and safety protocols and as per the requirements of the LIRR's EPC-03-001 document entitled Excavating Soils at Railroad Locations, dated August 11, 2003 and revised March 2017.

2.6.1.2 SOIL

Exposure to contaminants within subsurface soil on-Site is not a significant potential route of exposure to Site workers during routine Site operations. There is the potential for on-Site workers to be exposed to these contaminants through dermal contact or inhalation of windblown dust during any future excavation activities. However, as stated above, excavations do not routinely take place on-Site and no excavations are currently planned. Any future excavations will be completed under proper health and safety protocols and as per the requirements of the LIRR's EPC-03-001 document entitled Excavating Soils at Railroad Locations, dated August 11, 2003 and revised March 2017.

2.6.1.3 GROUNDWATER

Downgradient monitoring wells located west of this area exhibited concentrations of VOCs below Class GA Values, including MW-2, GW-03, GW-04S, and GW-04D, suggesting that the observed groundwater contamination has not migrated to downgradient locations. It is likely that the clay-rich unit present throughout the Site helps limit the overall migration of contaminants. Given that the contamination has not migrated and the below grade nature of the groundwater contamination, direct exposure of the public and on-Site workers to these groundwater contaminants would not be expected under current conditions. In addition, groundwater in this area of Queens is not utilized as a potable water supply source.

2.6.1.4 AIR

Because there are no structures built over the area of soil and groundwater contamination, direct exposure by inhalation of the chlorinated VOCs detected in soil gas would not be expected under current condition. In addition, indoor air sampling completed within the closest structure (the

LIRR Engineering Support Building) exhibited VOC concentrations below AGVs and similar to outdoor concentrations. Comparison of the results for the sub-slab soil vapor sample and the indoor air sample using the NYSDOH decision matrices suggest that no action is needed to address human exposures. However, a soil vapor intrusion evaluation will be conducted whenever there is a change in use and/or occupied structures with soil vapor intrusion pathways are constructed at the Site.

2.6.2 FISH & WILDLIFE REMEDIAL IMPACT ANALYSIS

A fish and wildlife resources impact analysis was completed in general conformance with the framework of Appendix 3C of the Draft DER–10 technical guidance. Significant findings of the analysis are presented below.

The Site was developed with little or no vegetated area prior to LIRR obtaining the property in 1966. The Site has not been subsequently developed with additional vegetated areas. Thus, no terrestrial wildlife resources exist on the Site itself. Further, PCBs and pesticides, bioaccumulable substances, were not found in on-Site soil during the RI at concentrations that exceed the Protection of Ecological Resources SCOs.

The urban Site is not located in close proximity to a surface water body, wetland, or other ecologically significant area. Therefore, in accordance with DER-10 Section 3.10.1(b), further evaluation related to the Fish and Wildlife Resources Impact Analysis is not warranted.

2.7 REMEDIAL ACTION OBJECTIVES

Based on the results of the Remedial Investigation, 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

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

2.7.2 SOIL

RAOs for Public Health Protection

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

3.1 EVALUATION OF REMEDIAL ALTERNATIVES

The purpose of this section is to present descriptions of and an evaluation of the remedial alternatives selected for analysis for the Site. The primary goal of this analysis is to demonstrate how the selected remedy will comply with the following nine (9) remedy selection factors in accordance with the NYSDEC regulations found at 6 NYCRR 375-1.8(f):

- Protection of human health and the environment;
- Compliance with 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.

Five remedial alternatives, consistent with the 6 NYCRR Subpart 375-3 Brownfield Cleanup Program requirements, have been developed for analysis. Descriptions of the alternatives are presented below. The goal of Alternatives 2 through 4 would be to achieve Industrial Use and Protection of Groundwater SCOs. The goal of Alternative 5 would be to achieve Unrestricted Use SCOs.

Remedial Alternative 1: No Action

The no further action alternative would serve as a baseline to compare and evaluate the effectiveness of the other alternatives. Since chlorinated VOC contaminated soil and groundwater would not be removed from the Site or treated as part of this alternative, Institutional Controls would be required. This would include establishment of an Institutional Control in the form of an Environmental Easement, which would ensure appropriate future use of the Site and would include restrictions to be protective of human health and the environment.

Remedial Alternative 2: In-Situ Chemical Reduction (ISCR) of Soil and Groundwater

Alternative 2 includes the performance of a Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and to conduct a laboratory-scale treatability study of In-Situ Chemical Reduction (ISCR) amendments. Prior to performance of the PDI, NYCDOT Bridge Department As-Built drawings for bridge geotechnical and structural elements would be requested-for and reviewed. Approval of any intrusive activity within 100 feet of NYCDOT bridge structures would be obtained prior to implementing the PDI. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared, and USEPA UIC Program permitting would be acquired. If required, a structural inspection and/or geotechnical survey would take place; this may include a baseline survey, monitoring during remedial action (e.g., surface tilt meters and abutment monitoring) and/or a post-remedial action survey.

Following the construction of a temporary amendment mixing and staging area, zero-valent iron (or similar) would be injected utilizing a direct-push method, in order to promote abiotic degradation of chlorinated ethenes, and post-injection groundwater monitoring for chlorinated ethenes would follow for a minimum of eight (8) quarters. Approximate direct-push locations are presented on **Figure 11**. The existing blue stone surface cover would be utilized as an Engineering Control. As necessary, an Environmental Easement and SMP would be developed, and a long-term groundwater monitoring program would be established. Groundwater monitoring wells would be abandoned in accordance with NYSDEC CP-43 upon completion of this alternative.

Remedial Alternative 3: ISCR and Enhanced In-Situ Bioremediation (EISB) of Soil and Groundwater

Alternative 3 would begin with the same initial steps as Alternative 2, including PDI, laboratory-scale treatability study, consultation with NYCDOT Bridge Department, and USEPA UIC permit obtainment.

Following the construction of a temporary amendment mixing and staging area, zero-valent iron (or similar) would be injected in order to promote abiotic degradation of chlorinated ethenes, and a controlled-release carbon source (e.g., guar, emulsified vegetable oil [EVO], etc.) and bioaugmentation cultures (i.e., *Dehalococcoides spp.)* would be injected in order to promote biological reduction of chlorinated ethenes; all injections would be carried out utilizing a direct-push method, and post-injection groundwater monitoring for chlorinated ethenes would follow for a minimum of eight (8) quarters. The existing blue stone surface cover would be utilized as an Engineering Control. As necessary, an Environmental Easement and SMP would be developed,

and a long-term groundwater monitoring program would be established. Groundwater monitoring wells would be abandoned in accordance with NYSDEC CP-43 upon completion of this alternative.

Remedial Alternative 4: Limited Soil Excavation and Removal with ISCR and EISB of Groundwater

Alternative 4 preparatory steps would be the same as Alternatives 2 and 3. In addition to refining the horizontal and vertical extents of treatment, the PDI performed under Alternative 4 would obtain necessary geotechnical data for excavation support design.

Following the construction of a temporary amendment mixing and staging area, soil "hot spots" impacted with chlorinated ethenes would be excavated (up to approximately 15 feet bgs) and disposed of off-site. Excavation would necessitate the installation of excavation support (shoring), and excavation dewatering, treatment, and discharge. Subsequently, clean backfill, amended with material to promote chemical and biological reduction of contaminants, would be placed and compacted. Upon completion of excavation and backfill activities, zero-valent iron (or similar) would be injected beyond the limits of excavation (vertically and laterally) in order to promote abiotic degradation of chlorinated ethenes, and a controlled-release carbon source (e.g., guar, emulsified vegetable oil [EVO], *etc.*) and bioaugmentation cultures (i.e., *Dehalococcoides spp.)* would be injected beyond the limits of excavation (vertically and laterally) in order to promote biological reduction of chlorinated ethenes; all injections would be carried out utilizing a direct-push method, and post-implementation groundwater monitoring for chlorinated ethenes would follow for a minimum of eight (8) quarters. The existing blue stone surface cover would be utilized as an Engineering Control. As necessary, an Environmental Easement and SMP would be developed, and a long-term groundwater monitoring program would be established. Groundwater monitoring wells would be abandoned in accordance with NYSDEC CP-43 upon completion of this alternative.

Remedial Alternative 5: Soil Excavation and Removal

Alternative 5 would begin with a pre-design investigation to refine horizontal and vertical extents of treatment and obtain necessary geotechnical data for excavation support design. Following the pre-design investigation, consultation and approval from the NYCDOT Bridge Department would be required.

Soil impacted with contaminants of concern at concentrations greater than Unrestricted SCOs would be excavated (up to 30 feet bgs) and disposed of off-site. Excavation would necessitate the

installation of excavation support (shoring), and excavation dewatering, treatment, and discharge. Subsequently, clean backfill, amended with material to promote the abiotic and biological reduction of contaminants, would be placed and compacted, and post-implementation groundwater monitoring would follow for a minimum of eight (8) quarters. As necessary, an Environmental Easement and SMP would be developed, and a long-term groundwater monitoring program would be established. Groundwater monitoring wells would be abandoned in accordance with NYSDEC CP-43 upon completion of this alternative.

3.1.1 Protection of Human Health and the Environment

Alternative 1 – No Action would not be protective of public health and the environment. The establishment of Institutional Controls would restrict contact with the source material but would not prevent migration of the source with the ability to adversely impact the environment.

Alternative 2 – ISCR of Soil and Groundwater would be protective of public health and the environment by promoting abiotic degradation of chlorinated ethenes through the injection of zero-valent iron or similar. The source area would be either degraded completely or partially which would require maintenance of the existing surface cover as an Engineering Control and an Environmental Easement and SMP to be developed to restrict contact with remaining source material.

Alternative 3 – ISCR and EISB of Soil and Groundwater would be protective of public health and the environment by promoting abiotic degradation of chlorinated ethenes through the injection of zero-valent iron or similar and controlled-release carbon source. The source area would be either degraded completely or partially which would require maintenance of the existing surface cover as an Engineering Control an Environmental Easement and SMP to be developed to restrict contact with remaining source material.

Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB of Groundwater would be protective of public health and the environment by removing approximately 1,000 tons of soil within the source area and by promoting abiotic degradation of chlorinated ethenes through the injection of zero-valent iron or similar and controlled-release carbon source. The source area would be either degraded completely or partially which would require maintenance of the existing surface cover as an Engineering Control an Environmental Easement and SMP to be developed to restrict contact with remaining source material.

Alternative 5 – Soil Excavation and Removal would be protective of public health and the environment by removing approximately 2,000 tons of soil which exceeds Unrestricted Use SCOs at the Site.

Alternatives 2 through 5 would be protective of public health and the environment. Alternatives 2 through 4 would either remove or greatly reduce the source and would allow for natural attenuation of any remaining source material. Alternative 5 would be protective of public health and the environment by removing all soil which exceeds Unrestricted SCOs entirely.

3.1.2 Compliance with Standards, Criteria, and Guidelines (SCGs)

Alternative 1 – No Action would not satisfy the SCGs (described in Section 2.5.3) and the RAOs (described in Section 2.7) developed for the Site.

Alternative 2 – ISCR of Soil and Groundwater would satisfy the SCGs and the RAOs for groundwater, soil, and soil vapor by promoting abiotic degradation of the source. Alternative 2 will prevent ingestion of contaminated groundwater and soil, limit the migration of contaminants, and mitigate vapor intrusion risks by removing the majority of the source, if not in its entirety.

Alternative 3 – ISCR and EISB of Soil and Groundwater would satisfy the SCGs and the RAOs for groundwater, soil, and soil vapor by promoting abiotic degradation of the source. Alternative 3 will prevent ingestion of contaminated groundwater and soil, limit the migration of contaminants, and mitigate vapor intrusion risks by removing the majority of the source, if not in its entirety.

Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB of Groundwater would satisfy the SCGs and the RAOs for groundwater, soil, and soil vapor by removing approximately 1,000 tons of source material and promoting abiotic degradation of the source. Soils excavated as part of Alternative 4 would be removed and disposed of in accordance with applicable regulations. Alternative 4 will prevent ingestion of contaminated groundwater and soil, limit the migration of contaminants, and mitigate vapor intrusion risks by removing the majority of the source, if not in its entirety.

Alternative 5 – Soil Excavation and Removal would satisfy the SCGs and the RAOs for groundwater, soil, and soil vapor by removing approximately 2,000 tons of soil which exceeds Unrestricted Use SCOs at the Site. Soils excavated as part of Alternative 5 would be removed and disposed of in accordance with applicable regulations.

Alternatives 2 through 5 would conform to the SCGs and RAOs applicable to soil and soil vapor for remediation of the Site, however, Alternatives 2 through 4 may require maintenance of an

Engineering Control (i.e., existing site cover) and Institutional Controls to prevent contact with contaminated groundwater and soil and to mitigate soil vapor risks.

3.1.3 Short-Term Effectiveness and Impacts

There would be no short-term impacts to the community associated with implementation of Alternative 1 – No Action. The Alternative would also not provide any short-term effectiveness.

Alternative 2 – ISCR of Soil and Groundwater and Alternative 3 – ISCR and EISB of Soil and Groundwater would have limited impact to the community. Potential short-term impacts include increased construction noise during the pre-design investigation and implementation of the remedy. As the Site is located in an industrial area and the work would be conducted in accordance with local sound ordinances, this impact would be minimal. On-site workers may be exposed to site-related contaminants and physical hazards associated with working around direct push equipment. The duration of both the pre-design investigation and implementation of the remedy would be short, limiting the impacts to the community and on-site workers. Alternative 3 would degrade the source more expeditiously than Alternative 2 and would provide greater short-term effectiveness.

Potential short-term impacts to the community associated with Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB of Groundwater include increased construction noise, increased truck traffic, and the potential creation of objectional odors, vapors, and/or dust. Shoring and possible interruptions to the 21st Street Bridge would be required to implement Alternative 4. Short-term impacts to the community would be minimized through remediation phase controls such as implementation of a Soil Management Plan (SoMP) and Community Air Monitoring Plan (CAMP), use of soil erosion controls, and adherence to pre-approved truck routes. Decontamination of vehicles and equipment prior to leaving the Site would minimize the potential for off-site soil migration during remediation. Short-term exposures to on-site workers would be minimized through implementation of and adherence to a site-specific Health and Safety Plan (HASP), which would establish procedures and personal protective equipment requirements for site work.

The implementation of Alternative 5 – Soil Excavation and Removal represents the potential for similar short-term impacts and would include the same impact mitigation strategies as those described for Alternative 4 except that the duration of the construction activities would be significantly longer due to the greater volume of material to be removed. In addition, lagging of shoring installed as part of Alternative 5 into bedrock would be necessary. Construction activities

under Alternative 5 could result in significant traffic interruptions to the 21st Street Bridge. Additionally, construction activities associated with Alternative 5 could pose a threat to the structural integrity of the 21st Street Bridge.

In summary, Alternatives 2 through 5 would be effective in the short term by either degrading and/or removal of the source material, and through the implementation of Institutional Controls for Alternatives 2 through 4, as applicable. Adherence to appropriate controls would minimize potential short-term impacts to the surrounding community and on-site workers. However, the potential for short-term impacts to the community and on-site workers during construction activities associated with Alternative 5 is greatest due to the volume of soil requiring removal. Alternative 4 also includes removal of soil and would have greater potential for short-term impacts than Alternatives 2 and 3.

3.1.4 Long-term Effectiveness and Permanence

Alternative 1 – No Action would not be a long-term effective and permanent alternative since the source of contamination would remain.

Alternative 2 – ISCR of Soil and Groundwater and Alternative 3 – ISCR and EISB of Soil and Groundwater would be effective in the long-term and permanent alternatives. Even if the source is not migrating, the rate of natural attenuation and required conditions have not been evaluated. The enhanced degradation of the source would improve the efficacy of the natural attenuation if occurring and if not, provide substrate to create a subsurface environment conducive to natural attenuation following the implementation of the remedy. Groundwater monitoring would be performed to determine progress with respect to remedial objectives. Further, the existing blue stone cover will be utilized as an Engineering Control and Institutional Controls will be established to ensure the long-term effectiveness and permanence of the remedy. While both alternatives achieve long-term effectiveness and permanence, Alternative 3 would have a greater likelihood to degrade the source completely.

The implementation of Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB of Groundwater would be a long-term effective and permanent alternative by removing approximately 1,000 tons of source material and promoting abiotic degradation of the source. Groundwater monitoring will be performed to determine progress with respect to remedial objectives. Further, the existing blue stone cover will be utilized as an Engineering Control and Institutional Controls will be established to ensure the long-term effectiveness and permanence of the remedy. Additionally, the treatment of dewatering fluids will further remove contaminants

from impacted groundwater and would enhance the long-term effectiveness and permanence of this alternative.

Alternative 5 – Soil Excavation and Removal and the removal of approximately 2,000 tons of soil with concentrations of contaminants exceeding the Unrestricted Use SCOs would a long-term effective and permanent alternative. Additionally, the treatment of dewatering fluids will further remove contaminants from impacted groundwater and would enhance the long-term effectiveness and permanence of this alternative.

Even though impacted soil may remain in place under Alternatives 2 through 4, the use of Institutional Controls would minimize the potential for exposure to Site-related contaminants. Therefore, all alternatives but Alternative 1 represent long-term effective and permanent remedies for the Site that are protective of human health and the environment.

3.1.5 Reduction of Toxicity, Mobility, or Volume of Contaminated Material

Alternative 1 – No Action would not reduce the toxicity, mobility, or volume of contaminated material.

Alternative 2 – ISCR of Soil and Groundwater and Alternative 3 – ISCR and EISB of Soil and Groundwater would reduce the toxicity, mobility, or volume of contaminated material by promoting abiotic degradation of chlorinated ethenes. Alternative 3 would result in greater reductions in toxicity, mobility, and volume of contaminated material via enhanced biological reduction of contaminants.

Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB of Groundwater would reduce the toxicity, mobility, or volume of contaminated material by removing approximately 1,000 tons of soil within the source area and by promoting abiotic degradation of chlorinated ethenes. Additionally, the treatment of dewatering fluids would further remove contaminants from impacted groundwater and would reduce the toxicity, mobility, and volume of the contaminated material under this alternative.

Alternative 5 – Soil Excavation and Removal would reduce the toxicity, mobility, or volume of contaminated material by removing approximately 2,000 tons of soil which exceeds Unrestricted Use SCOs at the Site. Additionally, the treatment of dewatering fluids will further remove contaminants from impacted groundwater and would reduce the toxicity, mobility, and volume of the contaminated material under this alternative.

Although Alternatives 2 through 5 would serve to reduce the toxicity, mobility, and volume of contamination, Alternative 5 would be more effective since all soil with concentrations greater than the Unrestricted Use SCOs would be removed and abiotic degradation would not be required.

3.1.6 Implementability

Alternative 2 – ISCR of Soil and Groundwater and Alternative 3 – ISCR and EISB of Soil and Groundwater can be implemented with standard construction techniques. Direct push equipment and injection substrate are widely available construction equipment and materials. There are no anticipated issues during implementation of Alternative 2 or 3.

Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB of Groundwater can be implemented with specialty construction techniques, using construction equipment limited availability. Installation of excavation support and dewatering will be required to remove soil to a depth of 15 feet bgs. However, it is anticipated that sheeting would be driven around the proposed excavation area since alternatives for excavation support (e.g., sloping or benching the excavation) are not feasible due to the proximity of the 21st Street Bridge and railroad tracks. The low clearance of the 21st Street Bridge could pose a challenge to the installation of sheeting. Changes in sheet pile driving methodology may require the utilization of specialty equipment with significant lead times due to the limited number of machines within the United States. Significant delays could occur if damage, settlement, or movement are observed during the installation of excavation support as part of monitoring of the 21st Street Bridge.

Alternative 5 – Soil Excavation and Removal would require installation of excavation support and excavation underneath the 21st Street Bridge. The clearance between the bridge and the ground would not readily allow the installation of excavation support to the depth required to remove all material with concentrations of contaminants greater than the Unrestricted Use SCOs.

Alternatives 2 and 3 are the most implementable of the alternatives that are protective of human health and the environment. Alternative 4 may require the use of specialized equipment to install excavation support. Due to the fact of the required excavation support and excavation underneath the 21st Street Bridge, Alternative 5 is deemed not implementable. Therefore, no further analysis of Alternative 5 will be discussed in this RAWP.

3.1.7 Cost Effectiveness

Cost estimates[2] were prepared for the three alternatives that would satisfy SCGs and RAOs and are implementable (i.e., Alternative 2, Alternative 3, and Alternative 4). Costs were assembled from recent bids for remediation projects and communications with remedial contractors, material suppliers, waste transporters, and disposal facilities. Alternative 2 – ISCR of Soil and Groundwater is estimated to cost $635,000. Alternative 3 – ISCR and EISB of Soil and Groundwater is estimated to cost $575,000. Alternative 4 – Limited Soil Excavation and Removal with ISCR and EISB is estimated to cost $2,000,000. The cost estimates are intended only for the purpose of determining relative cost in comparison to other alternatives. Cost estimates are included in **Appendix H**.

The cost of Alternative 4 is significantly higher than Alternatives 2 and 3 due to the requirement for soil removal and disposal and dewatering operations. Alternative 2 has a higher cost than Alternative 3 since it is anticipated that remedial goals will be satisfied with four (4) injection events while it is estimated only three (3) injection events will be required for Alternative 3 due to the added remedial efficacy of biological reductive dechlorination.

3.1.8 Community Acceptance

Alternatives 2 and 3 would have minimal impacts to the community due to the limited duration of proposed activities. Alternative 4 would entail excavation of contaminated soil and include the implementation of a SoMP and CAMP to minimize the potential for off-site migration of dust, which would promote community acceptance. Additional truck traffic required for the transportation and disposal of excavated material may adversely impact the community. Alternatives 2 and 3 are anticipated to be more acceptable to the community based on the limited duration and minimal increase in truck traffic.

Public comments that are provided during the public comment period on this RAWP will be evaluated, and this RAWP may be modified as appropriate in response to comments.

[2] A 7% discount rate was used to calculate present value cost for Alternatives 2, 3, and 4.

3.1.9 Land Use

Redevelopment and/or change of land use are not being contemplated for the Site. The Site is currently used by Kawasaki Rail Car to conduct routine maintenance of LIRR's M9 rail car fleet and chlorinated solvents are not used on-site.

Citizens participation in connection with the RAWP and planned future use of the Site is described in the CPP attached as **Appendix D**.

3.2 SELECTION OF THE PREFERRED REMEDY

Alternatives 2 through 4 would be protective of human health and the environment, provide a long term and effective remedy for the Site, and are implementable. However, Alternative 3 – ISCR and EISB of Soil and Groundwater would result in fewer potential short-term impacts to the community due to the shorter duration of on-site activities without soil removal. Further, Alternative 3 is more cost effective when compared to other alternatives that achieve Industrial Use and Protection of Groundwater SCOs.

Therefore, based on the evaluation of the remedial alternatives against the nine (9) remedy selection factors in accordance with the requirements of 6 NYCRR 375, Alternative 3 – ISCR and EISB of Soil and Groundwater is the selected remedy for the Site. Alternative 3 satisfies the soil, groundwater, and soil vapor remedial action objectives for the Site and will be protective of human health and the environment.

The land use factor evaluation below examines the selected alternative in comparison to the criteria required by Article 27, Title 14 of the Environmental Conservation Law 27-1415.

3.2.1 Zoning;

The Yard is zoned for industrial use and the surrounding properties is a combination of commercial, light industrial, professional office space, residential, and utility right of way.

3.2.2 Applicable comprehensive community master plans or land use plans;

The proposed use of the Site is consistent with the allowed land use in this portion of Queens. There are currently no available Community Master Plans or Land Use Plans for the Site. As indicated previously, a master planning process to develop a vision for the long-term future of the yard is in preparation.

3.2.3 Surrounding property uses;

The neighborhood surrounding the Site includes warehouses, automotive repair shops, taxi garages, apartment buildings, and gasoline stations in the vicinity of the Yard. In addition, below grade subway tunnels (G line) run beneath Jackson Avenue immediately north of the Yard and beneath 49th Avenue immediately south of the Yard for the G and 7 line, respectively.

3.2.4 Citizen participation;

Refer to section 4.1.9 for information on the Citizen Participation Plan. The NYSDEC-approved CPP is provided as **Appendix D**.

3.2.5 Environmental justice concerns;

The Site is located in an Environmental Justice Area with a large Hispanic-American population. Therefore, Fact Sheets issued for this Site will be translated into Spanish. Additional details regarding community outreach and environmental justice are included in the Citizen Participation Plan.

3.2.6 Land use designations;

The proposed use of the Site is consistent with the land use designation in this portion of Queens.

3.2.7 Population growth patterns;

The continued use of the Site as a railyard does not impede population growth within this portion of Queens.

3.2.8 Accessibility to existing infrastructure;

The continued use of the Site as an industrial property is accessible to the required infrastructure (e.g., utilities, transportation, etc.).

3.2.9 Proximity to cultural resources;

There are no cultural resources within immediate proximity of the Site identified as part of this RAWP.

3.2.10 Proximity to natural resources;

The nearest water bodies to the Site include: East River, located approximately 0.6 miles to the west, and Newtown Creek, located approximately 0.3 miles to the south. On-Site groundwater is not used as a source of potable water. The selected remedial alternative would not impact natural resources.

3.2.11 Off-Site groundwater impacts;

The fine-grained nature and high organic content of the soil matrix below a depth of 10 feet bgs is likely to minimize potential off-site impacts to groundwater.

3.2.12 Proximity to floodplains;

The Site is not located in a flood zone.

3.2.13 Geography and geology of the Site; and

The continued use of the Site as an industrial property would not alter the geology of the Site.

3.2.14 Current Institutional Controls.

Currently there are no Institutional Controls for the Site. Following the completion of the remedial action, an Environmental Easement will be recorded as described in section 10.1

3.3 SUMMARY OF SELECTED REMEDIAL ACTIONS

Remedial activities will be performed in accordance with this RAWP. The following activities will be performed to achieve the remedial objectives:

1. **Remedial Design**

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. In-Situ Chemical Reduction

In-situ chemical reduction (ISCR) will be implemented to treat chlorinated VOCs in soil and groundwater. Zero valent iron (or similar) will be injected into the subsurface to promote abiotic destruction of contaminants. A Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and a laboratory-scale treatability study of In-Situ Chemical Reduction (ISCR) will be conducted prior to the full implementation of this technology. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared, and USEPA UIC Program permitting would be acquired.

3. Enhanced Bioremediation

In-situ enhanced biodegradation will be employed to treat chlorinated VOCs in soil and groundwater in the area depicted on figure. The biological breakdown of contaminants through anaerobic reductive dechlorination will be enhanced by injection of controlled-release carbon source (e.g., guar, emulsified vegetable oil, etc.) and bioaugmentation cultures (i.e., Dehalococcoides spp.) to promote biological reduction of chlorinated ethenes. A Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and a laboratory-scale treatability study of Enhanced Bioremediation will be conducted prior to the full implementation

of this technology. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared.

4. Groundwater Monitoring

Monitoring will be required up-gradient, down-gradient and within the treatment zone. Monitoring will be conducted for chlorinated VOCs and field parameters to determine the effectiveness of the groundwater treatment remedies.

5. Cover System

A site cover currently exists in areas not occupied by buildings and will be maintained to allow for industrial use of the site. Any site redevelopment will maintain the existing site cover. The site cover may include paved surface parking areas, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable soil cleanup objectives (SCOs) for industrial use. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6NYCRR part 375-6.7(d).

Exposure to residual contaminated soils and groundwater will be prevented by maintaining the existing blue stone surface cover at the Site. A map showing the aerial distribution of the cover is included in Figure 12.

6. Institutional Control

Imposition of an institutional control in the form of an environmental easement for the controlled property which will:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional controls in accordance with Part 375-1.8 (h)(3);
- allow the use and development of the controlled property for industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOH; and
- require compliance with the Department approved Site Management Plan.

7. Site Management Plan

A Site Management Plan is required, which includes the following:

a. An Institutional Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional controls remain in place and effective:

- Institutional Controls: The Environmental Easement discussed above.
- Engineering Control: The Cover System discussed above.

This plan includes, but may not be limited to:

- an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
- a provision for evaluation of the potential for soil vapor intrusion for any occupied buildings on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
- descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
- maintaining site access controls and Department notification; and
- the steps necessary for the periodic reviews and certification of the institutional controls.

b. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

- monitoring of groundwater to assess the performance and effectiveness of the remedy;
- a schedule of monitoring and frequency of submittals to the Department; and
- monitoring for vapor intrusion for any buildings on the site, as may be required by the Institutional and Engineering Control Plan discussed above.

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

4.0 REMEDIAL ACTION PROGRAM

The objective of this section of the RAWP is to present a scope of work which will be approved by NYSDEC and when completely implemented will ready the Site for development for the Contemplated Use.

The following activities will be performed to achieve the remedial objectives:

1. Remedial Design

A remedial design program will be implemented to provide the details necessary for the construction, operation, optimization, maintenance, and monitoring of the remedial program. Green remediation principles and techniques will be implemented to the extent feasible in the design, implementation, and site management of the remedy as per DER-31. The major green remediation components are as follows:

- Considering the environmental impacts of treatment technologies and remedy stewardship over the long term;
- Reducing direct and indirect greenhouse gases and other emissions;
- Increasing energy efficiency and minimizing use of non-renewable energy;
- Conserving and efficiently managing resources and materials;
- Reducing waste, increasing recycling and increasing reuse of materials which would otherwise be considered a waste;
- Maximizing habitat value and creating habitat when possible;
- Fostering green and healthy communities and working landscapes which balance ecological, economic and social goals; and
- Integrating the remedy with the end use where possible and encouraging green and sustainable re-development.

2. In-Situ Chemical Reduction

In-situ chemical reduction (ISCR) will be implemented to treat chlorinated VOCs in soil and groundwater. Zero valent iron (or similar) will be injected into the subsurface to promote abiotic destruction of contaminants. A Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and a laboratory-scale treatability study of In-Situ Chemical Reduction

(ISCR) will be conducted prior to the full implementation of this technology. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared, and USEPA UIC Program permitting would be acquired.

3. Enhanced Bioremediation

In-situ enhanced biodegradation will be employed to treat chlorinated VOCs in soil and groundwater in the area depicted on figure. The biological breakdown of contaminants through anaerobic reductive dechlorination will be enhanced by injection of controlled-release carbon source (e.g., guar, emulsified vegetable oil, etc.) and bioaugmentation cultures (i.e., Dehalococcoides spp.) to promote biological reduction of chlorinated ethenes. A Pre-design Investigation (PDI) to refine horizontal and vertical extents of treatment, and a laboratory-scale treatability study of Enhanced Bioremediation will be conducted prior to the full implementation of this technology. Based on the results of the PDI and treatability study, Remedial Design documents would be prepared.

4. Groundwater Monitoring

Monitoring will be required up-gradient, down-gradient and within the treatment zone. Monitoring will be conducted for chlorinated VOCs and field parameters to determine the effectiveness of the groundwater treatment remedies.

5. Cover System

A site cover currently exists in areas not occupied by buildings and will be maintained to allow for industrial use of the site. Any site redevelopment will maintain the existing site cover. The site cover may include paved surface parking areas, sidewalks or soil where the upper one foot of exposed surface soil meets the applicable soil cleanup objectives (SCOs) for industrial use. Any fill material brought to the site will meet the requirements for the identified site use as set forth in 6NYCRR part 375-6.7(d).

Exposure to residual contaminated soils and groundwater will be prevented by maintaining the existing blue stone surface cover at the Site. A map showing the aerial distribution of the cover is included in Figure 12.

6. Institutional Control

Imposition of an institutional control in the form of an environmental easement for the controlled property which will:

- require the remedial party or site owner to complete and submit to the Department a periodic certification of institutional controls in accordance with Part 375-1.8 (h)(3);
- allow the use and development of the controlled property for industrial use as defined by Part 375-1.8(g), although land use is subject to local zoning laws;
- restrict the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by the NYSDOH or NYCDOH; and
- require compliance with the Department approved Site Management Plan.

7. Site Management Plan

A Site Management Plan is required, which includes the following:

c. An Institutional Control Plan that identifies all use restrictions and engineering controls for the site and details the steps and media-specific requirements necessary to ensure the following institutional controls remain in place and effective:

  – Institutional Controls: The Environmental Easement discussed above.
  – Engineering Control: The Cover System discussed above.

  This plan includes, but may not be limited to:

  - an Excavation Plan which details the provisions for management of future excavations in areas of remaining contamination;
  - a provision for evaluation of the potential for soil vapor intrusion for any occupied buildings on the site, including provision for implementing actions recommended to address exposures related to soil vapor intrusion;
  - descriptions of the provisions of the environmental easement including any land use and groundwater use restrictions;
  - maintaining site access controls and Department notification; and
  - the steps necessary for the periodic reviews and certification of the institutional controls.

d. A Monitoring Plan to assess the performance and effectiveness of the remedy. The plan includes, but may not be limited to:

   - monitoring of groundwater to assess the performance and effectiveness of the remedy;
   - a schedule of monitoring and frequency of submittals to the Department; and
   - monitoring for vapor intrusion for any buildings on the site, as may be required by the Institutional and Engineering Control Plan discussed above.

4.1 GOVERNING DOCUMENTS

4.1.1 Site Specific Health & Safety Plan (HASP)

All remedial work performed under this plan will be in full compliance with governmental requirements, including Site and worker safety requirements mandated by Federal Occupational Safety and Health Administration (OSHA).

The LIRR 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 HASP and for the appropriate performance of work according to that plan and applicable laws.

The HASP, provided as **Appendix E**, and requirements defined in this RAWP pertain to all remedial and invasive work performed at the Site until the issuance of a Certificate of Completion (COC).

The Site Safety Coordinator will be identified prior to the start of remedial construction. A resume will be provided to NYSDEC prior to the start of remedial construction.

4.1.2 Quality Assurance Project Plan (QAPP)

A QAPP has been prepared for the Site and is provided in **Appendix F**. The QAPP will be implemented during the collection of all samples collected in association with the completion of the Site remedy. The QAPP identifies procedures to be utilized to ensure the quality of work performed meets the objectives of this RAWP and includes details regarding the sampling procedures, data usability objectives, analytical methods, etc. for all samples collected during implementation of, and in support of, the Site remedy, as detailed further below.

The QAPP provides information regarding:

- Description of sample collection methods for each sample matrix including sample containers, sample custody, sample packaging, storage and shipping procedures;
- The analytical protocols to be utilized;
- Quality control methods and procedures for each specific test to be used during construction;
- Reporting procedures for quality assurance activities including proposed reporting formats; and,
- Method for notification of changes.

The Remedial Engineer will be responsible for implementing the QAPP.

The QAPP will be revised as a pre-design investigation work plan and Remedial Design describing with the following sampling activities: 1) sampling to be completed during the pre-design investigation; 2) post-injection groundwater monitoring, and; 3) long-term groundwater monitoring, are approved by NYSDEC.

A pre-design investigation work plan has not yet been developed and will be prepared prior to implementation of the pre-design investigation. Depending on the results of the pre-design investigation, the proposed remediation area may be modified, which will ultimately dictate the quantity of samples to be collected during implementation of the remedy. Furthermore, specific requirements for post-remediation groundwater sampling will be detailed in the SMP, which will be prepared at the completion of remedial construction concurrent with the FER. As such, the QAPP may be updated to reflect sample details and procedures as project conditions change.

4.1.3 Construction Quality Assurance Plan (CQAP)

The CQAP will be submitted to the NYSDEC for approval prior to the start of work. The CQAP will provide a detailed description of the observation and testing activities that will be used to monitor construction quality and confirm that remedy construction is in conformance with the remediation objectives and specifications prepared for the environmental remediation components of the project. The CQAP will include the following:

- Responsibilities and authorities of the organizations and key personnel involved in the design and construction of the remedy;

- Qualifications of the quality assurance personnel that demonstrate that they possess the proper training and experience necessary to fulfill project-specific responsibilities;
- The observations and tests that will be used to monitor construction and the frequency of performance of such activities;
- The sampling activities, sample size, sample locations, frequency of testing, acceptance and rejection criteria, and plans for implementing corrective measures as addressed in the plans and specifications;
- Requirements for project coordination meetings between LIRR and its representatives, the Construction Manager, Excavation Contractor, remedial or environmental subcontractors, and other involved parties;
- Description of the reporting requirements for quality assurance activities including such items as daily summary reports, schedule of data submissions, inspection data sheets, problem identification and corrective measures reports, evaluation reports, acceptance reports, and final documentation; and,
- Description of the final documentation retention provisions.

4.1.4 Community Air Monitoring Plan (CAMP)

During ground-intrusive work activities the requirements of the CAMP presented in **Appendix E** will be implemented. The CAMP requires real-time monitoring for VOCs and particulates (i.e., dust) at the downwind and upwind perimeter of the Site. 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 remediation work activities) from potential airborne contaminant releases as a direct result of remedial work activities. The action levels specified in the CAMP require increased monitoring, corrective actions to abate emissions, and/or work shutdown. Additionally, the CAMP documents that work activities did not spread contamination off-Site through the air.

4.1.5 Contractors Site Operations Plan (SOP)

The Remedial Engineer has reviewed all plans and submittals for this remedial project (including those listed above and contractor and sub-contractor document submittals) and confirms that they

are in compliance with this RAWP. 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 RAWP. All remedial documents will be submitted to NYSDEC and NYSDOH in a timely manner and prior to the start of work.

Detailed remedial construction design documents will be submitted to NYSDEC for approval prior to the start of work.

4.1.6 Citizen Participation Plan

A certification of mailing will be sent by the Participant 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 D**.

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

1. Queens Library

   Long Island City Branch

   37-44 21st Street

   Long Island City, NY 11101

   (718) 752-3700

   Hours: Mon: 9 AM to 8 PM, Tue: 1 PM to 6 PM, Wed: 10 AM to 6 PM, Thu: 12 PM to 8 PM, Fri: 10 AM to 6 PM, Sat: 10 AM to 5 PM, Sun: Closed

2. Hasan Ahmed

   NYSDEC Region 2

   Division of Environmental Remediation

47-40 21st St., First Fl.

Long Island City, NY 11104

(718) 482-6405

Hours: 8am – 4pm (call for appointment)

4.2 GENERAL REMEDIAL CONSTRUCTION INFORMATION

4.2.1 Project Organization

LIRR has contracted TRC to prepare this RAWP and provide remedial action design services associated with the RAWP. Site monitoring will be completed by LIRR and the TRC Remedial Engineer. The Contractor, who will be selected prior to remediation activities, will implement the Remedial Action. An organization chart of key TRC personnel involved in the Remedial Action is provided in Section 3 of the HASP in **Appendix E**. Resumes of key personnel involved in the Remedial Action are included in **Appendix G**.

4.2.2 Remedial Engineer

The Remedial Engineer for this project will be Kirsten Myers. 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 Site (Site No. 241222). The Remedial Engineer will certify in the FER that the remedial activities were observed by qualified environmental professionals under their supervision and that the remediation requirements set forth in the 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 RAWP.

The Remedial Engineer will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including pre-design investigation, injection to promote abiotic reduction of chlorinated ethenes, groundwater monitoring, air monitoring, emergency spill response services, 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 RAWP and will certify compliance in the FER.

The Remedial Engineer will provide the certifications listed in Section 10.1 in the FER.

4.2.3 Remedial Action Construction Schedule

A remediation schedule prepared by the contractor will be submitted to the NYSDEC prior to the start of work.

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 LIRR 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. The Yard is surrounded by a fence. The fences and gates will be closed and locked when there is no activity on site, and any breaks or gaps will be repaired immediately.

All personnel and visitors will be required to sign in and sign out upon arrival and departure. Personnel and visitors entering the Exclusion Zone will be required to have 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and participate in a medical surveillance program. A log of vehicles and equipment entering and leaving the Yard will be maintained. Warning signs will be placed approximately every 200 linear feet on the perimeter fence to alert passersby and discourage trespassing. At the Yard entrance and egress points, signs stating "Proper Personal Protective Equipment Must Be Worn," and "Restricted Area - No Unauthorized Access" will be posted. Signs stating "No Eating, Drinking or Smoking," will be posted at the entrance to the Exclusion Zone. Additionally, each access and egress point will be indexed with a unique number.

Within the limits of the area portion of the Site subject to this RAWP, work zones consisting of a Clean Zone, a Contaminant Reduction Zone, a Support Zone and an Exclusion Zone will be established. The Exclusion Zone will be located, at a minimum, adjacent to the area receiving injections of amendment and the mixing area. Should the injection area change, the location of this zone will also change.

Decontamination of trucks, hydraulic equipment and personnel will be performed within the limits of the Contaminant Reduction Zone.

The Clean Zone will be a contaminant-free area designated for visitors and/or remedial staff. Personal protective equipment will not be required in the Clean Zone. The office trailer, if required, would be located within the limits of the Clean Zone.

4.2.6 Traffic Control

A traffic control plan will be developed by the Contractor and submitted to the NYSDEC prior to the start of work.

4.2.7 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during the remedial activities, sampling will be performed on product and environmental media as appropriate. Chemical analyses will be for appropriate parameters (target analyte list [TAL] metals, target compound list [TCL] volatiles and semivolatiles, TCL pesticides, and/or PCBs). These analyses will not be limited to CP-51 parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

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

4.2.8 Worker Training and Monitoring

Any individual working on the Site which could potentially be exposed to site soil must have current certifications documenting OSHA 40-hour and 8-hour refresher HAZWOPER training and medical monitoring in accordance with 29 CFR 1910.120 (for work on hazardous waste sites). Contractors that may be exposed to site soil during intrusive work will maintain a medical monitoring and respiratory protection program and documentation for individuals who will perform ground intrusive-related work at the Site have appropriate training and that medical monitoring is being performed in accordance with the requirements of OSHA will be included as part of the Site-Specific HASP. Additionally, the Contractor's Site-Specific HASP will include a description and documentation of training, respirator fit testing, and medical monitoring for each individual proposed for Remedial Action work.

4.2.9 Agency Approvals

LIRR has addressed all State Environmental Quality Review Act (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.

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 will be developed and submitted to the NYSDEC prior to the start of work. 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 FER.

4.2.10 Pre-Construction Meeting with NYSDEC

A Pre-Construction meeting between the NYSDEC and LIRR will be scheduled prior to the start of construction activities. The purpose of the meeting will be to review the environmental conditions present at the Site and review the scope of the RAWP and design documents with involved parties. No additional meetings will be scheduled prior to implementation of the RAWP, unless specifically requested by the NYSDEC.

4.2.11 Emergency Contact Information

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

4.2.12 Remedial Action Costs

The total estimated cost of the Remedial Action is $575,000. An itemized and detailed summary of estimated costs for all remedial activity is attached as **Appendix H**. This will be revised based on actual costs and submitted as an Appendix to the FER.

4.3 SITE PREPARATION

4.3.1 Mobilization

Site mobilization activities by the remediation contractor will occur prior to initiation of the implementation of the site remediation. Staging areas for construction equipment and material storage and handling, decontamination areas and temporary facilities will be established in an area of the Yard, as approved by the LIRR.

4.3.2 Monitoring Well / 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 prior to remedial construction in accordance with NYSDEC policy CP-43.

4.3.3 Erosion and Sedimentation Controls

If required, the erosion and sediment controls will be in conformance with requirements presented in the New York State Standards and Specifications for Erosion and Sediment Control.

4.3.4 Utility Marker and Easements Layout

LIRR and its contractors are solely responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. LIRR and its contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. LIRR 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 RAWP. Approval of this 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 little to no risk or impediment to the planned work under this RAWP is posed by utilities or easements on the Site. If unknown utilities or easements are located or determined during the PDI, the feasibility of the remedy will be further evaluated.

4.3.5 Equipment and Material Staging

Equipment and material will be stored and staged in a manner that is consistent with local, State, and Federal regulations, as well as in accordance with the requirements of the New York State Standards and Specifications for Erosion and Sediment Control.

4.3.6 Decontamination Area

The Contractor will be required to perform decontamination of equipment and reusable materials to prevent contamination from exiting the Contaminant Reduction Zone.

The water used to decontaminate the equipment will be containerized and disposed off-site.

4.3.7 Site Fencing

The Site is surrounded by a fence. The fences and gates will be closed and locked when there is no activity on site, and any breaks or gaps will be repaired immediately.

4.3.8 Demobilization

Demobilization will include:

- Restoration of areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, 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 FER.

4.4.1 Daily Reports

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

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

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 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. Photographs and videos of work performed during the day will be included as appropriate. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public.

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 by the 10th day of the month 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., volume of solution injected, 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 Action 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 FER.

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

Complaints from the public regarding nuisance or other conditions will be addressed promptly. Complaints and the response to those complaints will be recorded in the daily reports. NYSDEC and NYSDOH will be notified of all odor events and of other complaints about the project.

4.4.5 Deviations from the RAWP

The process to be followed if there are any deviations from the RAWP, at a minimum, will include a written submission to the NYSDEC with the following information:

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

5.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

5.1 Fluids Management

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

6.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

Since residual contaminated soil and groundwater will exist beneath the Site after the remedy is complete, an Engineering Control and Institutional Controls will be required to protect human health and the environment. The existing blue stone surface cover will be maintained as a cover system Engineering Control to prevent exposure to residual contamination at the Site. Long-term management of Institutional Controls and of residual contamination will be executed under a Site-specific SMP that will be developed and included in the FER.

The FER will report residual contamination on the Site in tabular and map form. This will include presentation of exceedances of both Track 1 and Track 4 sites.

7.0 ENGINEERING CONTROLS

7.1 EXISTING BLUE STONE SURFACE COVER

Exposure to residual contaminated soils and groundwater will be prevented by maintaining the existing blue stone surface cover at the Site. A map showing the aerial distribution of the cover is included in **Figure 12**.

A Soil Management Plan will be included in the SMP and will outline the procedures to be followed in the event that the cover system and underlying residual contamination are disturbed after the Remedial Action is complete.

Maintenance of this cover system will be described in the SMP in the FER.

8.0 INSTITUTIONAL CONTROLS

8.1 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. It was determined an Environmental Easement would be appropriate in place of a soil cover cap since the Site is zoned for industrial use, there are no exceedances of Industrial Use SCOs in the upper 2 feet of Site soil, the Site is located behind a locked gate, and the presence of stone ballast prevents accidental exposure to Site soil. An Environmental Easement approved by NYSDEC will be filed and recorded with the New York City County Office of the City Register. The Environmental Easement will be submitted as part of the FER.

The Environmental Easement renders the Site a Controlled Property. The Environmental Easement must be recorded with the New York City County Office of the City Register before the COC 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 of the subsurface soil and restricting the use of the Site to Industrial uses only. 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 SMP, 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;
- Groundwater and other environmental or public health monitoring must be performed as 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, 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 SMP (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 SMP;
- The Controlled Property may be used for Industrial use only, provided the long-term Engineering and Institutional Controls included in the SMP are employed;
- The Controlled Property may not be used for a higher level of use, such as restricted residential 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 annual statement must be certified by an expert that the NYSDEC finds acceptable.

8.2 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation, as necessary, and begins with the approval of the FER and issuance of the COC for the Remedial Action. The SMP is submitted as part of the FER 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 SMP are performed.

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 Order on Consent with the NYSDEC. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls (EC/ICs); (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. The SMP 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 SMP in the FER will include a monitoring plan for groundwater at the down-gradient Site perimeter to evaluate Site -wide performance of the remedy. Appropriately placed groundwater

monitor wells will also be installed immediately down-gradient of all VOC remediation areas for the purpose of evaluation of the effectiveness of the remedy that is implemented. Additionally, the evaluation for potential indoor air impacts via soil vapor intrusion whenever there is a change in use and/or any occupied buildings with soil vapor intrusion pathways are constructed at the Site will be required in the SMP.

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

9.0 FINAL ENGINEERING REPORT

A FER will be submitted to NYSDEC following implementation of the Remedial Action defined in this RAWP. The FER provides the documentation that the remedial work required under this 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 chemical injections at the Site including the surveyed map(s) of all injection points. The FER will include as-built drawings for all constructed elements, calculation for injection rates, manifests, bills of lading as well as the complete SMP (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 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 SMP and Environmental Easement. This determination will be made by NYSDEC in the context of the FER review.

The FER 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 Site after the remedy is complete. Residual contamination includes all contamination that exceeds the Track 1 Unrestricted Use SCO in 6NYCRR 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 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 FER 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 COC, all project reports must be submitted in digital form on electronic media (PDF).

9.1 CERTIFICATIONS

Certification will appear in front of the Executive Summary of the Final Engineering Report and will follow the current FER template to be provided by NYSDEC. The certification will be signed by the Remedial Engineer, Kirsten Myers, who is a Professional Engineer registered in New York State. This certification will be appropriately signed and stamped.

10.0 SCHEDULE

The Remedial Action will be implemented following the completion of the pre-design investigation and treatability study. The draft schedule for the completion of the pre-design investigation and treatability study through the Remedial Action is included as Appendix I. It is anticipated that the injection activities would be conducted in approximately six (6) months following approval of the Remedial Design documents by the NYSDEC. Following completion of the initial injection event, groundwater sampling and monitoring will be performed to determine the efficacy of the treatment. Annual groundwater sampling will be conducted during the remedy to refine loading calculations for the second and third injection events. A total of seven (7) years of groundwater sampling and reporting has been assumed to be required to satisfy the SCGs and the RAOs for groundwater, soil, and soil vapor. The NYSDEC will be provided notification of any changes to the schedule.

TABLES

FIGURES

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

APPENDIX F

APPENDIX G

APPENDIX H

APPENDIX I

TABLES

Table 1
Long Island Rail Road
Arch Street Yard RAWP
Remedial Investigation Scope Summary

Investigation Method/Media	Sample Point ID	Completion Depth Below Grade (feet)	No. of Samples Selected for Analysis	Sample Depth Below Grade (feet)	Analysis [1]								Installation/ Sample Date	Comments/Deviations from Work Plan	Sample Point Objectives
					TCL VOCs	TCL SVOCs	1-4-dioxane	PCBs	TCL Pesticides	TCL Herbicides	TAL Metals	TCL PFAS			
Remedial Investigation - First Phase (Completed)															
Verification Borings/ Subsurface Soil	VB-01	27	1	13-15	X	--	--	--	--	--	--	--	10/30/2015	Refusal encountered at 27 feet below grade.	Collect soil samples to verify the results of the MIP study.
	VB-02	26.5	1	12-14	X	--	--	--	--	--	--	--	10/30/2015	Refusal encountered at 26.5 feet below grade.	
Verification Borings/ Groundwater	VB-01	27	2	15-16, 26-27	X	--	--	--	--	--	--	--	10/30/2015	Refusal encountered at 27 feet below grade.	Collect groundwater samples to verify the results of the MIP study.
	VB-02	26.5	2	5, 12-14	X	--	--	--	--	--	--	--	10/30/2015	Refusal encountered at 26.5 feet below grade.	
Remedial Investigation - Second Phase (Completed)															
Deep Soil Borings/ Subsurface Soil	SB-01	25	2	13-15, 23-25	X	X	--	--	--	--	--	--	3/16/2016	--	Characterize soil and collect soil samples to define the limits of the contaminated area, with the primary contaminants of concern being VOCs.
	SB-02	25	2	13-15, 23-25	X	X	--	--	--	--	--	--	3/17/2016	--	
	SB-03	25	2	12-14	X	X	--	X	X	--	X	--	3/17/2016	Moved 4 feet south of planned location due to presence of underground utilities.	
				18-20	X	X	--	--	--	--	--	--			
	SB-04	29	3	3-5	X	X	--	X	X	--	X	--	3/16/2016	Refusal encountered at 29 feet below grade.	
				10-12, 27-29	X	X	--	--	--	--	--	--			
	SB-05	25	2	10-11	X	X	--	X	X	--	X	--	3/16/2016	Blind duplicate collected for sample at 10-11'.	
				11-13	X	X	--	--	--	--	--	--			
	SB-06	25	2	8-10	X	X	--	X	X	--	X	--	3/17/2016	--	
				11-13	X	X	--	--	--	--	--	--			
	SB-07	25	2	12-14	X	X	--	X	X	--	X	--	3/18/2016	--	
				23-25	X	X	--	--	--	--	--	--			
	SB-08	25	3	4-6, 6-8, 13-15	X	X	--	--	--	--	--	--	3/17/2016	--	
Remedial Investigation - Second Phase (Completed)															
Shallow PCB Soil Borings/ Subsurface Soil	SB-09	8	4	0-1, 2-3 4-5, 7-8	--	--	--	X	--	--	--	--	3/18/2016	Top of boring below 24" of bluestone. Moved 5 feet north of planned location due to presence of underground utilities.	Characterize soil and collect soil samples for PCB analysis to define the limits of shallow soil PCB contamination, identified in 2000.
	SB-10	8	4	0-1, 2-3 4-5, 7-8	--	--	--	X	--	--	--	--	3/18/2016	Top of boring below 18" of bluestone. Blind duplicate collected for sample at 45'. Moved southeast of planned	
	SB-11	8	4	0-1, 2-3 4-5, 7-8	--	--	--	X	--	--	--	--	3/18/2016	Top of boring below 24" of bluestone.	
	SB-12	6	3	0-1, 2-3 5-6	--	--	--	X	--	--	--	--	3/21/2016	Top of boring below 3" of bluestone. Moved 4 feet west of planned location	
	SB-13	6	3	0-1, 2-3 5-6	--	--	--	X	--	--	--	--	3/21/2016	Top of boring below 24" of bluestone. Blind duplicate collected for sample at	
	SB-14	6	3	0-1, 2-3 5-6	--	--	--	X	--	--	--	--	3/21/2016	Top of boring below 24" of bluestone.	
	SB-15	6	3	0-1, 2-3 5-6	--	--	--	X	--	--	--	--	3/18/2016	Top of boring below 24" of bluestone. Moved north of planned location due to	
	SB-16	6	3	0-1, 2-3 5-6	--	--	--	X	--	--	--	--	3/18/2016	Top of boring below 12" of bluestone. Moved 5 feet north of planned location	
	SB-17	6	3	0-1, 2-3 5-6	--	--	--	X	--	--	--	--	3/18/2016	Top of boring below 12" of bluestone. Moved 8 feet west of planned location	

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					TCL VOCs	TCL SVOCs	1-4-dioxane	PCBs	TCL Pesticides	TCL Herbicides	TAL Metals	TCL PFAS			
Remedial Investigation - Second Phase (Completed)															
Groundwater Monitoring Well Borings/ Subsurface Soil	GW-01 (upgradient)	20	3	4-5, 18-20	X	X	--	--	--	--	--	--	3/21/2016	--	Determine background concentrations of contaminants of concern.
				13-15	X	X	--	X	X	--	X	--			
	GW-02	--	--	--	--	--	--	--	--	--	--	--	--	Soil samples not collected since soil boring VB-01 was previously completed	Determine the presence and extent of soil contamination.
	GW-03	20	3	3-4, 18-20	X	X	--	--	--	--	--	--	3/21/2016	--	
				12-14	X	X	--	X	X	--	X	--			
	GW-04	19	3	2-3, 16-18	X	X	--	--	--	--	--	--	3/23/2016	Top of boring below 24" of bluestone. Refusal encountered at depth of 19 feet. Blind duplicate collected for	
				12-14	X	X	--	X	X	--	X	--			
Newly Installed Groundwater Monitoring Wells/ Groundwater	GW-01 (upgradient)	20	1	Screen interval 10-20	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Installed on 3/22/2016 Developed on 3/24/2016	Determine the presence or absence of contaminants of concern within upgradient groundwater. Confirm groundwater flow direction and the
	GW-02S	7	1	Screen interval 2-7	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Installed on 3/22/2016 Developed on 3/25/2016	Determine the presence and extent of downgradient groundwater contamination. Confirm groundwater flow direction and the influence of the East River and Newtown Creek.
	GW-02D	20	1	Screen interval 10-20	X	X	--	X	X	--	X	--	Sampled 4/7/2016	Installed on 3/22/2016 Developed on 3/24/2016	
	GW-03	19	1	Screen interval 9-19	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Installed on 3/21/2016 Developed on 3/24/2016	
	GW-04S	8	1	Screen interval 3-8	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Installed on 3/23/2016 Developed on 3/25/2016	
	GW-04D	18	1	Screen interval 8-18	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Installed on 3/23/2016 Developed on 3/25/2016	
Existing Groundwater Monitoring Wells/ Groundwater	MW-1	N/A	1	Well depth 12.6	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Developed on 3/24/2016. Blind duplicate collected.	Determine the presence and extent of downgradient groundwater contamination. Confirm groundwater flow direction and the influence of the East River and Newtown Creek.
	MW-2	N/A	1	Well depth 6.85	X	X	--	--	--	--	--	--	Sampled 4/7/2016	Developed on 3/25/2016	
	MW-3	N/A	1	Well depth 12.75	X	X	--	X	X	--	X	--	Sampled 4/7/2016	Developed on 3/24/2016	

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					TCL VOCs	TCL SVOCs	1-4-dioxane	PCBs	TCL Pesticides	TCL Herbicides	TAL Metals	TCL PFAS			
Remedial Investigation - Third Phase (Completed)															
Soil Vapor Probes and Indoor/ Ambient Air	SV-01	2.7	1	Screen interval 2.2-2.7	X	--	--	--	--	--	--	--	8/17/2016	Outside soil vapor probe.	Determine if soil vapor intrusion is a potential exposure pathway.
	SV-02	4.4	1	Screen interval 3.9-4.4	X	--	--	--	--	--	--	--	8/17/2016	Outside soil vapor probe. Completed within area of soil and groundwater chlorinated VOC contamination.	
	SV-03	4.8	1	Screen interval 4.3-4.8	X	--	--	--	--	--	--	--	8/17/2016	Outside soil vapor probe.	
	SV-04	4.4	1	Screen interval 3.9-4.4	X	--	--	--	--	--	--	--	8/17/2016	Outside soil vapor probe.	
	SV-05	4.5	1	Screen interval 4-4.5	X	--	--	--	--	--	--	--	8/17/2016	Outside soil vapor probe.	
	SV-06	Below Building Slab	1	Below Building Slab	X	--	--	--	--	--	--	--	8/17/2016	Sub-slab soil vapor sample collected in office area of LIRR Engineering Support Building.	
	SV-06(R)	Below Building Slab	1	Below Building Slab	X	--	--	--	--	--	--	--	2/22/2017	Recollected during the heating season at the request of NYSDEC.	
	IA-01	N/A	1	N/A	X	--	--	--	--	--	--	--	8/17/2016	Collected in office area of LIRR Engineering Support Building.	
	IA-01(R)	N/A	1	N/A	X	--	--	--	--	--	--	--	2/22/2017	Recollected during the heating season at the request of NYSDEC.	
	AA-01	N/A	1	N/A	X	--	--	--	--	--	--	--	8/17/2016	Outdoor ambient air sample collected upwind of soil vapor/indoor air sampling area.	
	AA-01(R)	N/A	1	N/A	X	--	--	--	--	--	--	--	2/22/2017	Recollected during the heating season at the request of NYSDEC.	
Remedial Investigation - Fourth Phase (Completed)															
Existing Groundwater Monitoring Wells/ Groundwater	MW-1	N/A	1	Well depth 12.6	--	--	X	--	--	--	--	X	10/2018	-	Determine the presence of emerging contaminants (PFAS & 1-4 dioxane) in groundwater.
	MW-2	N/A	1	Well depth 6.85	--	--	X	--	--	--	--	X	10/2018	-	
	MW-3	N/A	1	Well depth 12.75	--	--	X	--	--	--	--	X	10/2018	-	

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					TCL VOCs	TCL SVOCs	1-4-dioxane	PCBs	TCL Pesticides	TCL Herbicides	TAL Metals	TCL PFAS			
Remedial Investigation - Fifth Phase (Completed)															
Verification Borings/ Surface Soil	TRC-SB-01	32*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	Determine the presence and extent of contaminants of concern in surface soil..
	TRC-SB-02	26*	1	N/A	X	X	X	X	X	X	X	X	12/9/2021	--	
	TRC-SB-03	31*	1	N/A	X	X	X	X	X	X	X	X	12/9/2021	--	
	TRC-SB-04	28*	1	N/A	X	X	X	X	X	X	X	X	12/9/2021	--	
	TRC-SB-05	33*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-06	29*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-07	27*	1	N/A	X	X	X	X	X	X	X	X	12/9/2021	--	
	TRC-SB-08	30*	1	N/A	X	X	X	X	X	X	X	X	12/9/2021	--	
	TRC-SB-09	29*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-10	27*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-11	42*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-12	42*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-13	27*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-14	28*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	
	TRC-SB-15	29*	1	N/A	X	X	X	X	X	X	X	X	12/8/2021	--	

Notes:

X: Sample selected for analysis.

--: Sample not selected for analysis.

N/A: Not available

* - Indicates sampling depth is in inches

As per Work Plan, approximately 20% of the soil and groundwater samples collected from the soil borings and groundwater monitoring wells during Phases 1, 2 and 3 were analyzed for TAL metals, PCBs and pesticides in addition to VOC and SVOCs, biased toward visually impacted samples. Analytical methods were as follows

Target Compound List (TCL) Volatile Organic Compounds (VOCs) by EPA Methods 5035 and 8260 for soil samples, EPA Method 8260 for groundwater samples and EPA Method TO-15 for air samples. TCL Semivolatile Organic Compounds (SVOCs) by EPA Method 8270.

Polychlorinated Biphenyls (PCBs) by EPA Method 8082.

TCL Pesticides by EPA Method 8081.

Target Analyte List (TAL) metals by EPA Method 6010.

Table 2
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Volatile Organic Compounds (VOCs)

			SAMPLE ID:	VB-01(13-15)		VB-02(12-14)		SB-01(13-15)		SB-01(23-25)		SB-02(13-15)		SB-02(23-25)		SB-03(12-14)		SB-03(18-20)		SB-04(3-5)		SB-04(10-12)		SB-04(27-29)	
			SAMPLING DATE:	10/30/2015		10/30/2015		3/16/2016		3/16/2016		3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/16/2016		3/16/2016		3/16/2016	
			START DEPTH (ft. bgs):	13		12		13		23		13		23		12		18		3		10		27	
			END DEPTH (ft. bgs):	15		14		15		25		15		25		14		20		5		12		29	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1,1-Trichloroethane	680	100000	1000000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,1,2,2-Tetrachloroethane	600	--	--	66900	U	7.6	U	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	4.6	J+	10.1	U	5.1	U
1,1,2-Trichloroethane	--	--	--	66900	U	7.6	UJ	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,1,2-Trichlorotrifluoroethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,1-Dichloroethane	270	26000	480000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,1-Dichloroethene	330	100000	1000000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,2,3-Trichlorobenzene	--	--	--	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	UJ	10.1	U	5.1	U
1,2,4-Trichlorobenzene	--	--	--	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	UJ	10.1	U	5.1	U
1,2-Dibromo-3-Chloropropane	--	--	--	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	UJ	10.1	U	5.1	U
1,2-Dibromoethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,2-Dichlorobenzene	--	100000	1000000	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	UJ	10.1	U	5.1	U
1,2-Dichloroethane	20	3100	60000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,2-Dichloropropane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
1,3-Dichlorobenzene	--	49000	560000	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	UJ	10.1	U	5.1	U
1,4-Dichlorobenzene	--	13000	250000	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	UJ	10.1	U	5.1	U
1,4-Dioxane	--	13000	250000	1338700	U	150	U	--		--		--		--		--		--		--		--		--	
2-Butanone	--	100000	1000000	334700	U	37.8	U	42.9	U	21.2	U	9.6	J	22.7	U	5.5	J	23.8	U	8.9	J	9.9	J	25.6	U
2-Hexanone	--	--	--	334700	U	37.8	U	42.9	U	21.2	U	53.3	U	22.7	U	28.7	U	23.8	U	27.7	U	50.4	U	25.6	U
4-Methyl-2-Pentanone	--	--	--	334700	U	37.8	U	42.9	U	21.2	U	53.3	U	22.7	U	28.7	U	23.8	U	27.7	U	50.4	U	25.6	U
Acetone	--	100000	1000000	334700	U	63.4		15.4	J	9.1	J	37.4	J	22.7	U	40.3		12.6	J	57		68.7		25.6	U
Benzene	--	4800	89000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	1.4	J	10.1	U	5.1	U
Bromochloromethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Bromodichloromethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Bromoform	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Bromomethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Carbon Disulfide	--	--	--	66900	U	49.4		8.9	J	4.2	U	11.3	J	4.5	U	5.7	U	2.6	J	5.5	U	10.1	U	5.1	U
Carbon Tetrachloride	760	2400	44000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Chlorobenzene	--	100000	1000000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Chloroethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Chloroform	370	49000	700000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Chloromethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
cis-1,2-Dichloroethene	250	100000	1000000	66900	U	40.4		5	J	1.3	J	7.3	J	1.1	J	5.7	U	4.8	U	12.5		43.4		5.1	U
cis-1,3-Dichloropropene	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Cyclohexane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Dibromochloromethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Dichlorodifluoromethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Ethyl Benzene	--	41000	780000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Isopropylbenzene	--	--	--	66900	U	7.6	UJ	8.6	UJ	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	4.8	J+	10.1	U	5.1	U
m/p-Xylenes	--	100000	1000000	133900	U	15.1	U	17.4	U	8.5	U	21.3	U	9.1	U	11.5	U	9.5	U	11.1	U	20.2	U	10.2	U
Methyl Acetate	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Methyl tert-butyl Ether	--	100000	1000000	66900	U	6.5	J	2.5	J	4.2	U	51.3		4.5	U	5.7	U	4.8	U	5.5	U	35.5		1.1	J
Methylcyclohexane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Methylene Chloride	50	100000	1000000	66900	U	1.8	J	7.9	UB	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
o-Xylene	--	100000	1000000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	1.4	J	10.1	U	5.1	U
Styrene	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
t-1,3-Dichloropropene	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Tetrachloroethene	1,300	19000	300000	**1160900**		6		8.6	U	4.2	U	10.7	U	3	J	5.7	U	4.8	U	19.6		10.5		1.1	J
Toluene	--	100000	1000000	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
trans-1,2-Dichloroethene	190	100000	1000000	66900	U	2.2	J	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Trichloroethene	470	21000	400000	66900	U	2.7	J	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	2.9	J	10.1	U	5.1	U
Trichlorofluoromethane	--	--	--	66900	U	7.6	U	8.6	U	4.2	U	10.7	U	4.5	U	5.7	U	4.8	U	5.5	U	10.1	U	5.1	U
Vinyl Chloride	20	900	27000	66900	U	7.6	U	8.6	U	1.5	J	7.7	J	4.5	U	5.7	U	4.8	U	6		6.2	J	5.1	U
Total Volatile Organic Compounds	--	--	--	1160900		172.4		39.7		12		125		4		46		15		119.1		174.2		2.2	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
UB: Not detected based on blank results
J+: Estimated bias high
D: Reported from secondary dilution
E: Exceeded calibration range estimated value
J: Estimated value or detection limits
--: No standard
Bolded values exceed Protection of Groundwater SCO (only compared to chlorinated VOCs per NYSDEC)
Highlighted values exceed the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 2
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Volatile Organic Compounds (VOCs)

			SAMPLE ID:	SB-05(10-11)		SB-05(10-11)BD		SB-05(11-13)		SB-06(8-10)		SB-06(11-13)		SB-07(12-14)		SB-07(23-25)		SB-08(4-6)		SB-08(6-8)		SB-08(13-15)		GW-01(4-5)	
			SAMPLING DATE:	3/16/2016		3/16/2016		3/16/2016		3/17/2016		3/17/2016		3/18/2016		3/18/2016		3/17/2016		3/17/2016		3/17/2016		3/21/2016	
			START DEPTH (ft. bgs):	10		10		11		8		11		12		23		4		6		13		4	
			END DEPTH (ft. bgs):	11		11		13		10		13		14		25		6		8		15		5	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1,1-Trichloroethane	680	100000	1000000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,1,2,2-Tetrachloroethane	600	--	--	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,1,2-Trichloroethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,1,2-Trichlorotrifluoroethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,1-Dichloroethane	270	26000	480000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,1-Dichloroethene	330	100000	1000000	5.3	U	5	U	8.7		6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,2,3-Trichlorobenzene	--	--	--	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,2,4-Trichlorobenzene	--	--	--	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,2-Dibromo-3-Chloropropane	--	--	--	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,2-Dibromoethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,2-Dichlorobenzene	--	100000	1000000	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,2-Dichloroethane	20	3100	60000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,2-Dichloropropane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
1,3-Dichlorobenzene	--	49000	560000	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,4-Dichlorobenzene	--	13000	250000	5.3	U	5	U	7.6	UJ	6.2	U	6.2	U	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
1,4-Dioxane	--	13000	250000	--		--		--		--		--		--		--		--		--		--		--	
2-Butanone	--	100000	1000000	3.8	J	5.9	J	15.1	J	4.4	J	5.2	J	28.7	U	21.7	U	51.5	U	24.9	U	24.3	U	28.9	UJ
2-Hexanone	--	--	--	26.6	U	25.1	U	37.8	U	4	J	31	U	28.7	U	21.7	U	51.5	U	24.9	U	24.3	U	28.9	UJ
4-Methyl-2-Pentanone	--	--	--	26.6	U	25.1	U	37.8	U	3.1	J	31	U	28.7	U	21.7	U	51.5	U	24.9	U	24.3	U	10.9	J+
Acetone	--	100000	1000000	15.8	J	27.4		75		16.6	J	33.4		17.1	J	13.9	J	140		29.7		14.2	J	30.8	J+
Benzene	--	4800	89000	5.3	U	5	U	2.4	J	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Bromochloromethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Bromodichloromethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Bromoform	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Bromomethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Carbon Disulfide	--	--	--	5.3	U	6.2	J	37.9	J	2.3	J	6.2	U	5.7	U	4.3	U	4.6	J	1.3	J	1.2	J	5.8	UJ
Carbon Tetrachloride	760	2400	44000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Chlorobenzene	--	100000	1000000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Chloroethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Chloroform	370	49000	700000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Chloromethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
cis-1,2-Dichloroethene	250	100000	1000000	**880**	**JD**	180	JD	**3400**	**JD**	**1600**	**D**	6.1	J	1.6	J	1.4	J	5.8	J	4.6	J	4.9	U	5.8	UJ
cis-1,3-Dichloropropene	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Cyclohexane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Dibromochloromethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Dichlorodifluoromethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Ethyl Benzene	--	41000	780000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Isopropylbenzene	--	--	--	5.3	U	5	U	7.6	UJ	6.2	U	1.4	J	5.7	U	4.3	U	10.3	UJ	5	UJ	4.9	U	5.8	UJ
m/p-Xylenes	--	100000	1000000	10.6	U	10.1	U	15.1	U	12.5	U	12.4	U	11.5	U	8.7	U	17.4	U	10	U	9.7	U	11.8	UJ
Methyl Acetate	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Methyl tert-butyl Ether	--	100000	1000000	2.8	J	1.3	J	26.7		6.2	U	6.2	U	4.2	J	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Methylcyclohexane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Methylene Chloride	50	100000	1000000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	UB	5.1	UB	35.2		5	U	4.9	U	5.8	UJ
o-Xylene	--	100000	1000000	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Styrene	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
t-1,3-Dichloropropene	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Tetrachloroethene	1,300	19000	300000	**20900**	**JD**	**7000**	**JD**	**31300**	**D**	1300	D	2	J	2.8	J	2.1	J	10.3	U	3.6	J	4.9	U	5.8	UJ
Toluene	--	100000	1000000	5.3	U	5	U	2.7	J	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
trans-1,2-Dichloroethene	190	100000	1000000	100	J	75.3	J	190	EJ	15.2	J	6.2	U	2.8	J	1.4	J	10.3	U	5	U	4.9	U	5.8	UJ
Trichloroethene	470	21000	400000	400	JD	81	JD	**2600**	**JD**	22.2	J	6.2	U	1.9	J	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Trichlorofluoromethane	--	--	--	5.3	U	5	U	7.6	U	6.2	U	6.2	U	5.7	U	4.3	U	10.3	U	5	U	4.9	U	5.8	UJ
Vinyl Chloride	20	900	27000	**560**	**JD**	**120**	**JD**	**2200**	**JD**	**410**	**JD**	2.2	J	5.7	U	4.3	U	10.3	U	4.8	J	4.9	U	5.8	UJ
Total Volatile Organic Compounds	--	--	--	22862		7497		39669		3378		50.3		33.1		23.9		185.6		44		15.4		41.7	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
UB: Not detected based on blank results
J+: Estimated bias high
D: Reported from secondary dilution
E: Exceeded calibration range estimated value
J: Estimated value or detection limits
--: No standard
Bolded values exceed Protection of Groundwater SCO (only compared to chlorinated VOCs per NYSDEC)
Highlighted values exceed the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 2
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Volatile Organic Compounds (VOCs)

			SAMPLE ID:	GW-01(13-15)		GW-01(18-20)		GW-03(3-4)		GW-03(12-14)		GW-03(18-20)		GW-04(2-3)		GW-04(12-14)		GW-04(12-14)BD		GW-04(16-18)	
			SAMPLING DATE:	3/21/2016		3/21/2016		3/21/2016		3/21/2016		3/21/2016		3/23/2016		3/23/2016		3/23/2016		3/23/2016	
			START DEPTH (ft. bgs):	13		18		3		12		18		2		12		12		16	
			END DEPTH (ft. bgs):	15		20		4		14		20		3		14		14		18	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1,1-Trichloroethane	680	100000	1000000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,1,2,2-Tetrachloroethane	600	--	--	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,1,2-Trichloroethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,1,2-Trichlorotrifluoroethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,1-Dichloroethane	270	26000	480000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,1-Dichloroethene	330	100000	1000000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,2,3-Trichlorobenzene	--	--	--	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,2,4-Trichlorobenzene	--	--	--	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,2-Dibromo-3-Chloropropane	--	--	--	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,2-Dibromoethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,2-Dichlorobenzene	--	100000	1000000	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,2-Dichloroethane	20	3100	60000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,2-Dichloropropane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
1,3-Dichlorobenzene	--	49000	560000	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,4-Dichlorobenzene	--	13000	250000	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
1,4-Dioxane	--	13000	250000	--		--		--		--		--		--		--		--		--	
2-Butanone	--	100000	1000000	4.3	J	21.5	U	22.3	U	46.1	U	25.4	U	24.3	U	32.5	U	35.2	U	22.4	U
2-Hexanone	--	--	--	24.7	U	21.5	U	22.3	U	46.1	U	25.4	U	24.3	U	32.5	U	35.2	U	22.4	U
4-Methyl-2-Pentanone	--	--	--	24.7	U	21.5	U	22.3	U	46.1	U	25.4	U	24.3	U	32.5	U	35.2	U	22.4	U
Acetone	--	100000	1000000	22	J	12.4	J	20	J	60.7	J	28.5	J	22.7	J	14.1	J	18.7	J	9.7	J
Benzene	--	4800	89000	4.9	U	4.3	U	1.6	J	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Bromochloromethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Bromodichloromethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Bromoform	--	--	--	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
Bromomethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Carbon Disulfide	--	--	--	4.9	U	4.3	U	4.5	U	43.5		5.1	U	4.9	U	3.2	J	10.2	J	2.7	J
Carbon Tetrachloride	760	2400	44000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Chlorobenzene	--	100000	1000000	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
Chloroethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Chloroform	370	49000	700000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Chloromethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
cis-1,2-Dichloroethene	250	100000	1000000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
cis-1,3-Dichloropropene	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Cyclohexane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Dibromochloromethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Dichlorodifluoromethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Ethyl Benzene	--	41000	780000	4.9	U	4.3	U	0.97	J+	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Isopropylbenzene	--	--	--	4.9	U	4.3	U	1.4	J+	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
m/p-Xylenes	--	100000	1000000	9.9	U	8.6	U	3.1	J+	18.4	U	10.2	U	9.7	U	13	U	14.1	U	9	U
Methyl Acetate	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Methyl tert-butyl Ether	--	100000	1000000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Methylcyclohexane	--	--	--	4.9	U	4.3	U	8		9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Methylene Chloride	50	100000	1000000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	3.3	J	7.5		7	U	5.1	
o-Xylene	--	100000	1000000	4.9	U	4.3	U	2.9	J+	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Styrene	--	--	--	4.9	U	4.3	U	4.5	UJ	9.2	U	5.1	U	4.9	UJ	6.5	U	7	U	4.5	U
t-1,3-Dichloropropene	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Tetrachloroethene	1,300	19000	300000	4.9	U	4.3	U	3	J+	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Toluene	--	100000	1000000	4.9	U	4.3	U	2.4	J	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
trans-1,2-Dichloroethene	190	100000	1000000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Trichloroethene	470	21000	400000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Trichlorofluoromethane	--	--	--	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Vinyl Chloride	20	900	27000	4.9	U	4.3	U	4.5	U	9.2	U	5.1	U	4.9	U	6.5	U	7	U	4.5	U
Total Volatile Organic Compounds	--	--	--	26.3		12.4		43.37		104.2		28.5		26		24.8		28.9		17.5	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
UB: Not detected based on blank results
J+: Estimated bias high
D: Reported from secondary dilution
E: Exceeded calibration range estimated value
J: Estimated value or detection limits
--: No standard
Bolded values exceed Protection of Groundwater SCO (only compared to chlorinated VOCs per NYSDEC)
Highlighted values exceed the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 3
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Semivolatile Organic Compounds (SVOCs)

			SAMPLE ID:		SB-01(13-15)		SB-01(23-25)		SB-02(13-15)		SB-02(23-25)		SB-03(12-14)		SB-03(18-20)		SB-04(3-5)		SB-04(10-12)		SB-04(27-29)		SB-05(10-11)	
			SAMPLING DATE:		3/16/2016		3/16/2016		3/17/2016		3/17/2016		3/17/2016		3/17/2016		3/16/2016		3/16/2016		3/16/2016		3/16/2016	
			START DEPTH (ft. bgs):		13		23		13		23		12		18		3		10		27		10	
			END DEPTH (ft. bgs):		15		25		15		25		14		20		5		12		29		11	
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1-Biphenyl	--	--	550	U	370	U	580	U	380	U	410	U	380	U	300	J	570	U	370	U	400	U
1,2,4,5-Tetrachlorobenzene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
1,4-Dioxane	13000	250000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,2-oxybis(1-Chloropropane)	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,3,4,6-Tetrachlorophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,4,5-Trichlorophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,4,6-Trichlorophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,4-Dichlorophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,4-Dimethylphenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	100	J	570	U	370	U	400	U
2,4-Dinitrophenol	--	--	550	UJ	370	UJ	580	UJ	380	UJ	410	UJ	380	UJ	400	UJ	570	UJ	370	UJ	400	UJ
2,4-Dinitrotoluene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2,6-Dinitrotoluene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2-Chloronaphthalene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2-Chlorophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2-Methylnaphthalene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	990		570	U	370	U	400	U
2-Methylphenol	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2-Nitroaniline	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
2-Nitrophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
3,3-Dichlorobenzidine	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
3+4-Methylphenols	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
3-Nitroaniline	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4,6-Dinitro-2-methylphenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4-Bromophenyl-phenylether	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4-Chloro-3-methylphenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4-Chloroaniline	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4-Chlorophenyl-phenylether	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4-Nitroaniline	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
4-Nitrophenol	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Acenaphthene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	2300		570	U	370	U	400	U
Acenaphthylene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Acetophenone	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Anthracene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	5600	D	570	U	370	U	400	U
Atrazine	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Benzaldehyde	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Benzo(a)anthracene	1000	11000	550	U	370	U	580	U	380	U	410	U	380	U	**5300**	**D**	570	U	370	U	400	U
Benzo(a)pyrene	1000	1100	550	U	370	U	580	U	380	U	410	U	380	U	**2900**		570	U	370	U	400	U
Benzo(b)fluoranthene	1000	11000	550	U	370	U	580	U	380	U	410	U	380	U	**4000**	**D**	570	U	370	U	400	U
Benzo(g,h,i)perylene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	1500		570	U	370	U	400	U
Benzo(k)fluoranthene	3900	110000	550	U	370	U	580	U	380	U	410	U	380	U	1100		570	U	370	U	400	U
bis(2-Chloroethoxy)methane	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
bis(2-Chloroethyl)ether	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Bis(2-ethylhexyl)phthalate	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Butylbenzylphthalate	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Caprolactam	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Carbazole	--	--	550	U	370	U	580	U	380	U	410	U	380	U	1600		570	U	370	U	400	U
Chrysene	3900	110000	550	U	370	U	580	U	380	U	410	U	380	U	3800	JD	570	U	370	U	400	U
Dibenzo(a,h)anthracene	330	1100	550	U	370	U	580	U	380	U	410	U	380	U	**430**		570	U	370	U	400	U
Dibenzofuran	59000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	1900		570	U	370	U	400	U
Diethylphthalate	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Dimethylphthalate	--	--	1000		550		1000		620		660		620		520		890		580		660	
Di-n-butylphthalate	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Di-n-octyl phthalate	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Fluoranthene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	10000	D	570	U	370	U	84.3	J
Fluorene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	2700		570	U	370	U	400	U
Hexachlorobenzene	1200	12000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Hexachlorobutadiene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Hexachlorocyclopentadiene	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Hexachloroethane	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Indeno(1,2,3-cd)pyrene	500	11000	550	U	370	U	580	U	380	U	410	U	380	U	**1900**		570	U	370	U	400	U
Isophorone	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Naphthalene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	1400		570	U	370	U	400	U
Nitrobenzene	15000	140000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
n-Nitroso-di-n-propylamine	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
n-Nitrosodiphenylamine	--	--	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Pentachlorophenol	6700	55000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Phenanthrene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	17100	D	570	U	370	U	400	U
Phenol	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	400	U	570	U	370	U	400	U
Pyrene	100000	1000000	550	U	370	U	580	U	380	U	410	U	380	U	7500	D	570	U	370	U	91.6	J
Total Semivolatile Compounds	--	--	1000		550		1000		620		660		620		72940		890		580		835.9	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
D: Reported from secondary dilution
J: Estimated value or detection limits
--: No standard
Highlighted and bolded values exceeded the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 3
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Semivolatile Organic Compounds (SVOCs)

			SAMPLE ID:		SB-05(10-11) BD		SB-05(11-13)		SB-06(8-10)		SB-06(11-13)		SB-07(12-14)		SB-07(23-25)		SB-08(4-6)		SB-08(6-8)		SB-08(13-15)		GW-01(4-5)	
			SAMPLING DATE:		3/16/2016		3/16/2016		3/17/2016		3/17/2016		3/18/2016		3/18/2016		3/17/2016		3/17/2016		3/17/2016		3/21/2016	
			START DEPTH (ft. bgs):		10		11		8		11		12		23		4		6		13		4	
			END DEPTH (ft. bgs):		11		13		10		13		14		25		6		8		15		5	
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1-Biphenyl	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
1,2,4,5-Tetrachlorobenzene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
1,4-Dioxane	13000	250000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,2-oxybis(1-Chloropropane)	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,3,4,6-Tetrachlorophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,4,5-Trichlorophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,4,6-Trichlorophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,4-Dichlorophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,4-Dimethylphenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,4-Dinitrophenol	--	--	390	UJ	490	UJ	430	UJ	380	UJ	450	U	360	U	660	UJ	380	UJ	380	U	400	U		
2,4-Dinitrotoluene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2,6-Dinitrotoluene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2-Chloronaphthalene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2-Chlorophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2-Methylnaphthalene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	290	J	380	U	380	U	400	U		
2-Methylphenol	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2-Nitroaniline	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
2-Nitrophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
3,3-Dichlorobenzidine	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
3+4-Methylphenols	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
3-Nitroaniline	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4,6-Dinitro-2-methylphenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4-Bromophenyl-phenylether	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4-Chloro-3-methylphenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4-Chloroaniline	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4-Chlorophenyl-phenylether	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4-Nitroaniline	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
4-Nitrophenol	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Acenaphthene	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Acenaphthylene	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Acetophenone	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Anthracene	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	230	J	100	J	380	U	90.4	J		
Atrazine	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Benzaldehyde	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Benzo(a)anthracene	1000	11000	390	U	490	U	92.3	J	380	U	450	U	360	U	590	J	220	J	380	U	330	J		
Benzo(a)pyrene	1000	1100	390	U	490	U	430	U	380	U	450	U	360	U	520	J	190	J	380	U	250	J		
Benzo(b)fluoranthene	1000	11000	390	U	490	U	430	U	380	U	450	U	360	U	680		260	J	380	U	340	J		
Benzo(g,h,i)perylene	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	320	J	120	J	380	U	140	J		
Benzo(k)fluoranthene	3900	110000	390	U	490	U	430	U	380	U	450	U	360	U	300	J	100	J	380	U	180	J		
bis(2-Chloroethoxy)methane	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
bis(2-Chloroethyl)ether	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Bis(2-ethylhexyl)phthalate	--	--	390	U	490	U	430	U	380	U	450	U	360	U	290	J	140	J	380	U	130	J		
Butylbenzylphthalate	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Caprolactam	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Carbazole	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Chrysene	3900	110000	390	U	490	U	430	U	380	U	450	U	360	U	630	J	220	J	380	U	280	J		
Dibenzo(a,h)anthracene	330	1100	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Dibenzofuran	59000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Diethylphthalate	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Dimethylphthalate	--	--	680		860		550		610		800		600		970		450		750		590	J		
Di-n-butylphthalate	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Di-n-octyl phthalate	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Fluoranthene	100000	1000000	390	U	490	U	170	J	380	U	450	U	360	U	1100		410		380	U	430	J		
Fluorene	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Hexachlorobenzene	1200	12000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Hexachlorobutadiene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Hexachlorocyclopentadiene	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Hexachloroethane	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Indeno(1,2,3-cd)pyrene	500	11000	390	U	490	U	430	U	380	U	450	U	360	U	240	J	91.5	J	380	U	170	J		
Isophorone	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Naphthalene	100000	1000000	390	U	490	U	160	J	380	U	450	U	360	U	300	J	88.9	J	380	U	400	U		
Nitrobenzene	15000	140000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
n-Nitroso-di-n-propylamine	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
n-Nitrosodiphenylamine	--	--	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Pentachlorophenol	6700	55000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Phenanthrene	100000	1000000	390	U	490	U	180	J	380	U	450	U	360	U	820		340	J	380	U	300	J		
Phenol	100000	1000000	390	U	490	U	430	U	380	U	450	U	360	U	660	U	380	U	380	U	400	U		
Pyrene	100000	1000000	390	U	490	U	190	J	380	U	450	U	360	U	950		400		380	U	370	J		
Total Semivolatile Compounds	--	--	680		860		1342.3		610		800		600		8230		3130.4		750		3600.4			

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
D: Reported from secondary dilution
J: Estimated value or detection limits
--: No standard
Highlighted and bolded values exceeded the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 3
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Semivolatile Organic Compounds (SVOCs)

			SAMPLE ID:		GW-01(13-15)		GW-01(18-20)		GW-03(3-4)		GW-03(12-14)		GW-03(18-20)		GW-04(2-3)		GW-04(12-14)		GW-04(12-14)BD		GW-04(16-18)	
			SAMPLING DATE:		3/21/2016		3/21/2016		3/21/2016		3/21/2016		3/21/2016		3/23/2016		3/23/2016		3/23/2016		3/23/2016	
			START DEPTH (ft. bgs):		13		18		3		12		18		2		12		12		16	
			END DEPTH (ft. bgs):		15		20		4		14		20		3		14		14		18	
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1-Biphenyl	--	--	390	U	370	U	77.7	J	540	U	390	U	370	U	520	U	550	U	370	U		
1,2,4,5-Tetrachlorobenzene	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
1,4-Dioxane	13000	250000	390	U	370	U	360	U	540	U	390	U	370	UJ	520	UJ	550	UJ	370	UJ		
2,2-oxybis(1-Chloropropane)	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,3,4,6-Tetrachlorophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,4,5-Trichlorophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,4,6-Trichlorophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,4-Dichlorophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,4-Dimethylphenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,4-Dinitrophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,4-Dinitrotoluene	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2,6-Dinitrotoluene	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2-Chloronaphthalene	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2-Chlorophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2-Methylnaphthalene	--	--	390	U	370	U	310	J	540	U	390	U	110	J	520	U	550	U	370	U		
2-Methylphenol	100000	1000000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2-Nitroaniline	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
2-Nitrophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
3,3-Dichlorobenzidine	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
3+4-Methylphenols	100000	1000000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
3-Nitroaniline	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4,6-Dinitro-2-methylphenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4-Bromophenyl-phenylether	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4-Chloro-3-methylphenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4-Chloroaniline	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4-Chlorophenyl-phenylether	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4-Nitroaniline	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
4-Nitrophenol	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Acenaphthene	100000	1000000	390	U	370	U	280	J	540	U	390	U	660	J	520	U	550	U	370	U		
Acenaphthylene	100000	1000000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Acetophenone	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Anthracene	100000	1000000	390	U	370	U	540	J	540	U	390	U	1200	J	520	U	550	U	370	U		
Atrazine	--	--	390	U	370	U	540	J	540	U	390	U	370	U	520	U	550	U	370	U		
Benzaldehyde	--	--	390	U	370	U	360	U	540	U	390	U	370	UJ	520	UJ	550	UJ	370	UJ		
Benzo(a)anthracene	1000	11000	390	U	370	U	610	J	540	U	390	U	**1200**	**J**	520	U	550	U	370	U		
Benzo(a)pyrene	1000	1100	390	U	370	U	370	J	540	U	390	U	810	J	520	U	550	U	370	U		
Benzo(b)fluoranthene	1000	11000	390	U	370	U	580	J	540	U	390	U	950	J	520	U	550	U	370	U		
Benzo(g,h,i)perylene	100000	1000000	390	U	370	U	190	J	540	U	390	U	430	J	520	U	550	U	370	U		
Benzo(k)fluoranthene	3900	110000	390	U	370	U	270	J	540	U	390	U	290	J	520	U	550	U	370	U		
bis(2-Chloroethoxy)methane	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
bis(2-Chloroethyl)ether	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Bis(2-ethylhexyl)phthalate	--	--	390	U	370	U	120	J	540	U	390	U	370	U	520	U	550	U	370	U		
Butylbenzylphthalate	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Caprolactam	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Carbazole	--	--	390	U	370	U	360	U	540	U	390	U	410	J	520	U	550	U	370	U		
Chrysene	3900	110000	390	U	370	U	660	J	540	U	390	U	990	J	520	U	550	U	370	U		
Dibenzo(a,h)anthracene	330	1100	390	U	370	U	360	U	540	U	390	U	120	J	520	U	550	U	370	U		
Dibenzofuran	59000	1000000	390	U	370	U	340	J	540	U	390	U	430	J	520	U	550	U	370	U		
Diethylphthalate	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Dimethylphthalate	--	--	660	J	370	J	240	J	440	J	580	J	510	J	960	J	780	J	590	J		
Di-n-butylphthalate	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Di-n-octyl phthalate	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Fluoranthene	100000	1000000	390	U	370	U	1500	J	540	U	390	U	2000	J	520	U	550	U	370	U		
Fluorene	100000	1000000	390	U	370	U	230	J	540	U	390	U	690	J	520	U	550	U	370	U		
Hexachlorobenzene	1200	12000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Hexachlorobutadiene	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Hexachlorocyclopentadiene	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Hexachloroethane	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Indeno(1,2,3-cd)pyrene	500	11000	390	U	370	U	270	J	540	U	390	U	**600**	**J**	520	U	550	U	370	U		
Isophorone	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Naphthalene	100000	1000000	390	U	370	U	420	J	540	U	390	U	200	J	520	U	550	U	370	U		
Nitrobenzene	15000	140000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
n-Nitroso-di-n-propylamine	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
n-Nitrosodiphenylamine	--	--	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Pentachlorophenol	6700	55000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Phenanthrene	100000	1000000	390	U	370	U	850	J	540	U	390	U	3000	D	520	U	550	U	370	U		
Phenol	100000	1000000	390	U	370	U	360	U	540	U	390	U	370	U	520	U	550	U	370	U		
Pyrene	100000	1000000	390	U	370	U	1000	J	540	U	390	U	2000	J	520	U	550	U	370	U		
Total Semivolatile Compounds	--	--	660		370		9397.7		440		580		16600		960		780		590			

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
D: Reported from secondary dilution
J: Estimated value or detection limits
--: No standard
Highlighted and bolded values exceeded the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 4
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
Polychlorinated Biphenyls (PCBs)

			SAMPLE ID:	SB-03(12-14)		SB-04(3-5)		SB-05(10-11)		SB-05(10-11) BD		SB-06(8-10)		SB-07(12-14)		SB-09(0-1)		SB-09(2-3)		SB-09(4-5)		SB-09(7-8)		SB-10(0-1)	
			SAMPLING DATE:	3/17/2016		3/16/2016		3/16/2016		3/16/2016		3/17/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/16/2016	
			START DEPTH (ft. bgs):	12		3		10		10		8		12		0		2		4		7		0	
			END DEPTH (ft. bgs):	14		5		11		11		10		14		1		3		5		8		1	
POLYCHLORINATED BIPHENYLS (PCBs)	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**	
Aroclor 1016	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor 1221	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor 1232	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor 1242	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor 1248	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor 1254	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor 1260	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	61.6	
Aroclor-1262	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Aroclor-1268	1000	25000		21.2	U	20.8	UJ	20.5	U	20.1	UJ	22.3	UJ	23.4	UJ	20	U	21.8	U	20.4	UJ	20	U	18.8	U
Total PCBs	1000	25000		0		0		0		0		0		0		0		0		0		0		61.6	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
J-: Estimated bias low
J: Estimated value or detection limits
--: No standard

Table 4
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
Polychlorinated Biphenyls (PCBs)

			SAMPLE ID:	SB-10(2-3)		SB-10(4-5)		SB-10(4-5) BD		SB-10(7-8)		SB-11(0-1)		SB-11(2-3)		SB-11(4-5)		SB-11(7-8)		SB-12(0-1)		SB-12(2-3)		SB-12(5-6)	
			SAMPLING DATE:	3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016		3/21/2016		3/21/2016		3/21/2016	
			START DEPTH (ft. bgs):	2		4		4		7		0		2		4		7		0		2		5	
			END DEPTH (ft. bgs):	3		5		5		8		1		3		5		8		1		3		6	
POLYCHLORINATED BIPHENYLS (PCBs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
Aroclor 1016	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor 1221	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor 1232	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor 1242	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor 1248	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor 1254	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor 1260	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor-1262	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Aroclor-1268	1000	25000	21.4	UJ	21	U	21.7	U	20.8	U	21.2	U	21.7	U	21.2	U	44.4	U	19.8	U	21.7	UJ	40.6	UJ
Total PCBs	1000	25000	0		0		0		0		0		0		0		0		0		0		0	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
J-: Estimated bias low
J: Estimated value or detection limits
--: No standard

Table 4
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
Polychlorinated Biphenyls (PCBs)

		SAMPLE ID:	SB-13(0-1)		SB-13(2-3)		SB-13(5-6)		SB-13(5-6)BD		SB-14(0-1)		SB-14(2-3)		SB-14(5-6)		SB-15(0-1)		SB-15(2-3)		SB-15(5-6)		SB-16(0-1)	
		SAMPLING DATE:	3/21/2016		3/21/2016		3/21/2016		3/21/2016		3/16/2016		3/21/2016		3/21/2016		3/18/2016		3/18/2016		3/18/2016		3/18/2016	
		START DEPTH (ft. bgs):	0		2		5		5		0		2		5		0		2		5		0	
		END DEPTH (ft. bgs):	1		3		6		6		1		3		6		1		3		6		1	
POLYCHLORINATED BIPHENYLS (PCBs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
Aroclor 1016	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor 1221	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor 1232	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor 1242	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor 1248	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor 1254	1000	25000	32		23	UJ	34.5	U	31.1	UJ	310		19.2	U	18.8	U	10	J-	19.1	U	19.3	U	17.9	U
Aroclor 1260	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor-1262	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Aroclor-1268	1000	25000	20.2	U	23	UJ	34.5	U	31.1	UJ	18.7	U	19.2	U	18.8	U	20.1	UJ	19.1	U	19.3	U	17.9	U
Total PCBs	1000	25000	32		0		0		0		310		0		0		10		0		0		0	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
J-: Estimated bias low
J: Estimated value or detection limits
--: No standard

Table 4
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
Polychlorinated Biphenyls (PCBs)

			SAMPLE ID:	SB-16(2-3)		SB-16(5-6)		SB-17(0-1)		SB-17(2-3)		SB-17(5-6)		GW-01(13-15)		GW-03(12-14)		GW-04(12-14)		GW-04(12-14)BD	
			SAMPLING DATE:	3/18/2016		3/18/2016		3/16/2016		3/18/2016		3/18/2016		3/21/2016		3/21/2016		3/23/2016		3/23/2016	
			START DEPTH (ft. bgs):	2		5		0		2		5		13		12		12		12	
			END DEPTH (ft. bgs):	3		6		1		3		6		15		14		14		14	
POLYCHLORINATED BIPHENYLS (PCBs)	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**	
Aroclor 1016	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor 1221	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor 1232	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor 1242	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor 1248	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor 1254	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor 1260	1000	25000		21	U	21.1	U	44.4		21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor-1262	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Aroclor-1268	1000	25000		21	U	21.1	U	19.5	U	21.9	UJ	19.5	U	20.2	UJ	27.9	UJ	26.9	U	28.6	U
Total PCBs	1000	25000		0		0		44.4		0		0		0		0		0		0	

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
J-: Estimated bias low
J: Estimated value or detection limits
--: No standard

Table 5
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TCL Pesticides

		SAMPLE ID:	SB-03(12-14)		SB-04(3-5)		SB-05(10-11)		SB-05(10-11) BD		SB-06(8-10)		SB-07(12-14)		GW-01(13-15)		GW-03(12-14)		GW-04(12-14)		GW-04(12-14)BD	
		SAMPLING DATE:	3/17/2016		3/16/2016		3/16/2016		3/16/2016		3/17/2016		3/18/2016		3/21/2016		3/21/2016		3/23/2016		3/23/2016	
		START DEPTH (ft. bgs):	12		3		10		10		8		12		13		12		12		12	
		END DEPTH (ft. bgs):	14		5		11		11		10		14		15		14		14		14	
PESTICIDES	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**	**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**	
4,4-DDD	13000	180000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
4,4-DDE	8900	120000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
4,4-DDT	7900	94000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Aldrin	97	1400	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
alpha-BHC	480	6800	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
alpha-Chlordane	4200	47000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
beta-BHC	360	14000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
delta-BHC	100000	1000000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Dieldrin	200	2800	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Endosulfan I	24000	920000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Endosulfan II	24000	920000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Endosulfan Sulfate	24000	920000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Endrin	11000	410000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Endrin aldehyde	--	--	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Endrin ketone	--	--	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
gamma-BHC (Lindane)	1300	23000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
gamma-Chlordane	4200	47000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Heptachlor	2100	29000	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Heptachlor epoxide	--	--	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Methoxychlor	--	--	2.1	U	2.1	U	2	U	2	U	2.2	U	2.3	U	2	U	2.8	U	2.7	U	2.9	U
Toxaphene	--	--	21.2	U	20.8	U	20.5	U	20.1	U	22.3	U	23.3	U	20.2	U	27.9	U	26.9	U	28.6	U

Notes:
ug/kg: Micrograms per kilogram
BD: Blind duplicate
U: Analyzed for but not detected
--: No standard

Table 6
Long Island Rail Road
Arch Street Yard RAWP
Subsurface Soil Samples
TAL Metals

		SAMPLE ID:	SB-01(13-15)		SB-01(23-25)		SB-03(12-14)		SB-04(3-5)		SB-05(10-11)		SB-05(10-11)BD		SB-06(8-10)		SB-07(12-14)		GW-01(13-15)		GW-03(12-14)		GW-04(12-14)		GW-04(12-14)BD	
		SAMPLING DATE:	3/16/2016		3/16/2016		3/17/2016		3/16/2016		3/16/2016		3/16/2016		3/17/2016		3/18/2016		3/21/2016		3/21/2016		3/23/2016		3/23/2016	
		START DEPTH (ft. bgs):	13		23		12		3		10		10		8		12		13		12		12		12	
		END DEPTH (ft. bgs):	15		25		14		5		11		11		10		14		15		14		14		14	
METALS	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**	**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**	
Aluminum	--	--	14000		4260		9310		2220		7560		8920		3330		11000		6940		13900		11800		12000	
Antimony	--	--	3.62	UJ	2.3	UJ	2.6	UJ	1.43	J	2.55	UJ	2.53	UJ	2.79	UJ	2.93	UJ	2.51	UJ	3.48	UJ	3.26	UJ	3.46	UJ
Arsenic	16	16	9.37		1.21		2.66		8.17		5		2.43		8.7		5.87		2.79		9.47		4.86		5.73	
Barium	400	10000	24.2	J	45.8	J	22.2	J	41.5	J	24.6	J	21.9	J	24.4	J	32.3	J	22	J	24.4	J	136	J	119	J
Beryllium	72	2700	0.982		0.353		0.526		0.72		0.486		0.496		0.611		0.573		0.453		0.983		0.708		0.704	
Cadmium	4.3	60	0.44	U	0.28	U	0.31	U	0.31	U	0.31	U	0.3	U	0.34	U	0.751		0.3	U	0.141	J	0.795		1.02	
Calcium	--	--	2130		5640		368		9980		1340	J	309	J	5700		2040	J	821		2880		696		733	
Chromium	180	6800	26.3		11		12.5		5.91		16.1		12.6		8.35		18.8	J	10.3		24.9		23.5	J	26.1	J
Cobalt	--	--	12	J	7.16	J	6.09	J	4.71	J	9.18	J	5.74	J	7.27	J	9.91		6.67		12.5		9.7		15.5	
Copper	270	10000	7.81	J	12.5	J	10.7	J	106	J	13.1	J	10.7	J	35.6	J	17.9	J	8.72		5.27		8.05	J	10.3	J
Iron	--	--	32500		14500		16600		51000	D	17400		15500		22800		22600		15800		35700		27300		23900	
Lead	400	3900	15.1		4.11		19.5		104		25.4		29.8		**483**		37.8		13		14.5		11.9		12	
Magnesium	--	--	6010		4330		2480		2350		3790		2430		1420		3400	J	2220		5610		3070	J	3290	J
Manganese	2000	10000	409		262		121		302		163		102		377		262	J	211	J	433	J	293	J	290	J
Mercury	0.81	5.7	0.206	J	0.033	J	0.039	J	0.135	J	0.047	J	0.161	J	0.199	J	**0.949**	**DJ**	0.052		0.159		0.015	J	0.03	
Nickel	310	10000	26.7		11.7		13.8		12.7		14.2		13.4		14.1		19.2		12.1		27.8		17		19.5	
Potassium	--	--	2730	J	1810	J	524	J	199	J	827	J	504	J	366	J	1440		511		2530		1900		2010	
Selenium	180	6800	1.45	U	0.92	U	1.04	U	1.03	U	1.02	U	1.01	U	1.12	U	1.17	U	1	U	1.39	U	1.3	U	1.39	U
Silver	180	6800	0.73	U	0.46	U	0.52	U	0.52	U	0.51	U	0.51	U	0.56	U	2.61		0.5	UJ	0.7	UJ	3.11		2.72	
Sodium	--	--	19000	J	2200	J	1390	J	208	J	2400	J	1290	J	428	J	6990		1700		13600		3930		4170	
Thallium	--	--	2.9	U	1.84	U	2.08	U	2.06	U	2.04	U	2.02	U	2.23	U	2.34	U	2.01	U	2.78	U	2.61	U	2.77	U
Vanadium	--	--	32.5		18.5		16.2		12.9		22.8		15.1		11.8		24		14.9		32		27.8		28.5	
Zinc	10000	10000	77.1	J	31	U	42.1	J	135	J	42.5	J	40.4	J	36.5	J	62.7		35.5		76.5		54.2		59.7	

Notes:
mg/kg: Milligrams per kilogram
U: Analyzed for but not detected
D: Detected in the secondary dilution
J: Estimated value or detection limits
--: No standard or not analyzed
Highlighted and bolded values exceeded the Restricted-Residential Use SCO

Table 7
Long Island Rail Road
Arch Street Yard RAWP
Groundwater Samples
TCL Volatile Organic Compounds (VOCs)

SAMPLE ID:		VB-01(15-16)		VB-01(26-27)		VB-02(5)		VB-02(12-14)		GW-01		GW-02S		GW-02D		GW-03		GW-04S		GW-04D		MW-1	
SAMPLING DATE:		10/30/2015		10/30/2015		10/30/2015		10/30/2015		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYSDEC Class GA - Standard or Guidance Value	Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)	
1,1,1-Trichloroethane	5	200	U	100	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	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichloroethane	1	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichlorotrifluoroethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethene	5	200	U	100	U	1	U	1	U	1	U	3.9		**23.6**		1	U	1	U	1	U	1	U
1,2,3-Trichlorobenzene	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2,4-Trichlorobenzene	5	200	U	100	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	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dibromoethane	0.0006	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichlorobenzene	3	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichloroethane	0.6	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichloropropane	1	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,3-Dichlorobenzene	3	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,4-Dichlorobenzene	3	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,4-Dioxane	--	20000	U	10000	U	100	U	100	U	--		--		--		--		--		--		--	
2-Hexanone	50	1000	U	500	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Acetone	50	1000	U	500	U	5	U	5	U	5	U	2.9	J	4.8	J	5	U	5	U	5	U	5	U
Benzene	1	200	U	100	U	1	U	1	U	1	U	1	U	0.38	J	1	U	1	U	1	U	1	U
Bromochloromethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromodichloromethane	50	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromoform	50	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromomethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Carbon Disulfide	60	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Carbon Tetrachloride	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chlorobenzene	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloroethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloroform	7	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloromethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cis-1,2-Dichloroethylene	5	**6900**		**1800**		**36**		1.2		1	U	**1700**	**D**	**8100**	**D**	1	U	1	U	1	U	1	U
Cis-1,3-Dichloropropene	0.4	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cyclohexane	--	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dibromochloromethane	50	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dichlorodifluoromethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Isopropylbenzene	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
m,p-Xylene	5	400	U	200	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Methyl Ethyl Ketone	50	1000	U	500	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Isobutyl Ketone	--	1000	U	500	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Methyl Acetate	--	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Methylcyclohexane	--	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
O-Xylene	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Styrene	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Tert-Butyl Methyl Ether	10	200	U	100	U	1.6		1.6		2.2		1	U	1	U	0.36	J	1.7		4		**26.2**	
Tetrachloroethylene	5	**17600**		**4500**		0.71	J	1.5		1	U	**69.4**	**J**	**5900**	**DJ**	1	U	1	U	1	U	1	U
Toluene	5	200	U	100	U	1	U	1	U	1	U	1	U	0.38	J	1	U	1	U	0.24	J	1	U
Trans-1,2-Dichloroethene	5	200	U	100	U	2.5		1	U	1	U	**27.5**		**68.7**		1	U	1	U	1	U	1	U
Trans-1,3-Dichloropropene	0.4	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trichloroethylene	5	**1000**		**1100**		2.2		0.93	J	1	U	**25.3**		**1400**	**D**	1	U	1	U	1	U	1	U
Trichlorofluoromethane	5	200	U	100	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Vinyl Chloride	2	**4900**		**560**		**17.9**		1	U	1	U	**1500**	**D**	**5300**	**D**	1	U	0.37	J	1	U	1	U
Total Volatile Compounds	--	30400		7960		61		5.2		2.2		3329		20798		0.36		2.07		4.24		26.2	

Notes:
ug/l: Micrograms per liter
U: Analyzed for but not detected
D: Detected in the secondary dilution
--: No standard or not analyzed
J: Estimated value
BD: Blind duplicate
Highlighted and bolded values exceeded the Class GA Value

Table 7
Long Island Rail Road
Arch Street Yard RAWP
Groundwater Samples
TCL Volatile Organic Compounds (VOCs)

SAMPLE ID:		MW-1 BD		MW-2		MW-3		TRIPBLANK		TRIP BLANK		TRIP BLANK		TRIP BLANK		FIELD BLANK		FIELD BLANK		FIELD BLANK	
SAMPLING DATE:		4/7/2016		4/7/2016		4/7/2016		10/30/2015		3/18/2016		3/23/2016		4/7/2016		3/18/2016		3/23/2016		4/7/2016	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYSDEC Class GA - Standard or Guidance Value	Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)	
1,1,1-Trichloroethane	5	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	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	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1,2-Trichlorotrifluoroethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,1-Dichloroethene	5	1	U	1	U	3.2		1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2,3-Trichlorobenzene	5	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	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	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dibromoethane	0.0006	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichlorobenzene	3	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	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,2-Dichloropropane	1	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,3-Dichlorobenzene	3	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,4-Dichlorobenzene	3	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
1,4-Dioxane	--	--		--		--		100	U	--		--		--		--		--		--	
2-Hexanone	50	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Acetone	50	5	U	4.1	J	1.9	J	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Benzene	1	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromochloromethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromodichloromethane	50	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromoform	50	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Bromomethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Carbon Disulfide	60	1	U	1.6		1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Carbon Tetrachloride	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chlorobenzene	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloroethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloroform	7	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Chloromethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cis-1,2-Dichloroethylene	5	1	U	1	U	**510**	**D**	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cis-1,3-Dichloropropene	0.4	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Cyclohexane	--	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dibromochloromethane	50	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Dichlorodifluoromethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Ethylbenzene	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Isopropylbenzene	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
m,p-Xylene	5	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U	2	U
Methyl Ethyl Ketone	50	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Isobutyl Ketone	--	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1.8		1	U	1	U
Methyl Acetate	--	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Methylcyclohexane	--	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
O-Xylene	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Styrene	5	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	**29.5**		0.54	J	0.74	J	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Tetrachloroethylene	5	1	U	0.5	J	**78.9**	**J**	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Toluene	5	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	1	U	1	U	2		1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trans-1,3-Dichloropropene	0.4	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trichloroethylene	5	1	U	1	U	**34.8**		1	U	1	U	1	U	1	U	1	U	1	U	1	U
Trichlorofluoromethane	5	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Vinyl Chloride	2	1	U	0.31	J	**240**	**D**	1	U	1	U	1	U	1	U	1	U	1	U	1	U
Total Volatile Compounds	--	29.5		7.05		872		0		0		0		0		1.8		0		0	

Notes:
ug/l: Micrograms per liter
U: Analyzed for but not detected
D: Detected in the secondary dilution
--: No standard or not analyzed
J: Estimated value
BD: Blind duplicate
Highlighted and bolded values exceeded the Class GA Value

Table 8
Long Island Rail Road
Arch Street Yard RAWP
Groundwater Samples
TCL Semivolatile Organic Compounds (SVOCs)

SAMPLE ID:		GW-01		GW-02S		GW-02D		GW-03		GW-04S		GW-04D		MW-1		MW-1 BD		MW-2		MW-3		FIELD BLANK		FIELD BLANK		FIELD BLANK	
SAMPLING DATE:		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		4/7/2016		3/18/2016		3/23/2016		4/7/2016	
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	NYSDEC Class GA - Standard or Guidance Value	Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)	
1,2,4,5-Tetrachlorobenzene	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
1,4-Dioxane	--	10.1	UJ	10	UJ	10.1	UJ	10.2	UJ	10.2	UJ	10.1	UJ	10.1	UJ	10.3	UJ	10.1	UJ	10.2	UJ	10	UJ	10.2	UJ	10	UJ
2,3,4,6-Tetrachlorophenol	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,4,5-Trichlorophenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,4,6-Trichlorophenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,4-Dichlorophenol	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,4-Dimethylphenol	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,4-Dinitrophenol	10	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,4-Dinitrotoluene	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2,6-Dinitrotoluene	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2-Chloronaphthalene	10	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2-Chlorophenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2-Methylnaphthalene	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2-Methylphenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2-Nitroaniline	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
2-Nitrophenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
3,3-Dichlorobenzidine	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
3-Nitroaniline	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
3+4-Methylphenols	1	10.1	UJ	10	UJ	10.1	UJ	10.2	UJ	10.2	UJ	10.1	UJ	10.1	UJ	10.3	UJ	10.1	UJ	10.2	UJ	10	UJ	10.2	UJ	10	UJ
4,6-Dinitro-2-methylphenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
4-Bromophenyl-phenylether	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
4-Chloro-3-methylphenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
4-Chloroaniline	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
4-Chlorophenylphenyl ether	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
4-Nitroaniline	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
4-Nitrophenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Acenaphthene	20	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Acenaphthylene	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Acetophenone	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Anthracene	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Atrazine	7.5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzaldehyde	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzo(a)anthracene	0.002	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzo(a)pyrene	ND	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzo(b)fluoranthene	0.002	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzo(ghi)perylene	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzo(k)fluoranthene	0.002	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Benzyl butyl phthalate	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Biphenyl	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Bis(2-chloroethoxy)methane	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Bis(2-chloroethyl)ether	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Bis(2-chloroisopropyl)ether	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Bis(2-ethylhexyl)phthalate (BEHP)	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Caprolactam	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Carbazole	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Chrysene	0.002	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Dibenzo(a,h)anthracene	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Dibenzofuran	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Diethyl phthalate	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Dimethyl phthalate	50	15.3	J-	10	U	4.9	J	2.6	J	10.2	U	2.9	J	10.1	U	10.3	U	3.5	J	10.2	U	10	U	10.2	U	10	U
Di-n-butyl phthalate	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Di-n-octyl phthalate	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Fluoranthene	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Fluorene	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Hexachlorobenzene	0.04	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Hexachlorobutadiene	0.5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Hexachlorocyclopentadiene	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Hexachloroethane	5	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Indeno(1,2,3-cd)pyrene	0.002	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Isophorone	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Naphthalene	10	10.1	UJ	10	U	10.1	U	4.5	J	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Nitrobenzene	0.4	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
N-Nitroso-di-n-propylamine	--	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
N-Nitrosodiphenylamine	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Pentachlorophenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Phenanthrene	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Phenol	1	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Pyrene	50	10.1	UJ	10	U	10.1	U	10.2	U	10.2	U	10.1	U	10.1	U	10.3	U	10.1	U	10.2	U	10	U	10.2	U	10	U
Total Semivolatile Compounds	--	15.3		0		4.9		7.1		0		2.9		0		0		3.5		0		0		0		0	

Notes:
ug/l: Micrograms per liter
U: Analyzed for but not detected
J-: Estimated bias low
--: No standard
J: Estimated value
BD: Blind duplicate

Table 9
Long Island Rail Road
Arch Street Yard RAWP
Groundwater Samples
TCL Pesticides

	SAMPLE ID:	GW-02D		MW-3		FIELD BLANK		FIELD BLANK		FIELD BLANK	
	SAMPLING DATE:	4/7/2016		4/7/2016		3/18/2016		3/21/2016		3/23/2016	
PESTICIDES	NYSDEC Class GA - Standard or Guidance Value	Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)	
Aldrin	ND	0.05	U	0.05	U	0.05	U	--		0.05	U
alpha BHC	0.01	0.05	U	0.05	U	0.05	U	--		0.05	U
alpha Endosulfan	--	0.05	U	0.05	U	0.05	U	--		0.05	U
alpha-Chlordane	0.05	0.05	U	0.05	U	0.05	U	--		0.05	U
beta-BHC	0.04	0.05	U	0.05	U	0.05	U	--		0.05	U
beta-Endosulfan	--	0.05	U	0.05	U	0.05	U	--		0.05	U
beta-Chlordane	0.05	0.05	U	0.05	U	0.05	U	--		0.05	U
delta-BHC	0.04	0.05	U	0.05	U	0.05	U	--		0.05	U
Dieldrin	0.004	0.05	U	0.05	U	0.05	U	--		0.05	U
Endosulfan sulfate	--	0.05	U	0.05	U	0.05	U	--		0.05	U
Endrin	ND	0.05	U	0.05	U	0.05	U	--		0.05	U
Endrin aldehyde	5	0.05	U	0.05	U	0.05	U	--		0.05	U
Endrin ketone	5	0.05	U	0.05	U	0.05	U	--		0.05	U
gamma-BHC (Lindane)	0.05	0.05	U	0.05	U	0.05	U	--		0.05	U
Heptachlor	0.04	0.05	U	0.05	U	0.05	U	--		0.05	U
Heptachlor epoxide	0.03	0.05	U	0.05	U	0.05	U	--		0.05	U
Methoxychlor	35	0.05	U	0.05	U	0.05	U	--		0.05	U
P,P'-DDD	0.3	0.05	U	0.05	U	0.05	U	--		0.05	U
P,P'-DDE	0.2	0.05	U	0.05	U	0.05	U	--		0.05	U
P,P'-DDT	0.2	0.05	U	0.05	U	0.05	U	--		0.05	U
Toxaphene	0.06	0.51	U	0.5	U	0.51	U	--		0.52	U

Notes:
ug/l: Micrograms per liter
U: Analyzed for but not detected
--: No standard or not analyzed
ND: Compound exceeds if detected

Table 10
Long Island Rail Road
Arch Street Yard RAWP
Groundwater Samples
Polychlorinated Biphenyls (PCBs)

SAMPLE ID:		GW-02D		MW-3		FIELD BLANK		FIELD BLANK		FIELD BLANK	
SAMPLING DATE:		4/7/2016		4/7/2016		3/18/2016		3/21/2016		3/23/2016	
POLYCHLORINATED BIPHENYLS (PCBs)	NYSDEC Class GA - Standard or Guidance Value	Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)		Result (ug/l)	
Aroclor-1016	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1221	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1232	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1242	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1248	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1254	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1260	0.09	0.52	U	0.52	U	0.51	U	0.52	U	0.51	U
Aroclor-1262	0.09	--		--		0.51	U	0.52	U	0.51	U
Aroclor-1268	0.09	--		--		0.51	U	0.52	U	0.51	U
Total PCBs	0.09	0		0		0		0		0	

Notes:
ug/l: Micrograms per liter
U: Analyzed for but not detected
--: No standard or not analyzed
ND: Compound exceeds if detected

Table 11
Long Island Rail Road
Arch Street Yard RAWP
Groundwater Samples
TAL Metals

	SAMPLE ID:	GW-02D		MW-3		FIELD BLANK		FIELD BLANK	
	SAMPLING DATE:	4/7/2016		4/7/2016		3/18/2016		3/23/2016	
METALS	**NYSDEC Class GA - Standard or Guidance Value**	**Result (ug/l)**		**Result (ug/l)**		**Result (ug/l)**		**Result (ug/l)**	
Aluminum	--	211		72.7		8.32	J	15.2	J
Antimony	3	25	U	25	U	25	U	25	U
Arsenic	25	6.13	J	4.63	J	10	U	10	U
Barium	1000	158		101		50	U	50	U
Beryllium	3	3	U	3	U	3	U	3	U
Cadmium	5	3	U	3	U	3	U	3	U
Calcium	--	36100		92500		1000	U	133	J
Chromium	50	2.3	J	4.04	J	5	U	5	U
Cobalt	--	15	U	15	U	15	U	15	U
Copper	200	10	U	10	U	10	U	10	U
Iron	300	**11100**		**4860**		50	U	50	U
Lead	25	4.97	J	6	U	6	U	6	U
Magnesium	35000	2770		5850		1000	U	1000	U
Manganese	300	**357**		148		10	U	10	U
Mercury	0.7	0.2	U	0.2	U	0.2	U	0.2	U
Nickel	100	20	U	20	U	20	U	20	U
Potassium	--	9850		4840		1000	U	1000	U
Selenium	10	10	U	10	U	10	U	10	U
Silver	50	5	U	5	U	5	U	5	U
Sodium	20000	**1770000**	**D**	**201000**		1000	U	92.8	J
Thallium	0.5	20	U	20	U	20	U	20	U
Vanadium	--	20	U	20	U	20	U	20	U
Zinc	2000	6.81	J	20	U	20	U	12.7	J

Notes:
ug/l: Micrograms per liter
U: Analyzed for but not detected
--: No standard or not analyzed
J: Estimated value or limit
Highlighted and bolded values exceeded the Class GA Value

Table 12
Long Island Rail Road
Arch Street Yard RAWP
Ambient Air Samples
Volatile Organic Compounds (VOCs)

	SAMPLE ID:	AA-01		IA-01	
	SAMPLING DATE:	8/17/2016		8/17/2016	
	LOCATION:	Outdoor		Indoor Office Area	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYSDOH Air Guideline Value	Result (ug/m^3)		Result (ug/m^3)	
1,1,1-Trichloroethane (TCA)	--	0.16	U	0.16	U
1,1,2,2-Tetrachloroethane	--	3.43	U	3.43	U
1,1,2-Trichloroethane	--	2.73	U	2.73	U
1,1,2-Trichlorotrifluoroethane	--	3.83	U	3.83	U
1,1-Dichloroethane	--	2.02	U	2.02	U
1,1-Dichloroethene	--	1.98	U	1.98	U
1,2,4-Trichlorobenzene	--	3.71	U	3.71	U
1,2,4-Trimethylbenzene	--	0.98	J	1.57	J
1,2-Dibromoethane	--	3.84	U	3.84	U
1,2-Dichlorobenzene	--	3.01	U	3.01	U
1,2-Dichloroethane	--	2.02	U	2.02	U
1,2-Dichloropropane	--	2.31	U	2.31	U
1,3,5-Trimethylbenzene	--	2.46	U	0.49	J
1,3-Butadiene	--	1.11	U	1.11	U
1,3-Dichlorobenzene	--	3.01	U	3.01	U
1,4-Dichlorobenzene	--	3.01	U	3.01	U
1,4-Dioxane	--	1.8	U	1.8	U
2,2,4-Trimethylpentane	--	0.7	J	1.03	J
2-Butanone	--	1.12	J	1.68	
2-Chlorotoluene	--	2.59	U	2.59	U
4-Ethyltoluene	--	2.46	U	0.59	J
4-Methyl-2-Pentanone	--	2.05	U	2.05	U
Acetone	--	7.6		22.8	
Allyl Chloride	--	1.57	U	1.57	U
Benzene	--	0.45	J	0.64	J
Bromodichloromethane	--	3.35	U	3.35	U
Bromoethene	--	2.19	U	2.19	U
Bromoform	--	5.17	U	5.17	U
Bromomethane	--	1.94	U	1.94	U
Carbon Disulfide	--	1.56	U	1.56	U
Carbon Tetrachloride	--	0.44		0.38	
Chlorobenzene	--	2.3	U	2.3	U
Chloroethane	--	1.32	U	1.32	U
Chloroform	--	2.44	U	2.44	U
Chloromethane	--	0.93	J	1.01	J
cis-1,2-Dichloroethylene	--	1.98	U	1.98	U
cis-1,3-Dichloropropene	--	2.27	U	2.27	U
Cyclohexane	--	1.72	U	0.48	J
Dibromochloromethane	--	4.26	U	4.26	U
Dichlorodifluoromethane	--	0.79	J	0.79	J
Dichlorotetrafluoroethane	--	3.49	UJ	3.49	UJ
Ethylbenzene	--	1.04	J	1.95	J
Heptane	--	0.49	J	0.98	J
Hexachloro-1,3-Butadiene	--	5.33	U	5.33	U
Hexane	--	1.76	U	1.73	J
m,p-Xylenes	--	3.47	J	5.65	
Methyl Methacrylate	--	2.05	U	2.05	U
Methyl tert-Butyl Ether (MTBE)	--	1.8	U	1.8	U
Methylene Chloride	60	1.11	UB	1.42	UB
Naphthalene	--	2.62	UJ	2.62	UJ
o-Xylene	--	1.17	J	1.87	J
Styrene	--	2.13	U	0.81	J
t-1,3-Dichloropropene	--	2.27	U	2.27	U
tert-Butyl alcohol	--	1.52	U	1.52	U
Tetrachloroethylene (PCE)	30	2.17		0.61	
Tetrahydrofuran	--	1.47	U	1.47	U
Toluene	--	6.03		12.1	
trans-1,2-Dichloroethene	--	1.98	U	1.98	U
Trichloroethylene (TCE)	2	0.16	U	0.16	U
Trichlorofluoromethane	--	1.18	J	1.35	J
Vinyl Chloride	--	0.08	U	0.08	U

Notes:
ug/m^3: Micrograms per cubic meter
U: Analyzed for but not detected
--: No guideline value
UB: Qualified as non-detect based on method blanks
J: Estimated value

Table 13
Long Island Rail Road
Arch Street Yard RAWP
Soil Vapor Samples
Volatile Organic Compounds (VOCs)

SAMPLE ID:		SV-01		SV-02		SV-03		SV-04		SV-05		SV-06	
SAMPLING DATE:		8/17/2016		8/17/2016		8/17/2016		8/17/2016		8/17/2016		8/17/2016	
SAMPLE DEPTH TOP (ft. bgs):		2.2		3.9		4.3		3.9		4.0		--	
SAMPLE DEPTH BOTTOM (ft. bgs):		2.7		4.4		4.8		4.4		4.5		--	
LOCATION:		Outside		Outside		Outside		Outside		Outside		Sub-slab	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYSDOH Air Guideline Value	Result (ug/m^3)		Result (ug/m^3)		Result (ug/m^3)		Result (ug/m^3)		Result (ug/m^3)		Result (ug/m^3)	
1,1,1-Trichloroethane (TCA)	--	1.42		7.64		0.16		1.04		7.09		0.16	U
1,1,2,2-Tetrachloroethane	--	3.43	U	3.43	U	3.43	U	3.43	U	3.43	U	3.43	U
1,1,2-Trichloroethane	--	2.73	U	2.73	U	2.73	U	2.73	U	2.73	U	2.73	U
1,1,2-Trichlorotrifluoroethane	--	3.83	U	0.92	J	2.15	J	3.83	U	0.92	J	0.69	J
1,1-Dichloroethane	--	2.02	U	2.02	U	2.02	U	0.89	J	3.36		0.97	J
1,1-Dichloroethene	--	65	JD	49.6		1.98	U	1.43	J	2.02		1.98	U
1,2,4-Trichlorobenzene	--	3.71	U	3.71	U	3.71	U	3.71	U	3.71	U	3.71	U
1,2,4-Trimethylbenzene	--	25.6		35.4		1.52	J	29.5		34.4		20.2	
1,2-Dibromoethane	--	3.84	U	3.84	U	3.84	U	3.84	U	3.84	U	3.84	U
1,2-Dichlorobenzene	--	3.01	U	3.01	U	3.01	U	3.01	U	3.01	U	3.01	U
1,2-Dichloroethane	--	2.02	U	2.02	U	2.79		23.9		2.02	U	2.02	U
1,2-Dichloropropane	--	2.31	U	2.31	U	2.31	U	2.31	U	2.31	U	2.31	U
1,3,5-Trimethylbenzene	--	8.36		13.3		0.74	J	10.8		14.3		7.37	
1,3-Butadiene	--	1.11	U	1.11	U	1.11	U	1.11	U	1.11	U	1.11	U
1,3-Dichlorobenzene	--	3.01	U	3.01	U	3.01	U	3.01	U	3.01	U	3.01	U
1,4-Dichlorobenzene	--	2.4	J	3.01	U	3.01	U	3.01	U	3.01	U	3.01	U
1,4-Dioxane	--	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U	1.8	U
2,2,4-Trimethylpentane	--	121	D	2.34	U	2.29	J	9.34		23.8		9.34	
2-Butanone	--	20.9		530	D	129	D	412	D	501	D	142	D
2-Chlorotoluene	--	2.59	U	2.59	U	2.59	U	2.59	U	2.59	U	2.59	U
4-Ethyltoluene	--	8.36		12.8		1.13	J	10.8		12.8		7.37	
4-Methyl-2-Pentanone	--	2.05	U	2.05	U	3.81		6.15		2.05	U	2.05	U
Acetone	--	1.19	U	261	D	68.4	D	136	D	153	D	1.19	U
Allyl Chloride	--	1.57	U	1.57	U	1.57	U	1.57	U	1.57	U	1.57	U
Benzene	--	14.7		47.9		5.43		20.8		47.6	D	90.1	D
Bromodichloromethane	--	3.35	U	3.35	U	3.35	U	3.35	U	3.35	U	3.35	U
Bromoethene	--	2.19	U	2.19	U	2.19	U	2.19	U	2.19	U	2.19	U
Bromoform	--	5.17	U	5.17	U	5.17	U	5.17	U	5.17	U	5.17	U
Bromomethane	--	1.94	U	1.94	U	1.94	U	1.94	U	1.94	U	1.94	U
Carbon Disulfide	--	37.4	JD	62.3	JD	12.8		31.8		72.9	D	59.5	D
Carbon Tetrachloride	--	1.07		0.94		0.38		0.88		0.82		0.25	
Chlorobenzene	--	2.3	U	2.3	U	2.3	U	2.3	U	2.3	U	2.3	U
Chloroethane	--	1.32	U	10.6		1.32	U	1.21	J	1.27	J	0.87	J
Chloroform	--	16.6		54.7		2.83		26.9		19		3.86	
Chloromethane	--	1.22		2.07		1.32		1.42		1.3		1.16	
cis-1,2-Dichloroethylene	--	261	D	2894	D	1.43	J	46.4		36.1		3.29	
cis-1,3-Dichloropropene	--	2.27	U	2.27	U	2.27	U	2.27	U	2.27	U	2.27	U
Cyclohexane	--	86.7	D	149	D	10.3		44.1		91.6	D	171	D
Dibromochloromethane	--	4.26	U	4.26	U	4.26	U	4.26	U	4.26	U	4.26	U
Dichlorodifluoromethane	--	4.3	J	1.09	J	1.24	J	0.74	J	1.34	J	3.91	J
Dichlorotetrafluoroethane	--	3.49	UJ	3.49	UJ	3.49	UJ	3.49	UJ	3.49	UJ	3.49	UJ
Ethylbenzene	--	8.25		17.4		6.95		16.1		19.1		12.2	
Heptane	--	12.3		22.1		4.1		18.4		48		32.8	
Hexachloro-1,3-Butadiene	--	5.33	U	5.33	U	5.33	U	5.33	U	5.33	U	5.33	U
Hexane	--	19.4		26.4		7.05		18.3		51.1	D	58.9	D
m,p-Xylenes	--	32.6		58.6		20		53.9		59.5		41.3	
Methyl Methacrylate	--	2.05	U	2.05	U	2.05	U	2.05	U	2.05	U	2.05	U
Methyl tert-Butyl Ether (MTBE)	--	167	D	1.8	U	1.8	U	1.8	U	43.3	JD	1.8	U
Methylene Chloride	60	2.85	UB	3.82	UB	11.8		7.3		12.2		5.91	
Naphthalene	--	8.91	J	13.1	J	2.62	UJ	8.39	J	5.77	J	2.83	J
o-Xylene	--	16.5		30.4		7.38		26.5		30.8		23.5	
Styrene	--	49.4		77.9	D	8.09		71.5	D	39.2	JD	46	
t-1,3-Dichloropropene	--	2.27	U	2.27	U	2.27	U	2.27	U	2.27	U	2.27	U
tert-Butyl alcohol	--	1.64		10.9		8.49		7.58		54.6	D	6.97	
Tetrachloroethylene (PCE)	30	**317**	**D**	**881**	**D**	7.46		**58.3**		**120**	**D**	23.1	
Tetrahydrofuran	--	4.13		10.3		1.74		7.96		9.44		6.78	
Toluene	--	23.7		45.2	JD	32.4		54.6		53.1		81	D
trans-1,2-Dichloroethene	--	193	D	911	D	0.95	J	8.33		15.5		1.23	J
Trichloroethylene (TCE)	2	**223**	**D**	**859**	**D**	**2.04**		**28.5**		**50.5**		**5**	
Trichlorofluoromethane	--	11.8		5.28		2.3	J	14		175	D	1.74	J
Vinyl Chloride	--	562	D	511	D	0.41		24.3		6.9		0.51	

Notes:
ug/m^3: Micrograms per cubic meter
U: Analyzed for but not detected
--: No guideline value
UB: Qualified as non-detect based on method blanks
J: Estimated value
bgs: Below ground surface
D: Reported from secondary dilution
Highlighted and bolded values exceed NYSDOH Air Guideline Value

Table 14
Long Island Rail Road
Arch Street Yard RAWP
Heating Season Air Samples
Volatile Organic Compounds (VOCs)

	SAMPLE ID:	AA-01(R)		IA-01(R)		SV-06(R)	
	SAMPLING DATE:	2/22/2017		2/22/2017		2/22/2017	
	LOCATION:	outdoor		indoor office area		sub-slab	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYSDOH Air Guideline Value	Result (ug/m^3)		Result (ug/m^3)		Result (ug/m^3)	
1,1,1-Trichloroethane (TCA)	--	0.16	U	0.16	U	0.16	U
1,1,2,2-Tetrachloroethane	--	3.43	U	3.43	U	3.43	U
1,1,2-Trichloroethane	--	2.73	U	2.73	U	2.73	U
1,1,2-Trichlorotrifluoroethane	--	3.83	U	3.83	U	3.83	U
1,1-Dichloroethane	--	2.02	U	2.02	U	2.02	U
1,1-Dichloroethene	--	1.98	U	1.98	U	1.98	U
1,2,4-Trichlorobenzene	--	3.71	U	3.71	U	3.71	U
1,2,4-Trimethylbenzene	--	2.46	U	0.79	J	1.72	J
1,2-Dibromoethane	--	3.84	U	3.84	U	3.84	U
1,2-Dichlorobenzene	--	3.01	U	3.01	U	3.01	U
1,2-Dichloroethane	--	2.02	U	2.02	U	2.02	U
1,2-Dichloropropane	--	2.31	U	2.31	U	2.31	U
1,3,5-Trimethylbenzene	--	2.46	U	2.46	U	0.69	J
1,3-Butadiene	--	1.11	U	1.11	U	1.11	U
1,3-Dichlorobenzene	--	3.01	U	3.01	U	3.01	U
1,4-Dichlorobenzene	--	3.01	U	3.01	U	3.01	U
1,4-Dioxane	--	1.8	U	1.8	U	1.8	U
2,2,4-Trimethylpentane	--	0.61	J	1.17	J	0.98	J
2-Butanone	--	1.53		1.47		16.8	
2-Chlorotoluene	--	2.59	U	2.59	U	2.59	U
4-Ethyltoluene	--	2.46	U	2.46	U	2.46	U
4-Methyl-2-Pentanone	--	2.05	U	2.05	U	4.92	
Acetone	--	14.2		19.5		237	D
Allyl Chloride	--	1.57	U	1.57	U	1.57	U
Benzene	--	1.09	J	1.57	J	1.82	
Bromodichloromethane	--	3.35	U	3.35	U	1.14	J
Bromoethene	--	2.19	U	2.19	U	2.19	U
Bromoform	--	5.17	U	5.17	U	5.17	U
Bromomethane	--	0.62	J	0.54	J	0.78	J
Carbon Disulfide	--	1.56	U	1.56	U	6.54	
Carbon Tetrachloride	--	0.31		0.38		0.19	U
Chlorobenzene	--	2.3	U	2.3	U	2.3	U
Chloroethane	--	1.32	U	1.32	U	1.32	U
Chloroform	--	2.44	U	2.44	U	12.2	
Chloromethane	--	1.36		1.12		1.3	
cis-1,2-Dichloroethylene	--	1.98	U	1.98	U	1.98	U
cis-1,3-Dichloropropene	--	2.27	U	2.27	U	2.27	U
Cyclohexane	--	1.72	U	1.38	J	28.9	
Dibromochloromethane	--	4.26	U	4.26	U	4.26	U
Dichlorodifluoromethane	--	1.04	J	1.04	J	2.82	J
Dichlorotetrafluoroethane	--	3.49	U	3.49	U	3.49	U
Ethyl benzene	--	2.17	U	0.74	J	0.61	J
Heptane	--	2.05	U	0.94	J	2.05	U
Hexachloro-1,3-Butadiene	--	5.33	U	5.33	U	5.33	U
Hexane	--	2.19		4.23		4.23	
m,p-Xylene	--	1.3	J	2.61	J	1.78	J
Methyl Methacrylate	--	2.05	U	2.05	U	2.05	U
Methyl tert-Butyl Ether (MTBE)	--	1.8	U	1.8	U	1.8	U
Methylene Chloride	60	4.17		5.91		6.95	
Naphthalene	--	2.62	U	2.62	U	2.62	U
o-Xylene	--	0.48	J	0.83	J	0.91	J
Styrene	--	2.13	U	0.72	J	3.24	
t-1,3-Dichloropropene	--	2.27	U	2.27	U	2.27	U
tert-Butyl alcohol	--	1.52	U	1.52	U	1.52	U
Tetrachloroethylene (PCE)	30	4.34		2.85		2.58	
Tetrahydrofuran	--	1.47	U	1.47	U	5.6	
Toluene	--	4.52		7.16		3.73	
trans-1,2-Dichloroethene	--	1.98	U	1.98	U	1.98	U
Trichloroethylene (TCE)	2	0.16	U	0.16	U	0.16	U
Trichlorofluoromethane	--	1.52	J	1.24	J	1.4	J
Vinyl Chloride	--	0.08	U	0.08	U	0.08	U

Notes:
ug/m^3: Micrograms per cubic meter
U: Analyzed for but not detected
--: No guideline value
J: Estimated value
D: Reported from secondary dilution

Table 15
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Volatile Organic Compounds (VOCs)

			SAMPLE ID:	TRC-SB-01 (0-0.5)		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
			SAMPLING DATE:	12/8/2021		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
			START DEPTH (in. bgs):	8		2		7		4		18		8		3		6	
			END DEPTH (in. bgs):	14		8		13		10		24		14		9		12	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1,1-Trichloroethane	680	100,000	1,000,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,1,2,2-Tetrachloroethane	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,1,2-Trichloro-1,2,2-trifluoroethane	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,1,2-Trichloroethane	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,1-Dichloroethane	270	26,000	480,000	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,1-Dichloroethene	330	100,000	1,000,000	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,2,3-Trichlorobenzene	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,2,4-Trichlorobenzene	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,2-Dibromo-3-Chloropropane	--	--	--	1.8	U	2.7	U *	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,2-Dichlorobenzene	1,100	100,000	1,000,000	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,2-Dichloroethane	20	3,100	60,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,2-Dichloropropane	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,3-Dichlorobenzene	2,400	49,000	560,000	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
1,4-Dichlorobenzene	1,800	13,000	250,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
2-Butanone (MEK)	120	13,000	250,000	9.0	U	13	U	7.1	J	7.8	U	4.4	J	11	U	7.5	U	14	U
2-Hexanone	--	--	--	9.0	U	13	U *	9.9	U	7.8	U	7.9	U	11	U	7.5	U	14	U
4-Methyl-2-pentanone (MIBK)	--	--	--	9.0	U	13	U *	9.9	U	7.8	U	7.9	U	11	U	7.5	U	14	U
Acetone	50	100,000	1,000,000	11	U	16	UJ	41		9.5		29		19		9.0	U	26	
Benzene	60	4,800	89,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Bromoform	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Bromomethane	--	--	--	3.6	U	5.4	UJ	3.9	U	3.1	U	3.1	U	4.6	U	3.0	U	5.8	U
Carbon disulfide	--	--	--	1.8	U	2.7	UJ	0.91	J	1.6	U	0.53	J	2.3	U	1.5	U	2.9	U
Carbon tetrachloride	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Chlorobenzene	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Chlorobromomethane	760	2,400	44,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Chlorodibromomethane	1,100	100,000	1,000,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Chloroethane	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Chloroform	370	49,000	700,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Chloromethane	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
cis-1,2-Dichloroethene	250	100,000	1,000,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
cis-1,3-Dichloropropene	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Cyclohexane	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Dichlorobromomethane	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Dichlorodifluoromethane	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Ethylbenzene	1,000	41,000	780,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Ethylene Dibromide	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Isopropylbenzene	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Methyl acetate	--	--	--	9.0	U	13	U	9.9	U	7.8	U	7.9	U	11	U	7.5	U	14	U
Methyl tert-butyl ether	930	100,000	1,000,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Methylcyclohexane	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Methylene Chloride	50	100,000	1,000,000	3.6	U	5.4	UJ	3.9	U	3.1	U	2.1	J	4.6	U	3.0	U	5.8	U
m-Xylene & p-Xylene	--	--	--	1.8	U	2.7	U	0.38	J	0.44	J	1.6	U	2.3	U	1.5	U	2.9	U
o-Xylene	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Styrene	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Tetrachloroethene	1,300	19,000	300,000	1.4	J	3.1		2.0	U	0.5	J	1.6	U	2.3	U	1.5	U	2.9	U
Toluene	700	100,000	1,000,000	1.8	U	2.7	U	2.0	U	0.61	J	1.6	U	2.3	U	1.5	U	2.9	U
trans-1,2-Dichloroethene	190	100,000	1,000,000	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
trans-1,3-Dichloropropene	--	--	--	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Trichloroethene	470	21,000	400,000	1.2	J	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Trichlorofluoromethane	--	--	--	1.8	U	2.7	UJ	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Vinyl chloride	20	900	27,000	1.8	U	2.7	U	2.0	U	1.6	U	1.6	U	2.3	U	1.5	U	2.9	U
Total Volatile Organic Compounds	--	--	--	2.6		3.1		49.39		11.05		36.03		19		0		26	

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind Duplicate
U: Analyzed for but not detected
* : LCS or LCSD is outside acceptance limits.
J: Estimated value or detection limits
--: No standard
Bolded values exceed Protection of Groundwater SCO (only compared to chlorinated VOCs per NYSDEC)
Highlighted values exceed the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 15
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Volatile Organic Compounds (VOCs)

			SAMPLE ID:	TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
			SAMPLING DATE:	12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
			START DEPTH (in. bgs):	5		3		14		12		3		4		5		2	
			END DEPTH (in. bgs):	11		9		20		18		9		10		11		8	
VOLATILE ORGANIC COMPOUNDS (VOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1,1-Trichloroethane	680	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
1,1,2,2-Tetrachloroethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
1,1,2-Trichloro-1,2,2-trifluoroethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,1,2-Trichloroethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
1,1-Dichloroethane	270	26,000	480,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,1-Dichloroethene	330	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,2,3-Trichlorobenzene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,2,4-Trichlorobenzene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,2-Dibromo-3-Chloropropane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
1,2-Dichlorobenzene	1,100	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,2-Dichloroethane	20	3,100	60,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
1,2-Dichloropropane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
1,3-Dichlorobenzene	2,400	49,000	560,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
1,4-Dichlorobenzene	1,800	13,000	250,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
2-Butanone (MEK)	120	13,000	250,000	10	U	9.1	U	8.8	U	8.4	U	12	U	7.1	U	8.3	U	12	U
2-Hexanone	--	--	--	10	U	9.1	U	8.8	U	8.4	U	12	U	7.1	U	8.3	U	12	U
4-Methyl-2-pentanone (MIBK)	--	--	--	10	U	9.1	U	8.8	U	8.4	U	12	U	7.1	U	8.3	U	12	U
Acetone	50	100,000	1,000,000	37		11	U	12		10	U	15	U	8.5	U	9.9	U	14	UJ
Benzene	60	4,800	89,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Bromoform	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Bromomethane	--	--	--	4.1	U	3.6	U	3.5	U	3.3	U	4.9	U	2.8	U	3.3	U	4.6	U
Carbon disulfide	--	--	--	1.0	J	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
Carbon tetrachloride	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Chlorobenzene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
Chlorobromomethane	760	2,400	44,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Chlorodibromomethane	1,100	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Chloroethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Chloroform	370	49,000	700,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Chloromethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
cis-1,2-Dichloroethene	250	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
cis-1,3-Dichloropropene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Cyclohexane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
Dichlorobromomethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Dichlorodifluoromethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	120	
Ethylbenzene	1,000	41,000	780,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Ethylene Dibromide	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Isopropylbenzene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Methyl acetate	--	--	--	10	U	9.1	U	8.8	U	8.4	U	12	U	7.1	U	8.3	U	12	U
Methyl tert-butyl ether	930	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Methylcyclohexane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
Methylene Chloride	50	100,000	1,000,000	4.1	U	3.6	U	3.5	U	3.3	U	4.9	U	2.8	U	2.3	J	4.6	UJ
m-Xylene & p-Xylene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
o-Xylene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Styrene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Tetrachloroethene	1,300	19,000	300,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	1.7	J
Toluene	700	100,000	1,000,000	2.1	U	1.8	U	0.45	J	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
trans-1,2-Dichloroethene	190	100,000	1,000,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
trans-1,3-Dichloropropene	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Trichloroethene	470	21,000	400,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
Trichlorofluoromethane	--	--	--	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	UJ
Vinyl chloride	20	900	27,000	2.1	U	1.8	U	1.8	U	1.7	U	2.4	U	1.4	U	1.7	U	2.3	U
Total Volatile Organic Compounds	--	--	--	38		0		12.45		0		0		0		2.3		1.7	

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind Duplicate
U: Analyzed for but not detected
* : LCS or LCSD is outside acceptance limits.
J: Estimated value or detection limits
--: No standard
Bolded values exceed Protection of Groundwater SCO (only compared to chlorinated VOCs per NYSDEC)
Highlighted values exceed the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 16
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Semivolatile Organic Compounds (SVOCs)

				SAMPLE ID:		TRC-SB-01 (0-0.5)		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
				SAMPLING DATE:		12/8/2021		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
				START DEPTH (in. bgs):		8		2		7		4		18		8		3		6	
				END DEPTH (in. bgs):		14		8		13		10		24		14		9		12	
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)			Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1-Biphenyl	--	--	--			340	U	5.2	J	17	J	6.8	J	27	J	8.5	J	15	J	380	U
1,2,4,5-Tetrachlorobenzene	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
1,4-Dioxane	100	13,000	250,000			34	U *	36	U *	39	U *	38	U *	36	U *	36	U *	38	U *	38	U *
2,2-oxybis(1-Chloropropane)	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2,3,4,6-Tetrachlorophenol	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2,4,5-Trichlorophenol	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2,4,6-Trichlorophenol	--	--	--			140	U	140	U	160	U	150	U	150	U	150	U	150	U	150	U
2,4-Dichlorophenol	--	--	--			140	U	140	U	160	U	150	U	150	U	150	U	150	U	150	U
2,4-Dimethylphenol	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2,4-Dinitrophenol	--	--	--			270	U	290	UJ	310	U	300	U	290	U	290	U	310	U	310	U
2,4-Dinitrotoluene	--	--	--			69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
2,6-Dinitrotoluene	--	--	--			69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
2-Chloronaphthalene	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2-Chlorophenol	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2-Methylnaphthalene	--	--	--			18	J	15	J	57	J	26	J	99	J	28	J	48	J	380	U
2-Methylphenol	330	100,000	1,000,000			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2-Nitroaniline	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
2-Nitrophenol	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
3,3-Dichlorobenzidine	--	--	--			140	U	140	U *	160	U *	150	U *	150	U	150	U	150	U *	150	U *
3+4-Methylphenols	330	100,000	1,000,000			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
3-Nitroaniline	--	--	--			270	U	360	U	310	U	310	U	290	U	290	U	310	U	310	U
4,6-Dinitro-2-methylphenol	--	--	--			340	U	290	UJ	390	U	380	U	360	U	360	U	380	U	380	U
4-Bromophenyl-phenylether	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
4-Chloro-3-methylphenol	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
4-Chloroaniline	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
4-Chlorophenyl-phenylether	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
4-Nitroaniline	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
4-Nitrophenol	--	--	--			690	U	730	U	790	U	780	U	730	U	740	U	770	U	780	U
Acenaphthene	98,000	100,000	1,000,000			14	J	16	J	120	J	37	J	140	J	25	J	36	J	29	J
Acenaphthylene	107,000	100,000	1,000,000			18	J	34	J	35	J	38	J	47	J	15	J	39	J	18	J
Acetophenone	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
Anthracene	1,000,000	100,000	1,000,000			41	J	65	J	300	J	130	J	210	J	59	J	160	J	93	J
Atrazine	--	--	--			140	U	140	U	160	U	150	U	150	U	150	U	150	U	150	U
Benzaldehyde	--	--	--			340	UJ	360	UJ	390	UJ	380	UJ	360	UJ	360	UJ	380	UJ	380	UJ
Benzo(a)anthracene	1,000	1,000	11,000			160		220		660		550		570		180		340		350	
Benzo(a)pyrene	22,000	1,000	1,100			140		220		610		510		520		160		330		300	
Benzo(b)fluoranthene	1,700	1,000	11,000			230		370		800		740		800		270		420		380	
Benzo(g,h,i)perylene	1,000,000	100,000	1,000,000			94	J	110	J	280	J	220	J	240	J	110	J	170	J	190	J
Benzo(k)fluoranthene	1,700	3,900	110,000			92		110		280		360		300		110		140		140	
bis(2-Chloroethoxy)methane	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
bis(2-Chloroethyl)ether	--	--	--			34	U	36	U	39	U	38	U	36	U	36	U	38	U	38	U
Bis(2-ethylhexyl)phthalate	--	--	--			340	U	360	U	390	U	620	JH	76	J	220	J	380	U	380	U
Butylbenzylphthalate	--	--	--			340	U	85	J	2400		1700		360	U	360	U	26	J	380	U
Caprolactam	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
Carbazole	--	--	--			20	J	27	J	100	J	45	J	73	J	22	J	37	J	28	J
Chrysene	1,000	3,900	110,000			160	J	210	J	610		520		560		180	J	300	J	310	J
Dibenzo(a,h)anthracene	1,000,000	330	1,100			22	J	32	J	77		73		56		16	J	39		54	
Dibenzofuran	210,000	59,000	1,000,000			17	J	14	J	80	J	26	J	110	J	29	J	35	J	15	J
Diethylphthalate	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
Dimethylphthalate	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
Di-n-butylphthalate	--	--	--			340	U	360	U	390	U	380	U	14	J	360	U	380	U	380	U
Di-n-octyl phthalate	--	--	--			340	U	360	U *	390	U *	380	U *	360	U	360	U	380	U *	380	U *
Fluoranthene	1,000,000	100,000	1,000,000			300	J	360		1300		850		1200		400		620		570	
Fluorene	386,000	100,000	1,000,000			14	J	26	J	130	J	33	J	130	J	14	J	70	J	28	J
Hexachlorobenzene	3,200	1,200	12,000			34	U	36	U	39	U	38	U	36	U	36	U	38	U	38	U
Hexachlorobutadiene	--	--	--			69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Hexachlorocyclopentadiene	--	--	--			340	U	360	UJ	390	U	380	U	360	U	360	U	380	U	380	U
Hexachloroethane	--	--	--			34	U	36	U	39	U	38	U	36	U	36	U	38	U	38	U
Indeno(1,2,3-cd)pyrene	8,200	500	11,000			140		130		360		290		380		130		200		210	
Isophorone	--	--	--			140	U	140	U	160	U	150	U	150	U	150	U	150	U	150	U
Naphthalene	12,000	100,000	1,000,000			21	J	16	J	84	J	35	J	130	J	41	J	69	J	11	J
Nitrobenzene	--	15,000	140,000			34	U	36	U	39	U	38	U	36	U	36	U	38	U	38	U
n-Nitroso-di-n-propylamine	--	--	--			34	U	36	U	39	U	38	U	36	U	36	U	38	U	38	U
n-Nitrosodiphenylamine	--	--	--			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
Pentachlorophenol	800	6,700	55,000			270	U	290	U	310	U	310	U	290	U	290	U	310	U	310	U
Phenanthrene	1,000,000	100,000	1,000,000			180	J	200	J	1100		440		740		210	J	520		380	
Phenol	330	100,000	1,000,000			340	U	360	U	390	U	380	U	360	U	360	U	380	U	380	U
Pyrene	1,000,000	100,000	1,000,000			260	J	350	J	1300		1000		1000		340	J	670		680	
Total Semivolatile Compounds	--	--	--			1941		2785.2		10820		8249.8		7422		2567.5		4379		3846	

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
U: Analyzed for but not detected
J: Estimated value or detection limits
* : LCS or LCSD is outside acceptance limits.
--: No standard or not sampled
Highlighted and bolded values exceeded the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 16
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Semivolatile Organic Compounds (SVOCs)

				SAMPLE ID:		TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
				SAMPLING DATE:		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
				START DEPTH (in. bgs):		5		3		14		12		3		4		5		2	
				END DEPTH (in. bgs):		11		9		20		18		9		10		11		8	
SEMIVOLATILE ORGANIC COMPOUNDS (SVOCs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1,1-Biphenyl	--	--	--	8.5	J	9.3	J	13	J	34	J	7.3	J	8.1	J	13	J	10	J
1,2,4,5-Tetrachlorobenzene	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
1,4-Dioxane	100	13,000	250,000	36	U *	36	U *	37	U *	36	U *	37	U *	36	U *	36	U *	36	U *
2,2-oxybis(1-Chloropropane)	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2,3,4,6-Tetrachlorophenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2,4,5-Trichlorophenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2,4,6-Trichlorophenol	--	--	--	150	U	150	U	150	U	140	U	150	U	140	U	140	U	150	U
2,4-Dichlorophenol	--	--	--	150	U	150	U	150	U	140	U	150	U	140	U	140	U	150	U
2,4-Dimethylphenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2,4-Dinitrophenol	--	--	--	290	U	290	U	300	U	290	U	300	U	290	U	290	U	290	UJ
2,4-Dinitrotoluene	--	--	--	74	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
2,6-Dinitrotoluene	--	--	--	74	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
2-Chloronaphthalene	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2-Chlorophenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2-Methylnaphthalene	--	--	--	28	J	37	J	46	J	250	J	24	J	48	J	45	J	19	J
2-Methylphenol	330	100,000	1,000,000	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2-Nitroaniline	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
2-Nitrophenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
3,3-Dichlorobenzidine	--	--	--	150	U	150	U	150	U	140	U	150	U	140	U	140	U	150	U *
3+4-Methylphenols	330	100,000	1,000,000	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
3-Nitroaniline	--	--	--	290	U	290	U	300	U	290	U	300	U	290	U	290	U	290	U
4,6-Dinitro-2-methylphenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	UJ
4-Bromophenyl-phenylether	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
4-Chloro-3-methylphenol	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
4-Chloroaniline	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
4-Chlorophenyl-phenylether	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
4-Nitroaniline	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
4-Nitrophenol	--	--	--	740	U	740	U	750	U	720	U	750	U	720	U	720	U	730	U
Acenaphthene	98,000	100,000	1,000,000	25	J	33	J	79	J	180	J	32	J	20	J	69	J	20	J
Acenaphthylene	107,000	100,000	1,000,000	15	J	27	J	21	J	14	J	22	J	24	J	27	J	71	J
Acetophenone	--	--	--	360	U	360	U	53	J	360	U	370	U	360	U	28	J	360	U
Anthracene	1,000,000	100,000	1,000,000	59	J	99	J	250	J	180	J	79	J	52	J	190	J	97	J
Atrazine	--	--	--	150	U	150	U	150	U	140	U	150	U	140	U	140	U	150	U
Benzaldehyde	--	--	--	360	UJ	360	U	370	UJ	360	UJ	370	UJ	360	UJ	360	UJ	360	UJ
Benzo(a)anthracene	1,000	1,000	11,000	180		340		720		410		330		310		660		350	
Benzo(a)pyrene	22,000	1,000	1,100	160		320		620		370		320		310		660		370	
Benzo(b)fluoranthene	1,700	1,000	11,000	270		470		860		550		470		480		880		600	
Benzo(g,h,i)perylene	1,000,000	100,000	1,000,000	110	J	160	J	290	J	210	J	180	J	180	J	340	J	200	J
Benzo(k)fluoranthene	1,700	3,900	110,000	110		190		350		250		170		170		380		290	
bis(2-Chloroethoxy)methane	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
bis(2-Chloroethyl)ether	--	--	--	36	U	36	U	37	U	36	U	37	U	36	U	36	U	36	U
Bis(2-ethylhexyl)phthalate	--	--	--	220	J	360	U	330	J	360	U	42	J	360	U	36	J	360	U
Butylbenzylphthalate	--	--	--	360	U	360	U	18	J	360	U	21	J	360	U	360	U	120	J
Caprolactam	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
Carbazole	--	--	--	22	J	33	J	73	J	85	J	33	J	22	J	58	J	42	J
Chrysene	1,000	3,900	110,000	180	J	340	J	660		400		340	J	320	J	610		340	J
Dibenzo(a,h)anthracene	1,000,000	330	1,100	16	J	32	J	82		46		35	J	52		68		51	
Dibenzofuran	210,000	59,000	1,000,000	29	J	36	J	56	J	120	J	31	J	19	J	45	J	20	J
Diethylphthalate	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
Dimethylphthalate	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
Di-n-butylphthalate	--	--	--	360	U	360	U	3400		360	U	15	J	360	U	360	U	360	U
Di-n-octyl phthalate	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U *
Fluoranthene	1,000,000	100,000	1,000,000	400		680		1400		840		630		510		1300		600	
Fluorene	386,000	100,000	1,000,000	14	J	30	J	82	J	130	J	33	J	15	J	60	J	22	J
Hexachlorobenzene	3,200	1,200	12,000	36	U	36	U	37	U	36	U	37	U	36	U	36	U	36	U
Hexachlorobutadiene	--	--	--	74	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Hexachlorocyclopentadiene	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	UJ
Hexachloroethane	--	--	--	36	U	36	U	37	U	36	U	37	U	36	U	36	U	36	U
Indeno(1,2,3-cd)pyrene	8,200	500	11,000	130		250		450		300		260		260		**550**		240	
Isophorone	--	--	--	150	U	150	U	150	U	140	U	150	U	140	U	140	U	150	U
Naphthalene	12,000	100,000	1,000,000	41	J	47	J	54	J	97	J	41	J	30	J	58	J	23	J
Nitrobenzene	--	15,000	140,000	36	U	36	U	37	U	36	U	37	U	36	U	36	U	36	U
n-Nitroso-di-n-propylamine	--	--	--	36	U	36	U	37	U	36	U	37	U	36	U	36	U	36	U
n-Nitrosodiphenylamine	--	--	--	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
Pentachlorophenol	800	6,700	55,000	290	U	290	U	300	U	290	U	300	U	290	U	290	U	290	U
Phenanthrene	1,000,000	100,000	1,000,000	210	J	430		870		680		370		260	J	770		290	J
Phenol	330	100,000	1,000,000	360	U	360	U	370	U	360	U	370	U	360	U	360	U	360	U
Pyrene	1,000,000	100,000	1,000,000	340	J	630		1200		700		560		480		1200		580	
Total Semivolatile Compounds	--	--	--	2567.5		4193.3		11977		5846		4045.3		3570.1		8047		4565	

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
U: Analyzed for but not detected
J: Estimated value or detection limits
* : LCS or LCSD is outside acceptance limits.
--: No standard or not sampled
Highlighted and bolded values exceeded the Restricted-Residential Use SCO
Bordered values exceed the Industrial Use SCO

Table 17
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
Polychlorinated Biphenyls (PCBs)

			SAMPLE ID:	TRC-SB-01 (0-0.5)		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
			SAMPLING DATE:	12/8/2021		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
			START DEPTH (in. bgs):	8		2		7		4		18		8		3		6	
			END DEPTH (in. bgs):	14		8		13		10		24		14		9		12	
POLYCHLORINATED BIPHENYLS (PCBs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
Aroclor 1016	3,200	1,000	25,000	69	UJ	73	UJ	79	UJ	78	UJ	73	UJ	74	UJ	77	UJ	78	UJ
Aroclor 1221	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor 1232	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor 1242	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor 1248	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor 1254	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor 1260	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor-1262	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Aroclor-1268	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U
Total PCBs	3,200	1,000	25,000	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
J: Estimated value or detection limits
U: Analyzed for but not detected
--: No standard or not analyzed

Table 17
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
Polychlorinated Biphenyls (PCBs)

			SAMPLE ID:	TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
			SAMPLING DATE:	12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
			START DEPTH (in. bgs):	5		3		14		12		3		4		5		2	
			END DEPTH (in. bgs):	11		9		20		18		9		10		11		8	
POLYCHLORINATED BIPHENYLS (PCBs)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
Aroclor 1016	3,200	1,000	25,000	76	UJ	74	UJ	75	UJ	72	UJ	75	UJ	72	UJ	72	UJ	73	UJ
Aroclor 1221	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor 1232	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor 1242	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor 1248	3,200	1,000	25,000	76	U	270	J	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor 1254	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor 1260	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor-1262	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Aroclor-1268	3,200	1,000	25,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
Total PCBs	3,200	1,000	25,000	76	U	270		75	U	72	U	75	U	72	U	72	U	73	U

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
J: Estimated value or detection limits
U: Analyzed for but not detected
--: No standard or not analyzed

Table 18
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Herbicides

				SAMPLE ID:		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
				SAMPLING DATE:		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
				START DEPTH (in. bgs):		2		7		4		18		8		3		6	
				END DEPTH (in. bgs):		8		13		10		24		14		9		12	
HERBICIDES	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
2,4,5-T	--	--	--	34	U	36	U	39	U	39	U	36	U	180	U	38	U	39	U
2,4-D	--	--	--	34	U	36	U	39	U	39	U	36	U	180	U	38	U	39	U
Silvex (2,4,5-TP)	3,800	100,000	1,000,000	34	UJ	36	U	39	U	39	U	36	UJ	180	UJ	38	U	39	U

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
U: Analyzed for but not detected
J: Estimated value or detection limits
--: No standard

Table 18
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Herbicides

			SAMPLE ID:	TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
			SAMPLING DATE:	12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
			START DEPTH (in. bgs):	5		3		14		12		3		4		5		2	
			END DEPTH (in. bgs):	11		9		20		18		9		10		11		8	
HERBICIDES	**NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**	**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**		**Result (ug/kg)**	
2,4,5-T	--	--	--	190	U	180	U	190	U	180	U	190	U	180	U	180	U	36	U
2,4-D	--	--	--	190	U	180	U	190	U	180	U	190	U	180	U	180	U	36	U
Silvex (2,4,5-TP)	3,800	100,000	1,000,000	190	UJ	180	UJ	190	UJ	180	UJ	190	UJ	180	UJ	180	UJ	36	U

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
U: Analyzed for but not detected
J: Estimated value or detection limits
--: No standard

Table 19
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Pesticides

			SAMPLE ID:	TRC-SB-01 (0-0.5)		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
			SAMPLING DATE:	12/8/2021		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
			START DEPTH (in. bgs):	8		2		7		4		18		8		3		6	
			END DEPTH (in. bgs):	14		8		13		10		24		14		9		12	
PESTICIDES	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
4,4'-DDD	14,000	13,000	180,000	6.9	U	7.3	U	25		7.8	U	9.8		7.4	U	7.7	U	7.8	U
4,4'-DDE	17,000	8,900	120,000	6.9	U	7.3	U	20		5.8	J	5.9	J	4.4	J	4.1	J	9.0	
4,4'-DDT	136,000	7,900	94,000	2.8	J	7.3	U	4.8	J	7.8	U	3.4	J p	7.4	U	3.1	J p	7.8	U
Aldrin	190	97	1,400	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
alpha-BHC	20	480	6,800	2.1	U	2.2	U	2.4	U	2.3	U	2.2	U	2.2	U	2.3	U	2.3	U
beta-BHC	90	4,200	47,000	2.1	U	2.2	U	2.4	U	2.3	U	2.2	U	2.2	U	2.3	U	2.3	U
Chlordane (technical)	--	360	14,000	69	U	73	U	140		59	J	73	U	74	U	77	U	78	U
delta-BHC	250	100,000	1,000,000	2.1	U	2.2	U	2.4	U	2.3	U	2.2	U	2.2	U	2.3	U	2.3	U
Dieldrin	100	200	2,800	2.1	U	2.2	U	2.4	U	2.3	U	2.2	U	2.2	U	2.3	U	2.3	U
Endosulfan I	102,000	24,000	920,000	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Endosulfan II	102,000	24,000	920,000	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Endosulfan sulfate	1,000,000	24,000	920,000	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Endrin	60	11,000	410,000	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Endrin aldehyde	--	--	--	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Endrin ketone	--	--	--	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
gamma-BHC (Lindane)	100	1,300	23,000	2.1	U	2.2	U	2.4	U	2.3	U	2.2	U	2.2	U	2.3	U	2.3	U
Heptachlor	380	4,200	47,000	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Heptachlor epoxide	--	2,100	29,000	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Methoxychlor	--	--	--	6.9	U	7.3	U	7.9	U	7.8	U	7.3	U	7.4	U	7.7	U	7.8	U
Toxaphene	--	--	--	69	U	73	U	79	U	78	U	73	U	74	U	77	U	78	U

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
J : Indicates an estimated value.
p : The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
U: Analyzed for but not detected
--: No standard

Table 19
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL Pesticides

			SAMPLE ID:	TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
			SAMPLING DATE:	12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
			START DEPTH (in. bgs):	5		3		14		12		3		4		5		2	
			END DEPTH (in. bgs):	11		9		20		18		9		10		11		8	
PESTICIDES	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
4,4'-DDD	14,000	13,000	180,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
4,4'-DDE	17,000	8,900	120,000	7.6	U	3.1	J	7.5	U	7.2	U	2.3	J	7.2	U	7.2	U	2.6	J
4,4'-DDT	136,000	7,900	94,000	7.6	U	3.6	J p	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	3.6	J p
Aldrin	190	97	1,400	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
alpha-BHC	20	480	6,800	2.3	U	2.2	U	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
beta-BHC	90	4,200	47,000	2.3	U	2.2	U	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
Chlordane (technical)	--	360	14,000	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U
delta-BHC	250	100,000	1,000,000	2.3	U	2.2	U	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
Dieldrin	100	200	2,800	2.3	U	2.2	U	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
Endosulfan I	102,000	24,000	920,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Endosulfan II	102,000	24,000	920,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Endosulfan sulfate	1,000,000	24,000	920,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Endrin	60	11,000	410,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Endrin aldehyde	--	--	--	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Endrin ketone	--	--	--	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
gamma-BHC (Lindane)	100	1,300	23,000	2.3	U	2.2	U	2.3	U	2.2	U	2.2	U	2.2	U	2.2	U	2.2	U
Heptachlor	380	4,200	47,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Heptachlor epoxide	--	2,100	29,000	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Methoxychlor	--	--	--	7.6	U	7.4	U	7.5	U	7.2	U	7.5	U	7.2	U	7.2	U	7.3	U
Toxaphene	--	--	--	76	U	74	U	75	U	72	U	75	U	72	U	72	U	73	U

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
J : Indicates an estimated value.
p : The %RPD between the primary and confirmation column/detector is >40%. The lower value has been reported.
U: Analyzed for but not detected
--: No standard

Table 20
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TAL Metals

				SAMPLE ID:		TRC-SB-01 (0-0.5)		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
				SAMPLING DATE:		12/8/2021		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
				START DEPTH (in. bgs):		8		2		7		4		18		8		3		6	
				END DEPTH (in. bgs):		14		8		13		10		24		14		9		12	
METALS	**NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**	**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**	
Aluminum	--	--	--	2,250		6,160		6,540		5,940		3,910		6,430		5,190		5,690	
Antimony	--	--	--	0.56	J	0.46	J	0.98	J	0.50	J	1.4	J	0.46	J	0.35	J	0.26	J
Arsenic	16	16	16	4.7		6.8		6.6		6.0		10.4		9.9		4.7		5.8	
Barium	820	400	10,000	34.6		72.5		92.2		73.9		129		67.8		68.8		97.3	
Beryllium	47	72	2,700	0.25	J	0.33	J	0.36	J	0.58		0.31	J	0.35	J	0.30	J	0.31	J
Cadmium	7.5	4.3	60	0.18	J	0.52	J	0.69	J	0.28	J	0.49	J	0.25	J	0.29	J	0.31	J
Calcium	--	--	--	8,530		49,000		32,500		46,100		13,100		47,400		50,300		45,100	
Chromium	--	180	6,800	11.1		15.7		21.3		23.2		16.4		17.3		15.9		20.0	
Cobalt	--	--	--	2.9		5.5		5.3		6.9		4.8		8.4		4.2		4.7	
Copper	1,720	270	10,000	40.3		64.3		82.8		**304**		108		68.2		45.3		25.2	
Iron	--	--	--	9,080		15,200		15,600		15,500		21,600		22,100		12,400		31,400	
Lead	450	400	3,900	66.3		129		153		121		278		77.4		74.0		83.3	
Magnesium	--	--	--	1,460		15,600	J	5610		8,260		2,260		5,380		8,650		7,940	
Manganese	2000	2,000	10,000	105		205		226		188		219		244		176		207	
Mercury	0.73	0.81	5.7	0.081		0.15		0.26		0.13		0.52		0.093		0.14		0.44	
Nickel	130	310	10,000	6.5		15.2		17.8		18.7		12.8		19.2		13.3		15.8	
Potassium	--	--	--	639		969	JH	1,290		1,020		698		764		906		638	
Selenium	4	180	6,800	0.19	J	0.35	J	0.58	J	0.27	J	0.58	J	0.22	J	0.27	J	0.24	J
Silver	8.3	180	6,800	0.97	UJ	0.13	J	0.25	J	0.19	J	2.1	UJ	0.14	J	0.15	J	0.19	J
Sodium	--	--	--	135		591	JH	707	JH	335	JH	159	J	311		187	JH	156	JH
Thallium	--	--	--	0.39	U	0.083	J	0.11	J	0.089	J	0.12	J	0.055	J	0.079	J	0.13	J
Vanadium	--	--	--	12.8		33.8	J	28.3		29.7		18.6		29.9		20.3		20.7	
Zinc	2,480	10,000	10,000	59.7		180	J	167		709		209		157		122		180	

Notes:
mg/kg: Milligrams per kilogram
U: Analyzed for but not detected
J: Estimated value or detection limits
H: Estimated high
--: No standard or not analyzed
Highlighted and bolded values exceeded the Restricted-Residential Use SCO

Table 20
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TAL Metals

			SAMPLE ID:	TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
			SAMPLING DATE:	12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
			START DEPTH (in. bgs):	5		3		14		12		3		4		5		2	
			END DEPTH (in. bgs):	11		9		20		18		9		10		11		8	
METALS	**NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)**	**NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)**	**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**		**Result (mg/kg)**	
Aluminum	--	--	--	5,200		3,970		8,700		3,330		5,060		4,120		4,480		6,090	
Antimony	--	--	--	1.2		1.3		0.34	J	0.49	J	0.43	J	0.54	J	0.66	J	0.44	J
Arsenic	16	16	16	11.0		8.1		4.5		4.3		5.1		6.1		6.5		5.8	
Barium	820	400	10,000	145		85.6		123		41.5		69.3		58.0		63.7		86.6	
Beryllium	47	72	2,700	0.55		0.33	J	0.34	J	0.25	J	0.34	J	0.31	J	0.28	J	0.31	J
Cadmium	7.5	4.3	60	0.65	J	0.50	J	0.27	J	0.28	J	0.26	J	0.37	J	0.42	J	0.54	J
Calcium	--	--	--	29,500		26,500		57,500		29,200		34,800		9,720		35,000		36,700	
Chromium	--	180	6,800	19.7		16.6		33.9		10.2		12.8		12.6		11.1		16.0	
Cobalt	--	--	--	7.2		5.1		6.3		3.4		4.6		10.3		5.6		5.6	
Copper	1,720	270	10,000	179		144		39.5		54.0		132		81.8		85.9		68.0	
Iron	--	--	--	18,300		16,500		16,500		11,100		9,740		12,700		14,700		15,800	
Lead	450	400	3,900	**682**		241		56.5		119		99.7		194		159		129	
Magnesium	--	--	--	6,940		10,400		8,730		9,340		5,990		2,810		12,400		10,200	
Manganese	2000	2,000	10,000	220		188		245		169		153		175		205		202	J
Mercury	0.73	0.81	5.7	**1.0**		0.52		0.13		0.24		**1.4**		**1.9**		0.49		0.15	
Nickel	130	310	10,000	20.2		13.5		16.4		11.1		11.8		13.0		12.6		15.8	
Potassium	--	--	--	785		604	JH	3,300	JH	490	JH	656	JH	536	JH	719	JH	942	
Selenium	4	180	6,800	1.0	J	0.83	J	0.21	J	0.21	J	0.20	J	0.35	J	0.40	J	0.29	J
Silver	8.3	180	6,800	0.46	J	0.27	J	1.1	J	0.11	J	0.15	J	0.14	J	0.17	J	0.12	J
Sodium	--	--	--	952		733		147		98.8	J	134		596		695		636	JH
Thallium	--	--	--	0.10	J	0.10	J	0.21	J	0.045	J	0.060	J	0.073	J	0.085	J	0.094	J
Vanadium	--	--	--	27.2		22.5		33.5		28.8		21.9		16.7		26.7		30.2	J
Zinc	2,480	10,000	10,000	511		200		100		107		105		200		161		193	J

Notes:
mg/kg: Milligrams per kilogram
U: Analyzed for but not detected
J: Estimated value or detection limits
H: Estimated high
--: No standard or not analyzed
Highlighted and bolded values exceeded the Restricted-Residential Use SCO

Table 21
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL PFAS

			SAMPLE ID:	TRC-SB-01 (0-0.5)		TRC-SB-02 (0-0.5)		TRC-SB-03 (0-0.5)		TRC-SB-04 (0-0.5)		TRC-SB-05 (0-0.5)		TRC-SB-06 (0-0.5)		TRC-SB-07 (0-0.5)		TRC-SB-08 (0-0.5)	
			SAMPLING DATE:	12/8/2021		12/9/2021		12/9/2021		12/9/2021		12/8/2021		12/8/2021		12/9/2021		12/9/2021	
			START DEPTH (in. bgs):	8		2		7		4		18		8		3		6	
			END DEPTH (in. bgs):	14		8		13		10		24		14		9		12	
PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	--	--	--	2.05	U	2.14	U	2.32	U	2.25	U	0.032	J	2.19	U	2.28	U	2.34	U
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	--	--	--	2.05	U	2.14	U	2.32	U	2.25	U	2.23	U	2.19	U	2.28	U	2.34	U
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	--	--	--	2.05	U	2.14	U	2.32	U	2.25	U	2.23	U	2.19	U	2.28	U	2.34	U
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	--	--	--	2.05	U	2.14	U	2.32	U	2.25	U	2.23	U	2.19	U	2.28	U	2.34	U
Perfluorobutanesulfonic acid (PFBS)	--	--	--	0.21	U	0.21	U	0.23	U	0.23	U	0.22	U	0.22	U	0.23	U	0.23	U
Perfluorobutanoic acid (PFBA)	--	--	--	0.51	U	0.54	U	0.58	U	0.56	U	0.56	U	0.55	U	0.57	U	0.58	U
Perfluorodecanesulfonic acid (PFDS)	--	--	--	0.032	J	0.063	J	0.070	J	0.029	J	0.030	J	0.034	J	0.032	J	0.060	J
Perfluorodecanoic acid (PFDA)	--	--	--	0.21	U	0.21	U	0.23	U	0.23	U	0.22	U	0.22	U	0.23	U	0.23	U
Perfluorododecanoic acid (PFDoA)	--	--	--	0.032	J	0.10	J	0.11	J	0.061	J	0.031	J	0.068	J	0.12	J	0.090	J
Perfluoroheptanesulfonic Acid (PFHpS)	--	--	--	0.21	U	0.021	J	0.23	U	0.23	U	0.22	U	0.22	U	0.23	U	0.23	U
Perfluoroheptanesulfonic Acid (PFHpS)	--	--	--	0.026	J	0.052	J	0.024	J	0.23	U	0.22	U	0.22	U	0.23	U	0.23	U
Perfluorohexanesulfonic acid (PFHxS)	--	--	--	0.21	U	0.21	U	0.23	U	0.23	U	0.22	U	0.22	U	0.23	U	0.016	J
Perfluorohexanoic acid (PFHxA)	--	--	--	0.037	J	0.050	J	0.027	J	0.029	J	0.22	U	0.029	J	0.032	J	0.23	U
Perfluorononanoic acid (PFNA)	--	--	--	0.048	J	0.063	J	0.058	J	0.030	J	0.22	U	0.22	U	0.021	J	0.23	U
Perfluorooctanesulfonamide (PFOSA)	--	--	--	0.21	U	0.033	J	0.11	J	0.23	U	0.22	U	0.22	U	0.23	U	0.23	U
Perfluorooctanesulfonic acid (PFOS)	3.4	44	440	0.50		2.26	JH	1.71	JH	0.35	JH	0.33		0.12	J	0.29	JH	0.23	U
Perfluorooctanoic acid (PFOA)	1.1	33	600	0.20	J	0.48		0.21	J	0.072	J	0.096	J	0.031	J	0.050	J	0.029	J
Perfluoropentanoic acid (PFPeA)	--	--	--	0.21	U	0.21	U	0.23	U	0.23	U	0.22	U	0.22	U	0.23	U	0.23	U
Perfluorotetradecanoic acid (PFTeA)	--	--	--	0.21	U	0.056	J	0.054	J	0.027	J	0.22	U	0.047	J	0.072	J	0.049	J
Perfluorotridecanoic acid (PFTriA)	--	--	--	0.21	U	0.055	J	0.067	J	0.034	J	0.018	J	0.036	J	0.065	J	0.047	J
Perfluoroundecanoic acid (PFUnA)	--	--	--	0.037	J	0.10	J	0.11	J	0.057	J	0.029	J	0.037	J	0.066	J	0.060	J

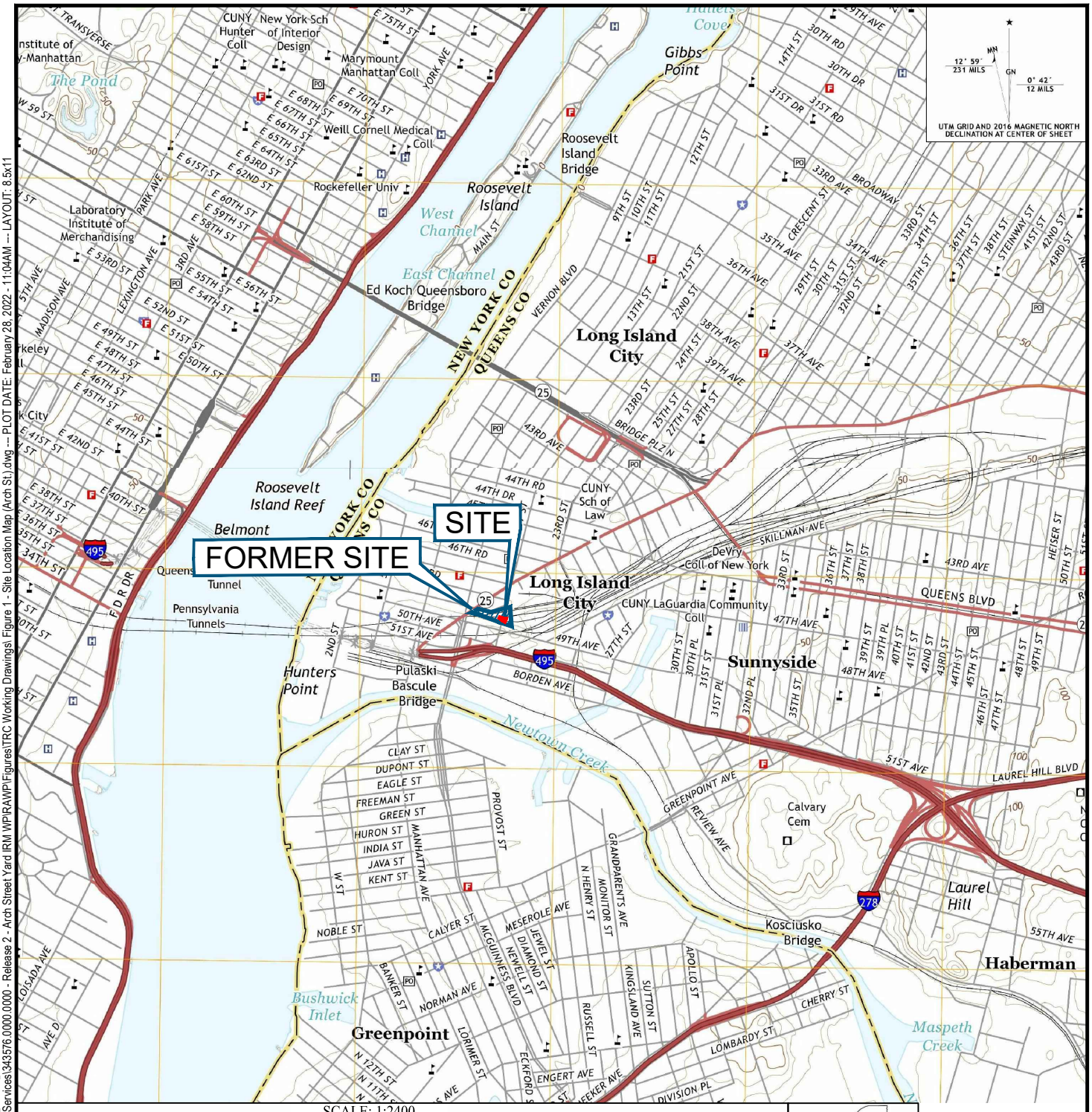
Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
U: Analyzed for but not detected
J: Estimated value or detection limits
JH: High Estimated value or detection limits
--: No standard
Restricted Residential, Protection of Groundwater Use, and Industrial Use SCOs for PFAS are presented in the NYSDEC Guidance Document titled "Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances Under NYSDEC's Part 375 Remedial Programs" (June 2021) and are proposed in an upcoming revision to 6 NYCRR Part 375-6.

Table 21
Long Island Rail Road
Arch Street Yard RAWP
Surface Soil Samples
TCL PFAS

			SAMPLE ID:	TRC-SB-09 (0-0.5)		TRC-SB-10 (0-0.5)		TRC-SB-11 (0-0.5)		TRC-SB-12 (0-0.5)		TRC-SB-13 (0-0.5)		TRC-SB-14 (0-0.5)		TRC-SB-15 (0-0.5)		TRC-DUP-1	
			SAMPLING DATE:	12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/8/2021		12/9/2021	
			START DEPTH (in. bgs):	5		3		14		12		3		4		5		2	
			END DEPTH (in. bgs):	11		9		20		18		9		10		11		8	
PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)	NYCRR 6 Part 375 - Protection of Groundwater* Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Restricted Residential Use Soil Cleanup Objectives (SCOs)	NYCRR 6 Part 375 - Industrial Use Soil Cleanup Objectives (SCOs)	Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)		Result (ug/kg)	
1H,1H,2H,2H-perfluorodecanesulfonic acid (8:2)	--	--	--	2.22	U	2.17	U	2.21	U	2.19	U	2.16	U	2.13	U	2.16	U	2.12	U
1H,1H,2H,2H-perfluorooctanesulfonic acid (6:2)	--	--	--	2.22	U	2.17	U	2.21	U	2.19	U	2.16	U	2.13	U	2.16	U	2.12	U
N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	--	--	--	2.22	U	2.17	U	2.21	U	2.19	U	2.16	U	2.13	U	2.16	U	2.12	U
N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	--	--	--	2.22	U	2.17	U	2.21	U	2.19	U	2.16	U	2.13	U	2.16	U	2.12	U
Perfluorobutanesulfonic acid (PFBS)	--	--	--	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.21	U	0.22	U	0.21	U
Perfluorobutanoic acid (PFBA)	--	--	--	0.55	U	0.54	U	0.55	U	0.55	U	0.54	U	0.23	J	0.54	U	0.53	U
Perfluorodecanesulfonic acid (PFDS)	--	--	--	0.027	J	0.026	J	0.023	J	0.042	J	0.032	J	0.025	J	0.045	J	0.058	J
Perfluorodecanoic acid (PFDA)	--	--	--	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.21	U	0.22	U	0.21	U
Perfluorododecanoic acid (PFDoA)	--	--	--	0.047	J	0.033	J	0.068	J	0.068	J	0.094	J	0.068	J	0.095	J	0.11	J
Perfluoroheptanesulfonic Acid (PFHpS)	--	--	--	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.21	U	0.22	U	0.025	J
Perfluoroheptanesulfonic Acid (PFHpS)	--	--	--	0.22	U	0.027	J	0.22	U	0.045	J	0.033	J	0.073	J	0.060	J	0.042	J
Perfluorohexanesulfonic acid (PFHxS)	--	--	--	0.22	U	0.22	U	0.22	U	0.016	J	0.22	U	0.21	U	0.22	U	0.21	U
Perfluorohexanoic acid (PFHxA)	--	--	--	0.22	U	0.051	J	0.024	J	0.035	J	0.047	J	0.13	J	0.11	J	0.055	J
Perfluorononanoic acid (PFNA)	--	--	--	0.027	J	0.042	J	0.021	J	0.22	U	0.031	J	0.052	J	0.053	J	0.079	J
Perfluorooctanesulfonamide (PFOSA)	--	--	--	0.22	U	0.22	U	0.22	U	0.22	U	0.22	U	0.21	U	0.22	U	0.21	U
Perfluorooctanesulfonic acid (PFOS)	3.4	44	440	0.33		0.58		0.11	J	0.15	J	0.13	J	0.28		0.21	J	2.22	JH
Perfluorooctanoic acid (PFOA)	1.1	33	600	0.065	J	0.099	J	0.042	J	0.033	J	0.044	J	0.098	J	0.095	J	0.45	
Perfluoropentanoic acid (PFPeA)	--	--	--	0.22	U	0.22	U	0.22	U	0.058	J	0.043		0.12	J	0.11	J	0.21	U
Perfluorotetradecanoic acid (PFTeA)	--	--	--	0.031	J	0.029	J	0.047	J	0.22	U	0.057	J	0.037	J	0.091	J	0.043	J
Perfluorotridecanoic acid (PFTriA)	--	--	--	0.028	J	0.020	J	0.033	J	0.034	J	0.050	J	0.028	J	0.063	J	0.054	J
Perfluoroundecanoic acid (PFUnA)	--	--	--	0.045	J	0.043	J	0.034	J	0.059	J	0.090	J	0.078	J	0.082	J	0.11	J

Notes:
ug/kg: Micrograms per kilogram
DUP: Blind duplicate
U: Analyzed for but not detected
J: Estimated value or detection limits
JH: High Estimated value or detection limits
--: No standard
Restricted Residential, Protection of Groundwater Use, and Industrial Use SCOs for PFAS are presented in the NYSDEC Guidance Document titled "Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances Under NYSDEC's Part 375 Remedial Programs" (June 2021) and are proposed in an upcoming revision to 6 NYCRR Part 375-6.

FIGURES



MAP INCLUDES INFORMATION FROM THE FOLLOWING MAP SHEET(S):
TP, BROOKLYN, NY, 7.5 MINUTE DATED 2016,
N, CENTRAL PARK, NY, 7.5 MINUTE DATED 2016.

MAP OBTAINED THROUGH USE OF TOPOVIEW WITH THE INTERFACE CREATED BY THE NATIONAL GEOLOGIC MAP DATABASE PROJECT (NGMDB), IN SUPPORT OF THE TOPOGRAPHIC MAPPING PROGRAM, MANAGED BY THE USGS NATIONAL GEOSPATIAL PROGRAM (NGP).

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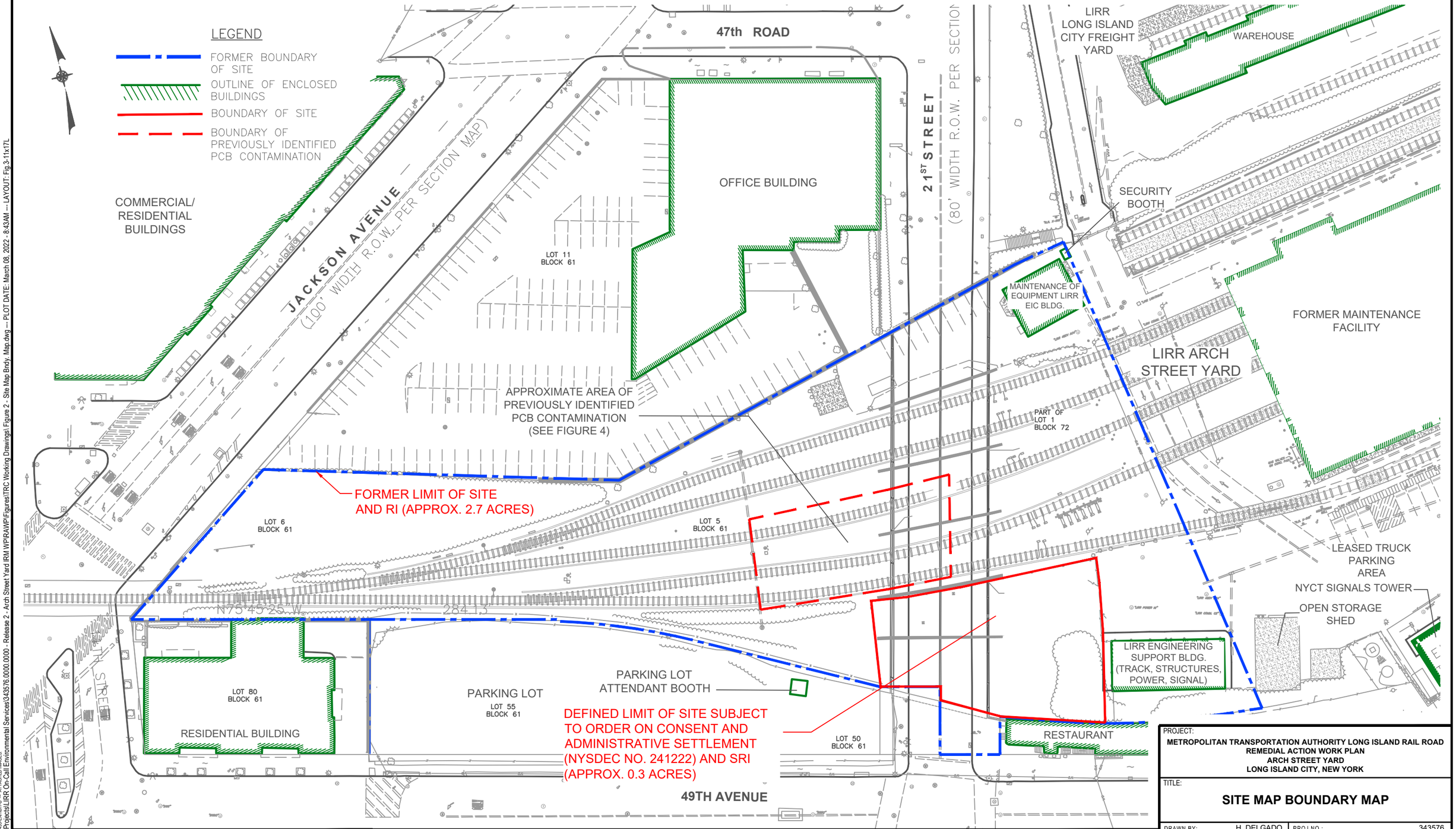
PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SITE LOCATION MAP

DRAWN BY:	B. SCHLAFF
CHECKED BY:	E. EBERT
APPROVED BY:	K. MYERS
DATE:	MARCH 2022
PROJ. NO.:	343576
FILE:	Figure 1 - Site Location Map (Arch St.).dwg

FIGURE 1

8.5x11 -- ATTACHED XREFS: -- ATTACHED IMAGES: NY_Brooklyn_20160824_TM, NY_Central_Park_20160824_TM;
DRAWING NAME: \\nyc-fp1\shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 1 - Site Location Map (Arch St.).dwg -- PLOT DATE: February 28, 2022 - 11:04AM -- LAYOUT: 8.5x11



NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-2 "SITE PLAN SHOWING DEFINED BOUNDARIES OF PROJECT SITE" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 60' 120'

SCALE: 1" = 60'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

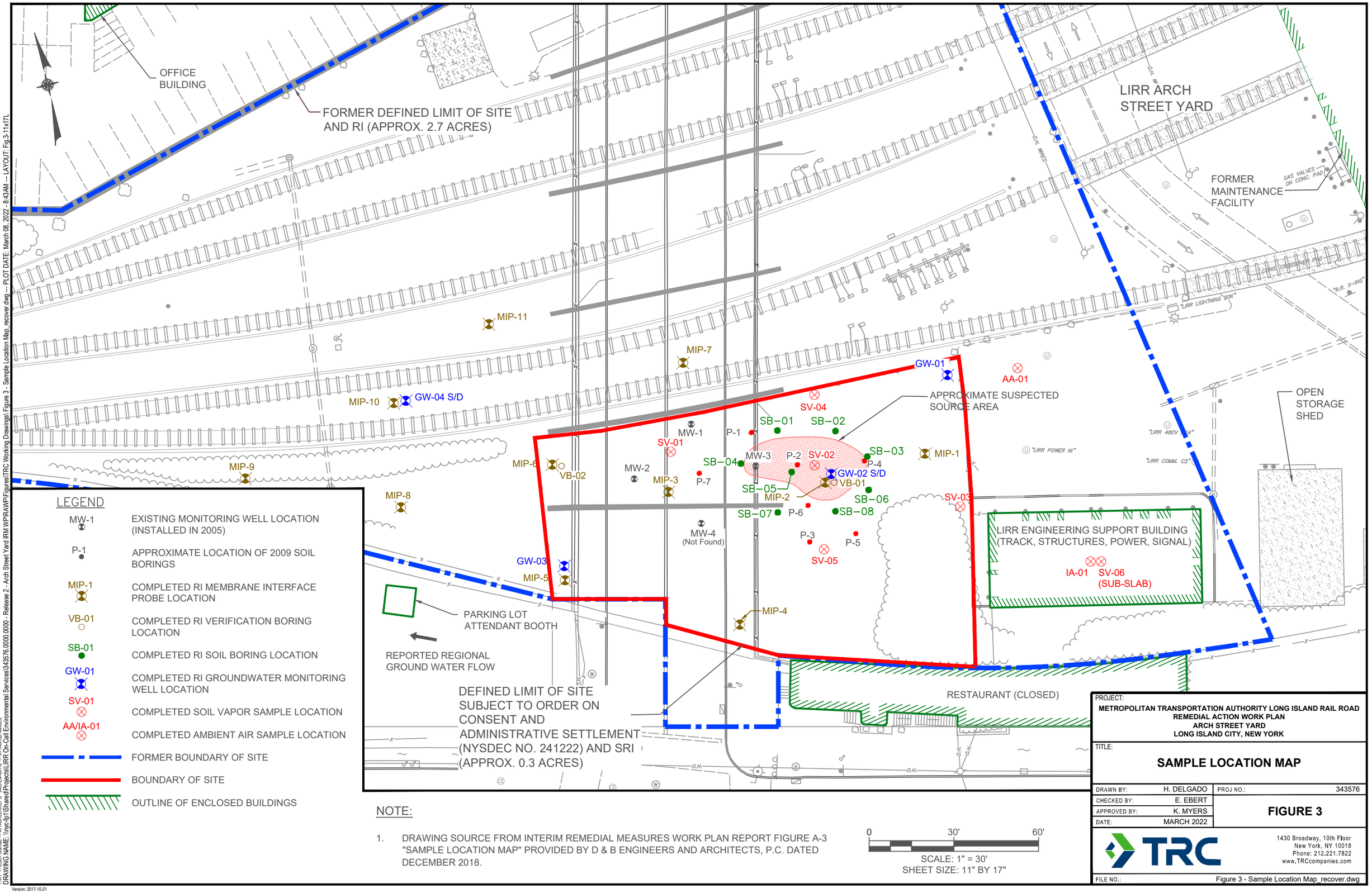
TITLE:
SITE MAP BOUNDARY MAP

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 2**
DATE:	MARCH 2022		

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FILE NO.: Figure 2 - Site Map Bndy. Map.dwg

11x17 -- USER: RSchiff -- ATTACHED XREFS: 3456 EXHIBIT.P -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 2 - Site Map Bndy. Map.dwg -- PLOT DATE: March 08, 2022 - 8:43AM -- LAYOUT: Fig.3-11x17L
Version: 2017-10-21



LEGEND

MW-1	EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
P-1	APPROXIMATE LOCATION OF 2009 SOIL BORINGS
MIP-1	COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
VB-01	COMPLETED RI VERIFICATION BORING LOCATION
SB-01	COMPLETED RI SOIL BORING LOCATION
GW-01	COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
SV-01	COMPLETED SOIL VAPOR SAMPLE LOCATION
AA/IA-01	COMPLETED AMBIENT AIR SAMPLE LOCATION
	FORMER BOUNDARY OF SITE
	BOUNDARY OF SITE
	OUTLINE OF ENCLOSED BUILDINGS

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-3 "SAMPLE LOCATION MAP" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

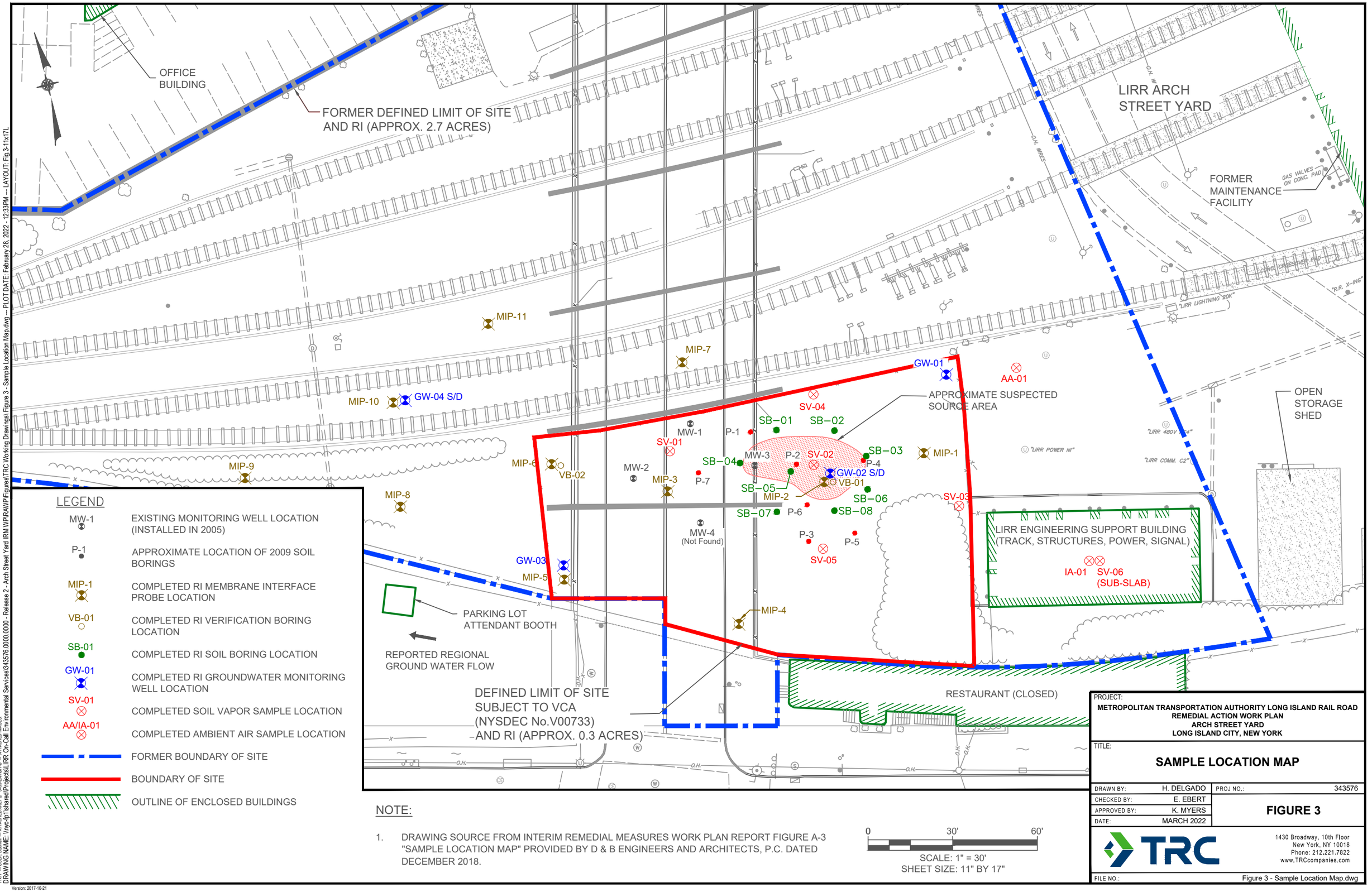
TITLE:
SAMPLE LOCATION MAP

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		**FIGURE 3**
APPROVED BY:	K. MYERS		
DATE:	MARCH 2022		

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FILE NO.: Figure 3 - Sample Location Map_recover.dwg

11x17 -- USER: RKhalil -- ATTACHED XREFS: 3445 EXHIBIT 2 -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Shared Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 3 - Sample Location Map_recover.dwg -- PLOT DATE: March 08, 2022 - 8:43AM -- LAYOUT: Fig.3-11x17L
Version: 2017-10-21



LEGEND

MW-1	EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
P-1	APPROXIMATE LOCATION OF 2009 SOIL BORINGS
MIP-1	COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
VB-01	COMPLETED RI VERIFICATION BORING LOCATION
SB-01	COMPLETED RI SOIL BORING LOCATION
GW-01	COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
SV-01	COMPLETED SOIL VAPOR SAMPLE LOCATION
AA/IA-01	COMPLETED AMBIENT AIR SAMPLE LOCATION
	FORMER BOUNDARY OF SITE
	BOUNDARY OF SITE
	OUTLINE OF ENCLOSED BUILDINGS

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-3 "SAMPLE LOCATION MAP" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

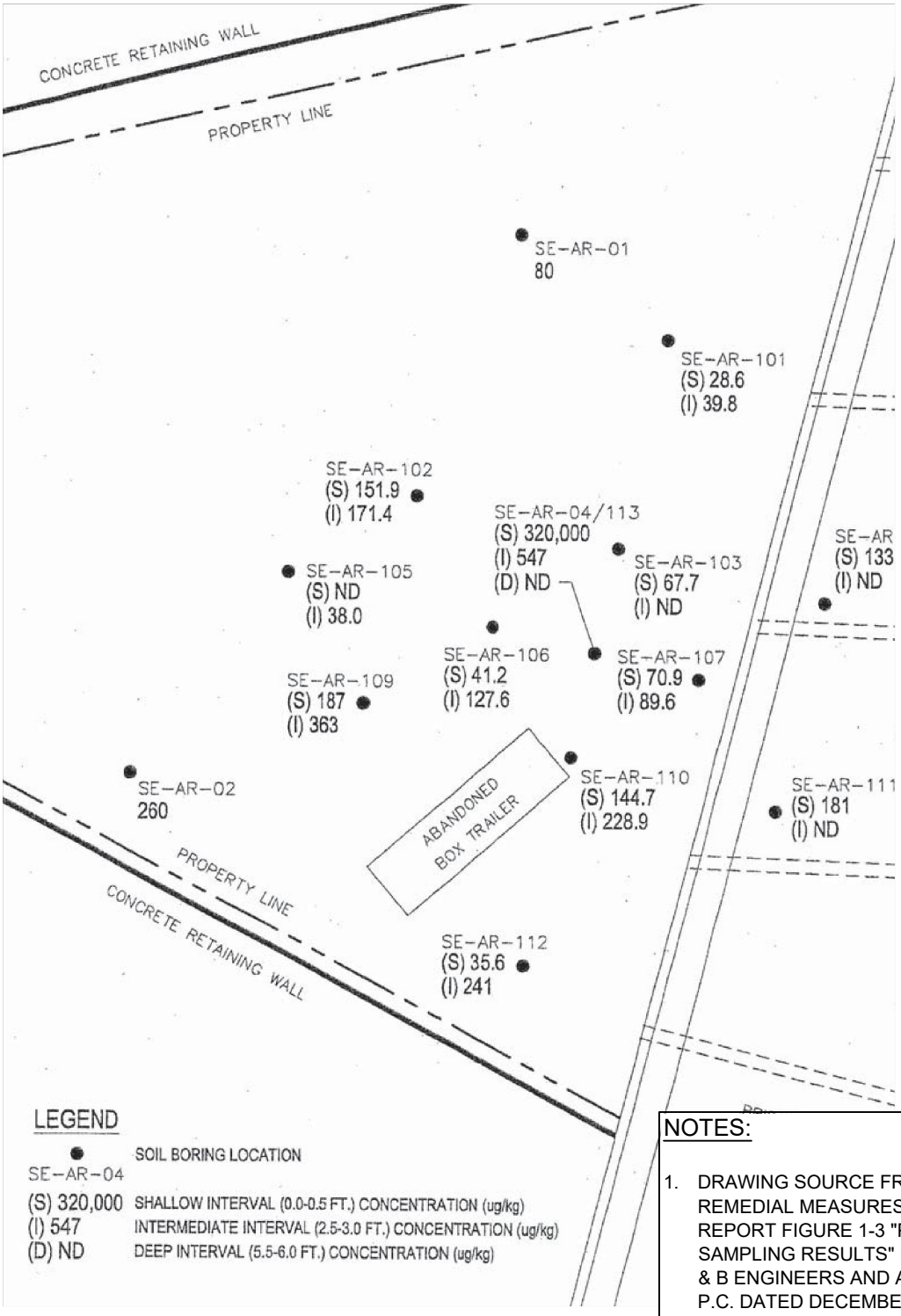
TITLE:
SAMPLE LOCATION MAP

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 3**
DATE:	MARCH 2022		

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FILE NO.: Figure 3 - Sample Location Map.dwg

11x17 -- USER: RKhalil -- ATTACHED XREFS: 3455 EXHIBIT.D -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM\WP\RAWP\Figures\TRC Working Drawings\ Figure 3 - Sample Location Map.dwg -- PLOT DATE: February 28, 2022 - 12:33PM -- LAYOUT: Fig.3-11x17L
Version: 2017-10-21



NOTES:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE 1-3 "PREVIOUS PCB SAMPLING RESULTS" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.
2. REFER TO FIGURE 2 FOR LOCATION WITHIN SITE BOUNDARY.

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PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:

PREVIOUS PCB SAMPLING RESULTS

DRAWN BY:	H. DELGADO
CHECKED BY:	D. WARREN
APPROVED BY:	K. MYERS
DATE:	OCTOBER 2019
PROJ. NO.:	343576
FILE:	Figure 4 - Prev. PCB Samp. Res. (8.5x11P).dwg

FIGURE 4

8.5x11 --- ATTACHED XREFS: --- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 4 - Prev. PCB Samp. Res. (8.5x11P).dwg --- PLOT DATE: October 10, 2019 - 9:51AM --- LAYOUT: 8.5x11

CQE28-02 21st Street Spill Investigation
Arch Street Mantenance Yard

LEGEND
- Existing Monitoring Well
- Boring Location

Jackson Avenue
Site Access
Arch Street
Gate
Chain-linked Fence
Site Security
LIRR Maintenance
Stone Stockpile
Electric Cable
LIRR Utility Manhole
Asphalt
Chain-link Fence
Gravel
Retaining Wall
Service Building
21st
MW - 1
MW - 2
MW - 3
MW - 4
P1
P2
P3
P4
P5
P6
P7

NY_TOGS_Water Criteria (ug/L)

Benzene = 1 ppb
cis-1,2-Dichloroethene = 5 ppb
Cyclohexane = NA
m&p-Xylenes = 5 ppb
Methyl-t-butyl ether = 10 ppb
Tetrachloroethene = 5 ppb
trans-1,2-Dichloroethene = 5 ppb
Trichloroethene = 5 ppb
Trichlorofluoromethane = 5 ppb
Vinyl chloride = 2 ppb
Xylenes (Total) = NA
Benzo[b]fluoranthene = 0.002 ppb
Benzoic acid = NA
Chrysene = 0.002 ppb

NY_Soil_TAGM Criteria (mg/Kg)

Tetrachloroethene = 1.4 ppm
trans-1,2-Dichloroethene = 0.3 ppm
Trichloroethene =0.7 ppm
Vinyl chloride = 0.2 ppm
Benzo[a]anthracene = 0.224 ppm
Benzo[a]pyrene = 0.061 ppm
Benzo[b]fluoranthene = 1.1 ppm
Chrysene = 1.4 ppm
Dibenzo[a,h]anthracene =0.014 ppm
Pentachlorophenol = 1 ppm

Groundwater
Benzene = 21 ppm
Cyclohexane = 3.3 ppb
m&p-Xylenes = 5.1 ppb
Methyl-t-butyl ether = 72 ppb
Xylenes (Total) = 6.3 ppb
Benzoic acid = 19 ppb
Benzo[b]fluoranthene = 2.2 ppb

Soil
Benzo[a]anthracene = 0.59 ppm
Benzo[a]pyrene = 0.51 ppm
Chrysene = 0.68 ppm

Groundwater
Cis-1,2-Dichloroethene = 6000 ppb
Tetrachloroethene = 14000 ppb
Trichloroethene = 1600 ppb
Benzoic acid = 19 ppb
Vinyl chloride = 1100 ppm

Soil
Tetrachloroethene = 89 ppm
Trichloroethene = 6 ppm
Vinyl chloride = 1.6 ppm
Benzo[a]anthracene = 1.8 ppm
Benzo[a]pyrene = 1.5 ppm
Benzo[b]fluoranthene = 2.2 ppm
Chrysene = 1.8 ppm

Groundwater
Tetrachloroethene = 290 ppb
Trans-1,2-Dichloroethene = 22 ppb
Trichloroethene = 290 ppb
Vinyl chloride = 130 ppb

Soil
Tetrachloroethene = 2.8 ppm
Benzo[a]anthracene = 1.2 ppm
Benzo[a]pyrene = 1 ppm
Benzo[b]fluoranthene = 1.7 ppm
Chrysene = 1.3 ppm
Dibenzo[a,h]anthracene = 0.25 ppm
Pentachlorophenol = 5.2 ppm

Groundwater
Cis-1,2-Dichloroethene = 110 ppb
Tetrachloroethene= 27 ppb
Trans-1,2-Dichloroethene = 56 ppb
Trichloroethene = 88 ppb
Vinyl chloride = 46 ppb
Benzo[b]fluoranthene =9.8 ppb
Chrysene = 8.4 ppb

Soil
Trans-1,2-Dichloroethene = 0.5 ppm
Vinyl chloride = 0.37 ppm
Benzo[a]anthracene = 0.67 ppm
Benzo[a]pyrene = 0.58 ppm
Chrysene = 0.84 ppm
Dibenzo[a,h]anthracene = 0.16 ppm

Groundwater
No Exceedances

Soil
Benzo[a]anthracene = 0.59 ppm
Benzo[a]pyrene = 0.51 ppm
Chrysene = 0.68 ppm

Groundwater
Methyl-t-butyl ether =11 ppb
Tetrachloroethene = 31 ppb
Trans-1,2-Dichloroethene = 4.4 ppb
Vinyl chloride =9.3 ppb

Soil
Chrysene = 0.46 ppm

Groundwater
Cis-1,2-Dichloroethene = 49 ppb
Tetrachloroethene = 30 ppb
Trans-1,2-Dichloroethene = 6.7 ppb
Trichloroethene = 17 ppb
Vinyl chloride = 28 ppb

Soil
Benzo[a]anthracene = 2.1 ppm
Benzo[a]pyrene = 2.1 ppm
Benzo[b]fluoranthene = 3.3 ppm
Chrysene = 2.5 ppm
Dibenzo[a,h]anthracene = 0.45 ppm
Pentachlorophenol = 2.3 ppm

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE 1-4 "DETECTED CONTAMINANTS IN PREVIOUS GROUNDWATER AND SOIL SAMPLES" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

NOT TO SCALE
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

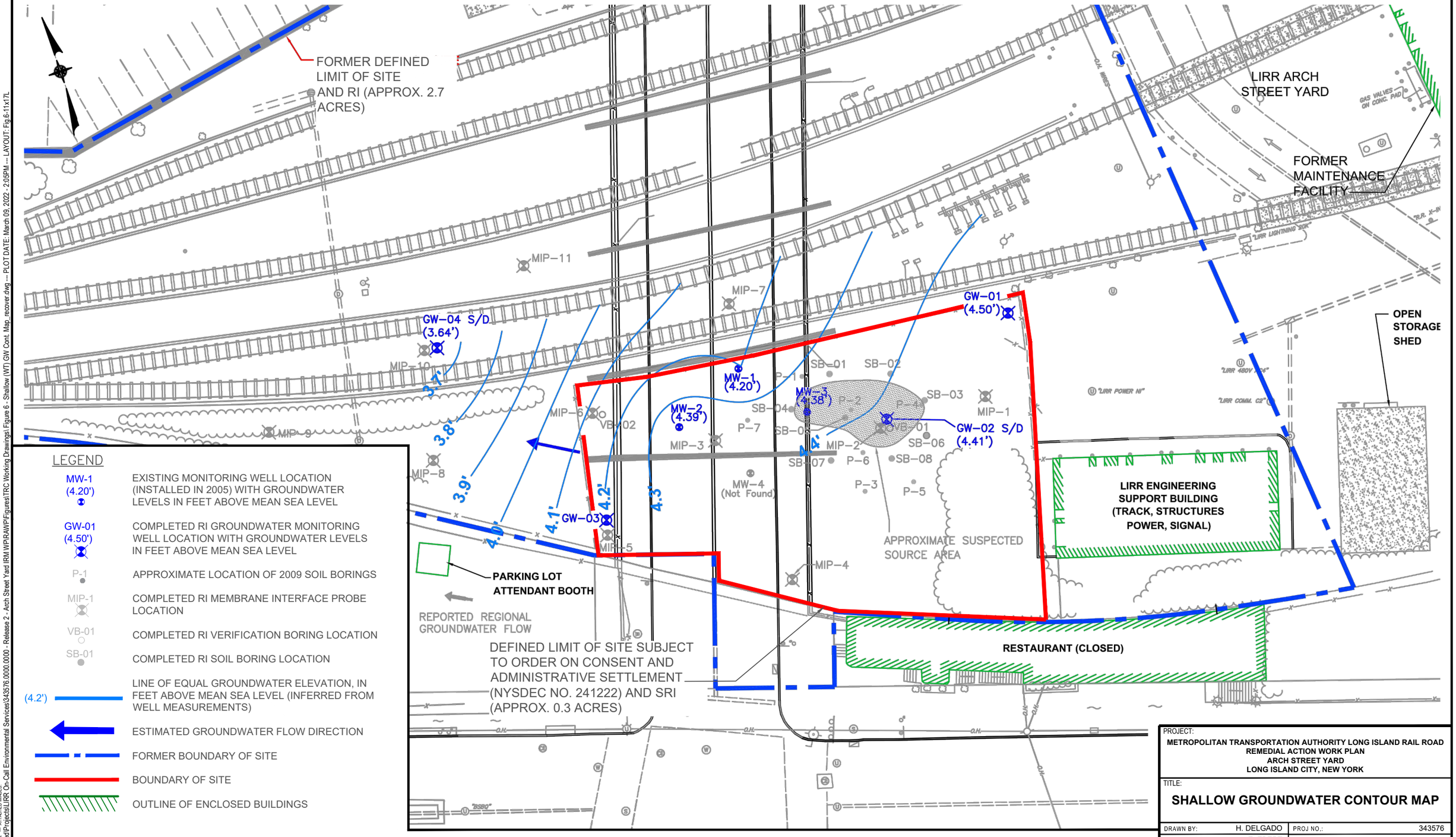
TITLE: **SUMMARY OF EXCEEDANCES OF TOGS AND TAGM CRITERIA IN PREVIOUS GROUNDWATER AND SOIL SAMPLES**

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	D. WARREN		
APPROVED BY:	K. MYERS		**FIGURE 5**
DATE:	OCTOBER 2019		

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FILE NO.: Figure 5 - Det. Cont. in Prev. GW & Soil Samp..dwg

11-17 -- USER: KMyers -- ATTACHED XREFS: -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 5 - Det. Cont. in Prev. GW & Soil Samp.dwg -- PLOT DATE: October 10, 2019 - 10:29AM -- LAYOUT: Fig.5-11x17L
Version: 2017-10-21



LEGEND

MW-1 (4.20')	EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005) WITH GROUNDWATER LEVELS IN FEET ABOVE MEAN SEA LEVEL
GW-01 (4.50')	COMPLETED RI GROUNDWATER MONITORING WELL LOCATION WITH GROUNDWATER LEVELS IN FEET ABOVE MEAN SEA LEVEL
P-1	APPROXIMATE LOCATION OF 2009 SOIL BORINGS
MIP-1	COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
VB-01	COMPLETED RI VERIFICATION BORING LOCATION
SB-01	COMPLETED RI SOIL BORING LOCATION
(4.2')	LINE OF EQUAL GROUNDWATER ELEVATION, IN FEET ABOVE MEAN SEA LEVEL (INFERRED FROM WELL MEASUREMENTS)
	ESTIMATED GROUNDWATER FLOW DIRECTION
	FORMER BOUNDARY OF SITE
	BOUNDARY OF SITE
	OUTLINE OF ENCLOSED BUILDINGS

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-3 "SAMPLE LOCATION MAP" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.
2. GROUNDWATER ELEVATIONS MEASURED ON APRIL 22, 2016

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

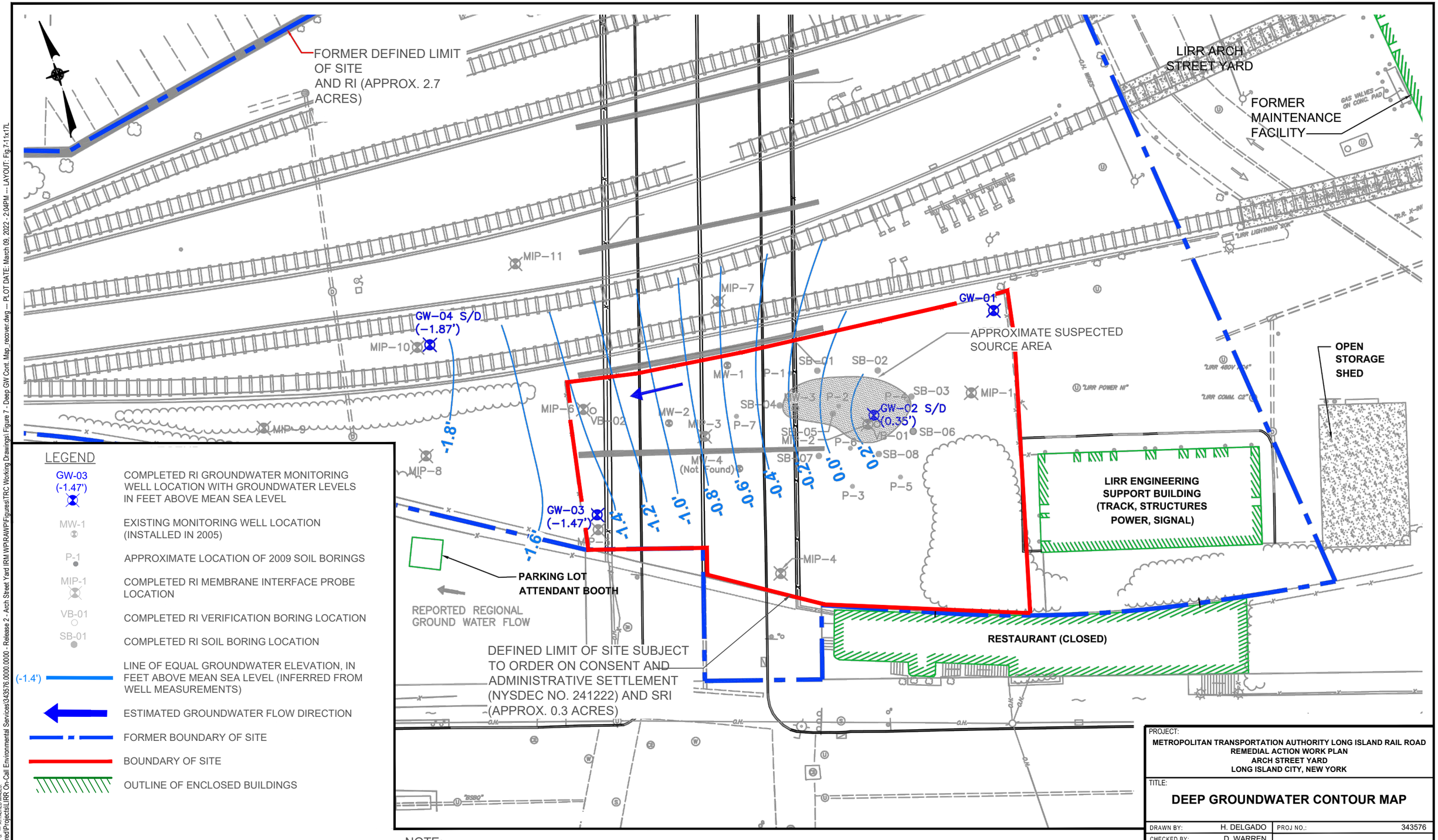
TITLE:
SHALLOW GROUNDWATER CONTOUR MAP

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 6**
DATE:	MARCH 2022		

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FILE NO.: Figure 6 - Shallow (WT) GW Cont. Map_recover.dwg

11x17 - USER: RBeiM - ATTACHED XREFS: - ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\shares\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 6 - Shallow (WT) GW Cont. Map_recover.dwg -- PLOT DATE: March 09, 2022 - 2:05PM -- LAYOUT: Fig 6-11x17L
Version: 2017-10-21



LEGEND

GW-03 (-1.47')	COMPLETED RI GROUNDWATER MONITORING WELL LOCATION WITH GROUNDWATER LEVELS IN FEET ABOVE MEAN SEA LEVEL
MW-1	EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
P-1	APPROXIMATE LOCATION OF 2009 SOIL BORINGS
MIP-1	COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
VB-01	COMPLETED RI VERIFICATION BORING LOCATION
SB-01	COMPLETED RI SOIL BORING LOCATION
(-1.4')	LINE OF EQUAL GROUNDWATER ELEVATION, IN FEET ABOVE MEAN SEA LEVEL (INFERRED FROM WELL MEASUREMENTS)
	ESTIMATED GROUNDWATER FLOW DIRECTION
	FORMER BOUNDARY OF SITE
	BOUNDARY OF SITE
	OUTLINE OF ENCLOSED BUILDINGS

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-3 "SAMPLE LOCATION MAP" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.
2. GROUNDWATER ELEVATIONS MEASURED ON APRIL 22, 2016

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
DEEP GROUNDWATER CONTOUR MAP

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	D. WARREN		
APPROVED BY:	K. MYERS		FIGURE 7
DATE:	MARCH 2022		

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FILE NO.: Figure 7 - Deep GW Cont. Map_recover.dwg

11x17 -- USER: BGuhl -- ATTACHED XREFS: -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 7 - Deep GW Cont. Map_recover.dwg -- PLOT DATE: March 09, 2022 - 2:04PM -- LAYOUT: Fig-7-11x17L
Version: 2017-10-21

FORMER DEFINED LIMIT OF SITE AND RI (APPROX. 2.7 ACRES)

DEFINED LIMIT OF SITE SUBJECT TO ORDER ON CONSENT AND ADMINISTRATIVE SETTLEMENT (NYSDEC NO. 241222) AND SRI (APPROX. 0.3 ACRES)

PARKING LOT ATTENDANT BOOTH

REPORTED REGIONAL GROUND WATER FLOW

APPROXIMATE SUSPECTED SOURCE AREA

LIRR ARCH STREET YARD

LIRR ENGINEERING SUPPORT BUILDING (TRACK, STRUCTURES, POWER, SIGNAL)

RESTAURANT (CLOSED)

OPEN STORAGE SHED

MW-1, MW-2, MW-3, MW-4 (Not Found)

P-1, P-2, P-3, P-4, P-5, P-6, P-7

SB-01, SB-02, SB-03, SB-04, SB-05, SB-06, SB-07, SB-08

MIP-1, MIP-2, MIP-3, MIP-4, MIP-5, MIP-6, MIP-7, MIP-8, MIP-9, MIP-10, MIP-11

VB-01, VB-02

SV-01, SV-02, SV-03, SV-04, SV-05, SV-06 (SUB-SLAB)

AA-01, IA-01

GW-01, GW-02 S/D, GW-03, GW-04 S/D

"LIRR POWER NI", "LIRR 480V", "LIRR COMM. C2", "LIRR LIGHTNING 20K", GAS VALVES ON CONC. PAD, CONC. ASSESSMENT PAD, "R.R. X-", O.H., U, W, L WIRES

GW-04

Soil Exceedances	Depth (feet bgs)		2'-3'
SVOCs (ug/kg)	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Benzo(a)anthracene	1,000	11,000	1,200 J
Indeno(1,2,3-cd)pyrene	500	11,000	600 J

SB-04

Soil Exceedances	Depth (feet bgs)		3'-5'
SVOCs (ug/kg)	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Benzo(a)anthracene	1,000	11,000	5,300 D
Benzo(a)pyrene	1,000	1,100	2,900
Benzo(b)fluoranthene	1,000	11,000	4,000 D
Dibenzo(a,h)anthracene	330	1,100	430
Indeno(1,2,3-cd)pyrene	500	11,000	1,900

SB-05

Soil Exceedances	Depth (feet bgs)			10'-11'	11'-13'
VOCs (ug/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.	CONC.
cis-1,2-Dichloroethene	250	100,000	1,000,000	***880 JD***	***3,400 JD***
Tetrachloroethene	1,300	19,000	300,000	***20,900 JD***	***31,300 D***
Trichloroethene	470	21,000	400,000	400 JD	***2,600 JD***
Vinyl Chloride	20	900	27,000	***560 JD***	***2,200 JD***

SB-07

Soil Exceedances	Depth (feet bgs)		12'-14'
METALS (mg/kg)	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Mercury	0.81	5.7	0.949 DJ

VB-01

Soil Exceedances	Depth (feet bgs)			13'-15'
VOCs (ug/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Tetrachloroethene	1,300	19,000	300,000	***1,160,900***

SB-06

Soil Exceedances	Depth (feet bgs)			8'-10'
VOCs (ug/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
cis-1,2-Dichloroethene	250	100,000	1,000,000	***1,600 D***
Vinyl Chloride	20	900	27,000	***410 JD***
METALS (mg/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Lead	N/A	400	3,900	483

LEGEND

- MW-1 — EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
- P-1 — APPROXIMATE LOCATION OF 2009 SOIL BORINGS
- MIP-1 — COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
- VB-01 — COMPLETED RI VERIFICATION BORING LOCATION
- SB-01 — COMPLETED RI SOIL BORING LOCATION
- GW-01 — COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
- SV-01 — COMPLETED SOIL VAPOR SAMPLE LOCATION
- AA/IA-01 — COMPLETED AMBIENT AIR SAMPLE LOCATION
- FORMER BOUNDARY OF SITE
- BOUNDARY OF SITE
- OUTLINE OF ENCLOSED BUILDINGS

NOTES:

DATA BOXES DEPICT SOIL CONCENTRATIONS ABOVE NYSDEC PART 375 PROTECTION OF GROUNDWATER SOIL CLEANUP OBJECTIVES (SCOs) FOR CHLORINATED VOCs, AND RESTRICTED-RESIDENTIAL USE SCOs AND INDUSTRIAL USE SCOs FOR ALL OTHER COMPOUNDS. SOIL UNITS ARE MICROGRAMS PER KILOGRAM (ug/kg) AND MILLIGRAMS PER KILOGRAM (mg/kg).

D: RESULT REPORTED FROM A SECONDARY DILUTION

J: ESTIMATED VALUE

CONCENTRATION EXCEEDS NYSDEC PART 375 PROTECTION OF GROUNDWATER SCO

CONCENTRATION EXCEEDS NYSDEC PART 375 RESTRICTED RESIDENTIAL USE

CONCENTRATION EXCEEDS NYSDEC PART 375 INDUSTRIAL USE SCO

DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE 3-6 "SUMMARY OF RI SAMPLE EXCEEDANCES" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SUMMARY OF REMEDIAL INVESTIGATION SOIL SAMPLE EXCEEDANCES

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 8**
DATE:	MARCH 2022		

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FILE NO.: Figure 8 - Sum. of RI Soil Samp. Exceed._recover.dwg

11x17 -- USER: BKnell -- ATTACHED XREFS: 3455-EXHIBIT.dwg -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM\WP\RAWP\Figures\TRC Working Drawings\ Figure 8 - Sum. of RI Soil Samp. Exceed._recover.dwg -- PLOT DATE: March 08, 2022 - 8:50AM -- LAYOUT: FIG-3-6
Version: 2017-10-21

FORMER DEFINED LIMIT OF SITE AND RI (APPROX. 2.7 ACRES)

DEFINED LIMIT OF SITE SUBJECT TO ORDER ON CONSENT AND ADMINISTRATIVE SETTLEMENT (NYSDEC NO. 241222) AND SRI (APPROX. 0.3 ACRES)

PARKING LOT ATTENDANT BOOTH

REPORTED REGIONAL GROUND WATER FLOW

APPROXIMATE SUSPECTED SOURCE AREA

LIRR ARCH STREET YARD

LIRR ENGINEERING SUPPORT BUILDING (TRACK, STRUCTURES, POWER, SIGNAL)

RESTAURANT (CLOSED)

OPEN STORAGE SHED

MW-1, MW-2, MW-3, MW-4 (Not Found)

P-1, P-2, P-3, P-4, P-5, P-6, P-7

SB-01, SB-02, SB-03, SB-04, SB-05, SB-06, SB-07, SB-08

MIP-1, MIP-2, MIP-3, MIP-4, MIP-5, MIP-6, MIP-7, MIP-8, MIP-9, MIP-10, MIP-11

VB-01, VB-02

SV-01, SV-02, SV-03, SV-04, SV-05, SV-06 (SUB-SLAB)

AA-01, IA-01

GW-01, GW-02 S/D, GW-03, GW-04 S/D

"LIRR POWER NI", "LIRR 480V", "LIRR COMM. C2", "LIRR LIGHTNING 20K", GAS VALVES ON CONC. PAD, CONC. ASSESSMENT PAD, "R.R. X-", O.H., U, W, L WIRES

GW-04

Soil Exceedances	Depth (feet bgs)		2'-3'
SVOCs (ug/kg)	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Benzo(a)anthracene	1,000	11,000	1,200 J
Indeno(1,2,3-cd)pyrene	500	11,000	600 J

SB-04

Soil Exceedances	Depth (feet bgs)		3'-5'
SVOCs (ug/kg)	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Benzo(a)anthracene	1,000	11,000	5,300 D
Benzo(a)pyrene	1,000	1,100	2,900
Benzo(b)fluoranthene	1,000	11,000	4,000 D
Dibenzo(a,h)anthracene	330	1,100	430
Indeno(1,2,3-cd)pyrene	500	11,000	1,900

SB-05

Soil Exceedances	Depth (feet bgs)			10'-11'	11'-13'
VOCs (ug/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.	CONC.
cis-1,2-Dichloroethene	250	100,000	1,000,000	***880 JD***	***3,400 JD***
Tetrachloroethene	1,300	19,000	300,000	***20,900 JD***	***31,300 D***
Trichloroethene	470	21,000	400,000	400 JD	***2,600 JD***
Vinyl Chloride	20	900	27,000	***560 JD***	***2,200 JD***

SB-07

Soil Exceedances	Depth (feet bgs)		12'-14'
METALS (mg/kg)	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Mercury	0.81	5.7	0.949 DJ

VB-01

Soil Exceedances	Depth (feet bgs)			13'-15'
VOCs (ug/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Tetrachloroethene	1,300	19,000	300,000	***1,160,900***

SB-06

Soil Exceedances	Depth (feet bgs)			8'-10'
VOCs (ug/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
cis-1,2-Dichloroethene	250	100,000	1,000,000	***1,600 D***
Vinyl Chloride	20	900	27,000	***410 JD***
METALS (mg/kg)	Part 375 Protection Groundwater	Part 375 Restricted-Residential Use SCO	Part 375 Industrial Use SCO	CONC.
Lead	N/A	400	3,900	483

LEGEND

- MW-1 — EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
- P-1 — APPROXIMATE LOCATION OF 2009 SOIL BORINGS
- MIP-1 — COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
- VB-01 — COMPLETED RI VERIFICATION BORING LOCATION
- SB-01 — COMPLETED RI SOIL BORING LOCATION
- GW-01 — COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
- SV-01 — COMPLETED SOIL VAPOR SAMPLE LOCATION
- AA/IA-01 — COMPLETED AMBIENT AIR SAMPLE LOCATION
- FORMER BOUNDARY OF SITE
- BOUNDARY OF SITE
- OUTLINE OF ENCLOSED BUILDINGS

NOTES:

DATA BOXES DEPICT SOIL CONCENTRATIONS ABOVE NYSDEC PART 375 PROTECTION OF GROUNDWATER SOIL CLEANUP OBJECTIVES (SCOs) FOR CHLORINATED VOCs, AND RESTRICTED-RESIDENTIAL USE SCOs AND INDUSTRIAL USE SCOs FOR ALL OTHER COMPOUNDS. SOIL UNITS ARE MICROGRAMS PER KILOGRAM (ug/kg) AND MILLIGRAMS PER KILOGRAM (mg/kg).

D: RESULT REPORTED FROM A SECONDARY DILUTION

J: ESTIMATED VALUE

CONCENTRATION EXCEEDS NYSDEC PART 375 PROTECTION OF GROUNDWATER SCO

CONCENTRATION EXCEEDS NYSDEC PART 375 RESTRICTED RESIDENTIAL USE

CONCENTRATION EXCEEDS NYSDEC PART 375 INDUSTRIAL USE SCO

DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE 3-6 "SUMMARY OF RI SAMPLE EXCEEDANCES" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SUMMARY OF REMEDIAL INVESTIGATION SOIL SAMPLE EXCEEDANCES

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 8**
DATE:	MARCH 2022		

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FILE NO.: Figure 8 - Sum. of RI Soil Samp. Exceed._recover.dwg

11x17 -- USER: BKnell -- ATTACHED XREFS: 3455-EXHIBIT.dwg -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM\WP\RAWP\Figures\TRC Working Drawings\ Figure 8 - Sum. of RI Soil Samp. Exceed._recover.dwg -- PLOT DATE: March 08, 2022 - 8:50AM -- LAYOUT: FIG-3-6
Version: 2017-10-21

FORMER DEFINED LIMIT OF SITE AND RI (APPROX. 2.7 ACRES)

DEFINED LIMIT OF SITE SUBJECT TO ORDER ON CONSENT AND ADMINISTRATIVE SETTLEMENT (NYSDEC NO. 241222) AND SRI (APPROX. 0.3 ACRES)

APPROXIMATE SUSPECTED SOURCE AREA

LIRR ARCH STREET YARD

REPORTED REGIONAL GROUND WATER FLOW

PARKING LOT ATTENDANT BOOTH

LIRR ENGINEERING SUPPORT BUILDING (TRACK, STRUCTURES, POWER, SIGNAL)

OPEN STORAGE SHED

RESTAURANT (CLOSED)

VB-02		
Groundwater Exceedances	Depth (feet bgs)	5'
VOCs (ug/l)	NYSDEC Class GA	CONC.
Cis-1,2-Dichloroethylene	5	*36*
Vinyl Chloride	2	*17.9*

MW-1		
Groundwater Exceedances	Sample Date	4/7/2016
VOCs (ug/l)	NYSDEC Class GA	CONC.
Tert-Butyl Methyl Ether	10	*26.2*

GW-02S		
Groundwater Exceedances	Sample Date	4/7/2016
VOCs (ug/l)	NYSDEC Class GA	CONC.
Cis-1,2-Dichloroethylene	5	*1,700 D*
Tetrachloroethylene	5	*69.4 J*
Trans-1,2-Dichloroethene	5	*27.5*
Trichloroethylene	5	*25.3*
Vinyl Chloride	2	*1,500 D*

GW-02D		
Groundwater Exceedances	Sample Date	4/7/2016
VOCs (ug/l)	NYSDEC Class GA	CONC.
1,1-Dichloroethene	5	*23.6*
Cis-1,2-Dichloroethylene	5	*8,100 D*
Tetrachloroethylene	5	*5,900 DJ*
Trans-1,2-Dichloroethene	5	*68.7*
Trichloroethylene	5	*1,400 D*
Vinyl Chloride	2	*5,300 D*
METALS (ug/l)	NYSDEC Class GA	CONC.
Iron	300	*11,000*
Manganese	300	*357*
Sodium	20,000	*1,770,000 D*

MW-3		
Groundwater Exceedances	Sample Date	4/7/2016
VOCs (ug/l)	NYSDEC Class GA	CONC.
Cis-1,2-Dichloroethylene	5	*510 D*
Tetrachloroethylene	5	*78.9 J*
Trichloroethylene	5	*34.8*
Vinyl Chloride	2	*240 D*
METALS (ug/l)	NYSDEC Class GA	CONC.
Iron	300	*4,860*
Sodium	20,000	*201,000*

VB-01			
Groundwater Exceedances	Depth (feet bgs)	15'-16'	26'-27'
VOCs (ug/l)	NYSDEC Class GA	CONC.	CONC.
Cis-1,2-Dichloroethylene	5	*6,900*	*1,800*
Tetrachloroethylene	5	*17,600*	*4,500*
Trichloroethylene	5	*1,000*	*1,100*
Vinyl Chloride	2	*4,900*	*560*

LEGEND

- MW-1 — EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
- P-1 — APPROXIMATE LOCATION OF 2009 SOIL BORINGS
- MIP-1 — COMPLETED RI MEMBRANE INTERFACE PROBE LOCATION
- VB-01 — COMPLETED RI VERIFICATION BORING LOCATION
- SB-01 — COMPLETED RI SOIL BORING LOCATION
- GW-01 — COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
- SV-01 — COMPLETED SOIL VAPOR SAMPLE LOCATION
- AA/IA-01 — COMPLETED AMBIENT AIR SAMPLE LOCATION
- FORMER BOUNDARY OF SITE
- BOUNDARY OF SITE
- OUTLINE OF ENCLOSED BUILDINGS

NOTES:

DATA BOXES DEPICT GROUNDWATER CONCENTRATIONS ABOVE CLASS GA STANDARDS. GROUNDWATER UNITS ARE MICROGRAMS PER LITER (ug/L)

D: RESULT REPORTED FROM A SECONDARY DILUTION

J: ESTIMATED VALUE

CONCENTRATION EXCEEDS NYSDEC CLASS GA GROUNDWATER STANDARD

DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE 3-6 "SUMMARY OF RI SAMPLE EXCEEDANCES" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

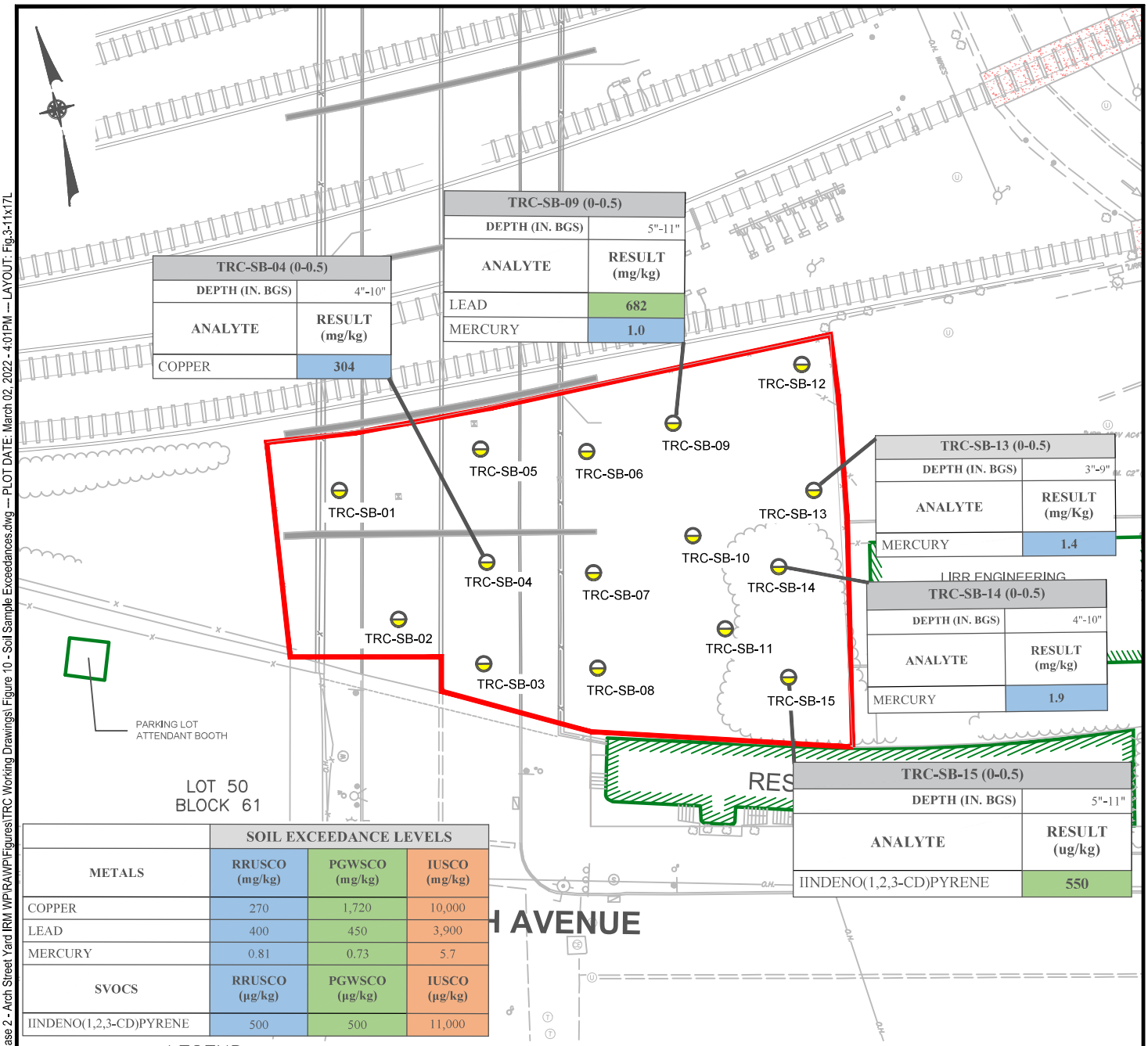
TITLE:
SUMMARY OF REMEDIAL INVESTIGATION GROUNDWATER SAMPLE EXCEEDANCES

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 9**
DATE:	MARCH 2022		

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FILE NO.: Figure 9 - Sum. of RI GW Samp Exceed..dwg

11x17 -- USER: BGraff -- ATTACHED XREFS: 3456.EXHIBIT.B -- ATTACHED IMAGES:
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Version: 2017-10-21



METALS	SOIL EXCEEDANCE LEVELS		
	RRUSCO (mg/kg)	PGWSCO (mg/kg)	IUSCO (mg/kg)
COPPER	270	1,720	10,000
LEAD	400	450	3,900
MERCURY	0.81	0.73	5.7
SVOCS	**RRUSCO (µg/kg)**	**PGWSCO (µg/kg)**	**IUSCO (µg/kg)**
IINDENO(1,2,3-CD)PYRENE	500	500	11,000

LEGEND

DEFINED LIMIT OF SITE

OUTLINE OF ENCLOSED BUILDINGS

SOIL SAMPLING LOCATION (SB-)

SVOC = SEMIVOLATILE ORGANIC COMPOUND

mg/kg = MILLIGRAMS PER KILOGRAM

µg/kg = MICROGRAMS PER KILOGRAM

RRUSCO = RESTRICTED RESIDENTIAL USE SOIL CLEANUP OBJECTIVE

PGWSCO = PROTECTION OF GROUNDWATER SOIL CLEANUP OBJECTIVE

IUSCO = INDUSTRIAL USE SOIL CLEANUP OBJECTIVE

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-2 "SITE PLAN SHOWING DEFINED BOUNDARIES OF PROJECT SITE" PROVIED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.
2. LOCATIONS AND DIMENSIONS OF PHYSICAL FEATURES, BOUNDARIES, AND SAMPLE LOCATIONS ARE APPROXIMATE.
3. SOIL BORING LOCATIONS WERE SUVEYED BY MUNOZ ENGINEERING AND LAND SURVERYING ON JANUARY 6, 2022.
4. SOIL EXCEEDANCE LEVELS BASED ON NYCRR 6 PART 375 SOIL CLEANUP OBJECTIVES

0 40' 80'

SCALE: 1" = 40'
SHEET SIZE: 8.5" BY 11"

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PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SUMMARY OF SRI SOIL SAMPLE EXCEEDANCES

DRAWN BY:	B. SCHLAFF
CHECKED BY:	E. EBERT
APPROVED BY:	K. MYERS
DATE:	MARCH 2022
PROJ. NO.:	41444
FILE:	Figure 10 - Soil Sample Exceedances.dwg

FIGURE 10

8.5x11 --- ATTACHED XREFS: 3455-EXHBIT-B --- ATTACHED IMAGES:
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OFFICE BUILDING

FORMER DEFINED LIMIT OF SITE AND RI (APPROX. 2.7 ACRES)

LIRR ARCH STRET YARD

FORMER MAINTENANCE FACILITY

OPEN STORAGE SHED

GW-01

GW-04 S/D

GW-02 S/D

GW-03

APPROXIMATE SUSPECTED SOURCE AREA

MW-1

MW-2

MW-3

MW-4 (Not Found)

DP-01 DP-02 DP-03 DP-04 DP-05 DP-06 DP-07 DP-08 DP-09 DP-10 DP-11 DP-12 DP-13 DP-14 DP-15

LIRR ENGINEERING SUPPORT BUILDING (TRACK, STRUCTURES, POWER, SIGNAL)

PARKING LOT ATTENDANT BOOTH

REPORTED REGIONAL GROUND WATER FLOW

DEFINED LIMIT OF SITE SUBJECT TO ORDER ON CONSENT AND ADMINISTRATIVE SETTLEMENT (NYSDEC NO. 241222) AND SRI (APPROX. 0.3 ACRES)

RESTAURANT (CLOSED)

O.H. WIRES

"LIRR LIGHTNING 80K"

"LIRR 480V"

"LIRR POWER NI"

"LIRR COMM. C2"

"R.R. X-ING"

LEGEND

MW-X	EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
GW-01	COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
	FORMER BOUNDARY OF SITE
	BOUNDARY OF SITE
	OUTLINE OF ENCLOSED BUILDINGS
DP-01	PROPOSED DIRECT PUSH LOCATION AND IDENTIFICATION

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-3 "SAMPLE LOCATION MAP" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

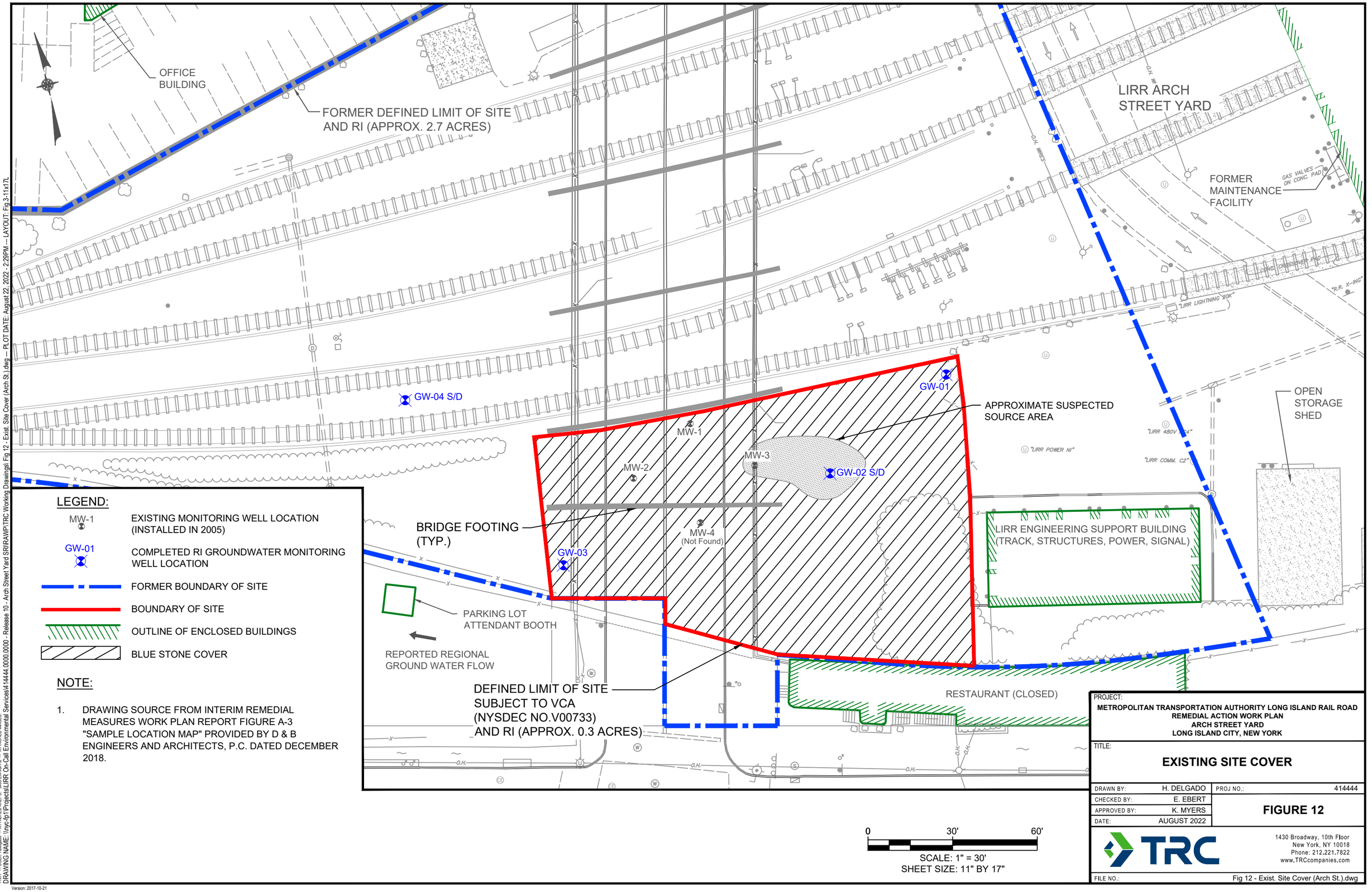
TITLE:
CONCEPTUAL LAYOUT OF DIRECT PUSH LOCATIONS

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		**FIGURE 11**
DATE:	MARCH 2022		

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FILE NO.: Figure 10 - Concept.Layout of DP Injection Loc R1.dwg

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Version: 2017-10-21



LEGEND:

MW-1	EXISTING MONITORING WELL LOCATION (INSTALLED IN 2005)
GW-01	COMPLETED RI GROUNDWATER MONITORING WELL LOCATION
	FORMER BOUNDARY OF SITE
	BOUNDARY OF SITE
	OUTLINE OF ENCLOSED BUILDINGS
	BLUE STONE COVER

NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-3 "SAMPLE LOCATION MAP" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 30' 60'

SCALE: 1" = 30'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
EXISTING SITE COVER

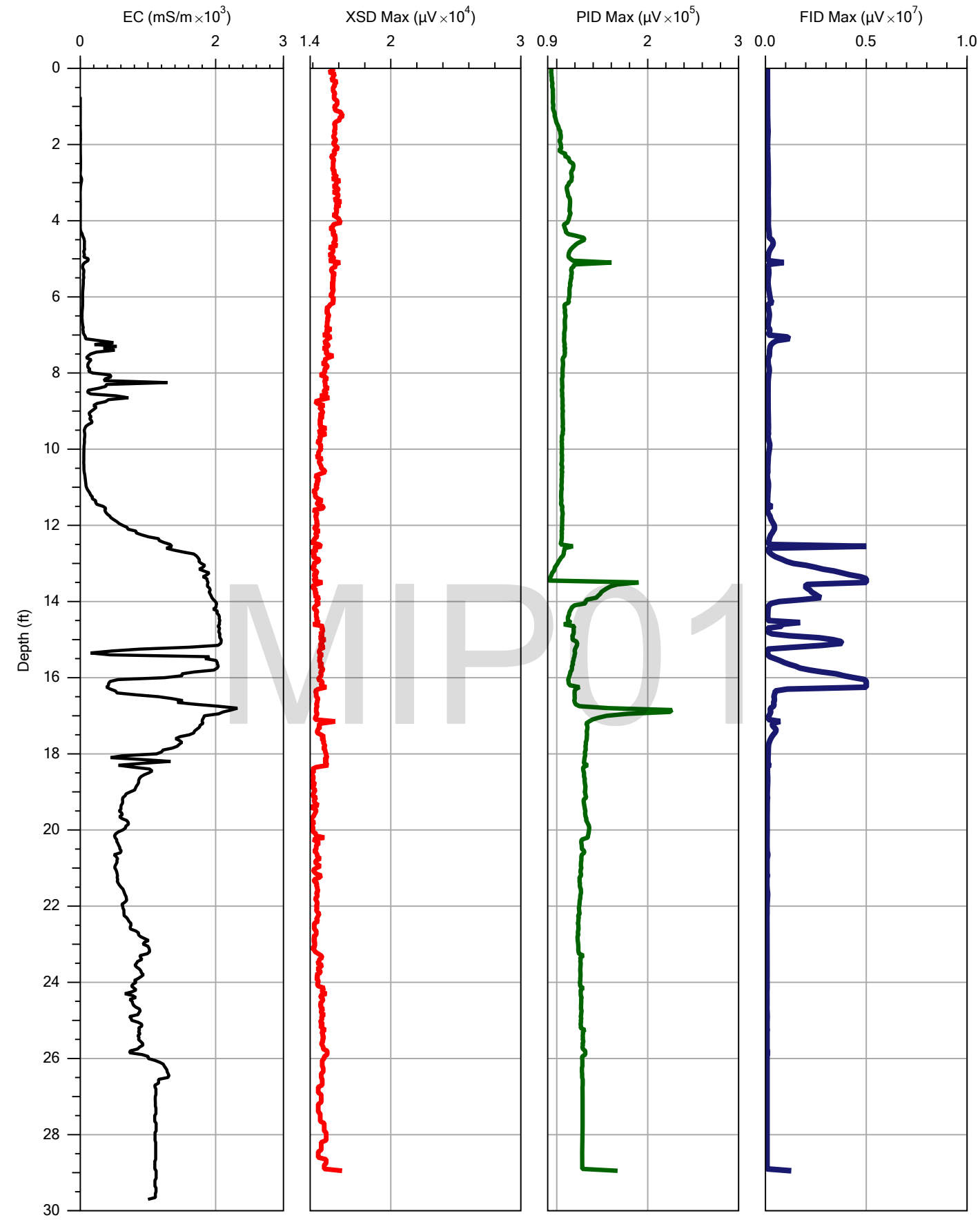
DRAWN BY:	H. DELGADO	PROJ NO.:	414444
CHECKED BY:	E. EBERT		
APPROVED BY:	K. MYERS		FIGURE 12
DATE:	AUGUST 2022		

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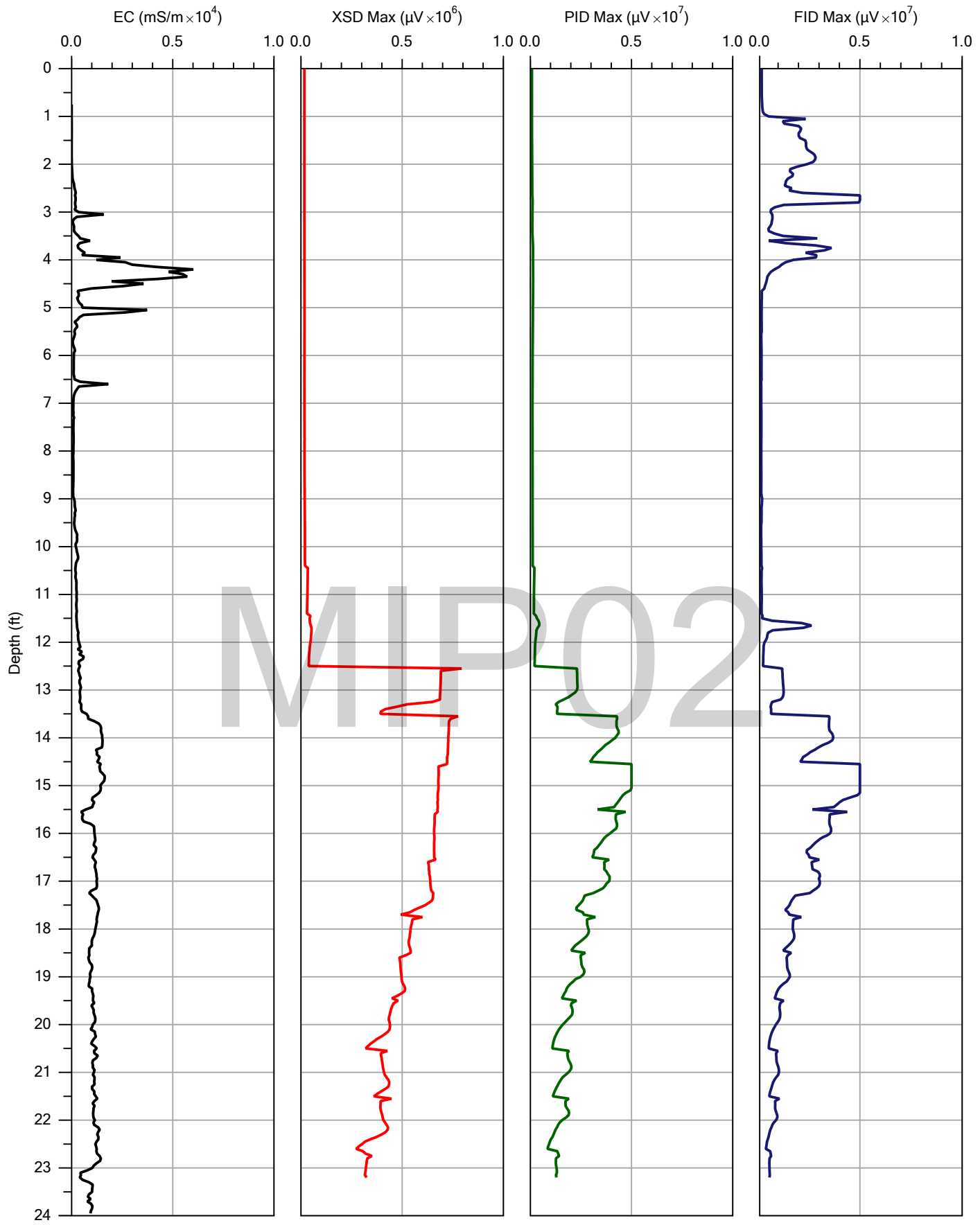
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Version: 2017-10-21

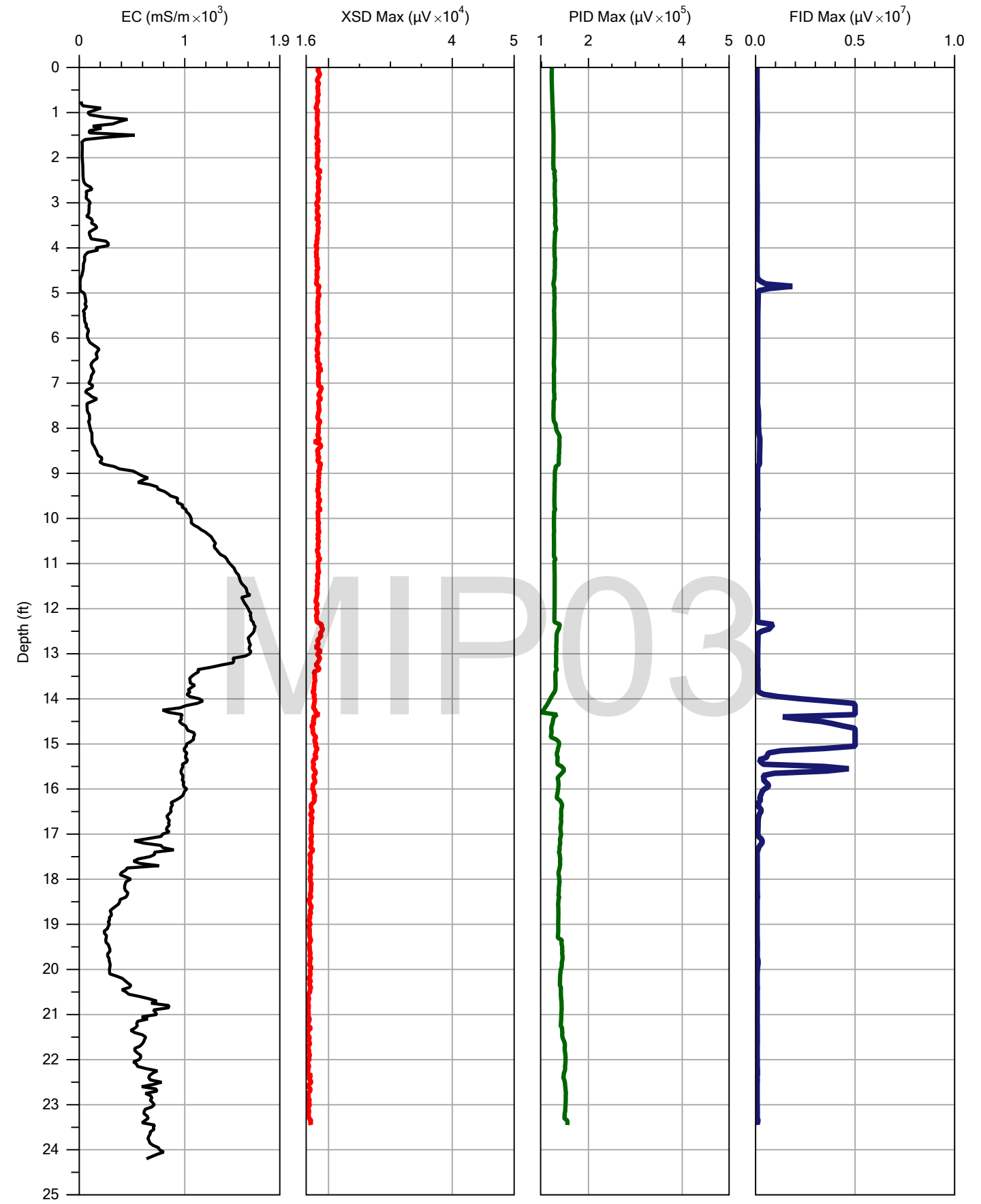
APPENDIX A



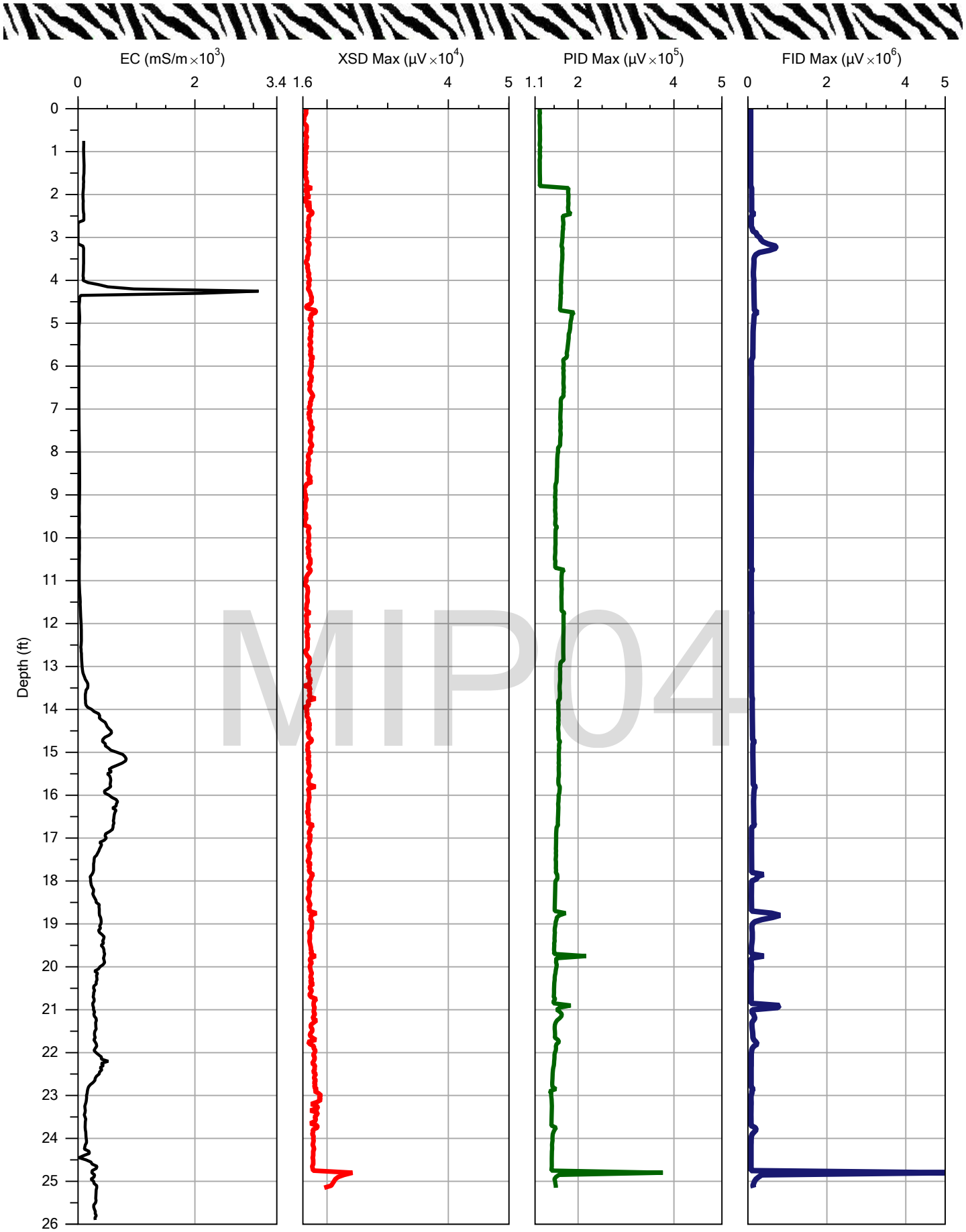
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Project ID: LIRR Arch Street Yard	Client: D&B Engineers and Architects		Location:



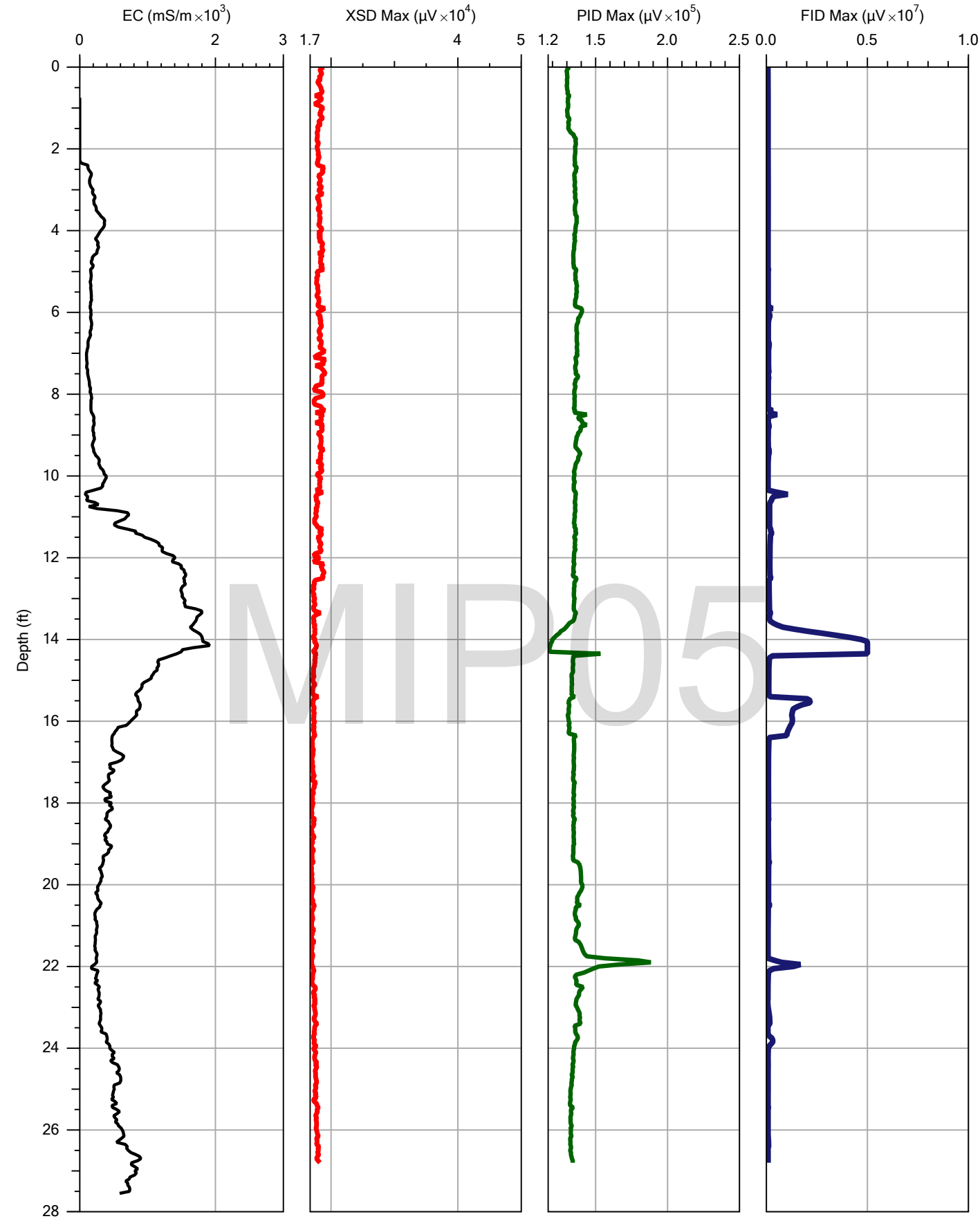
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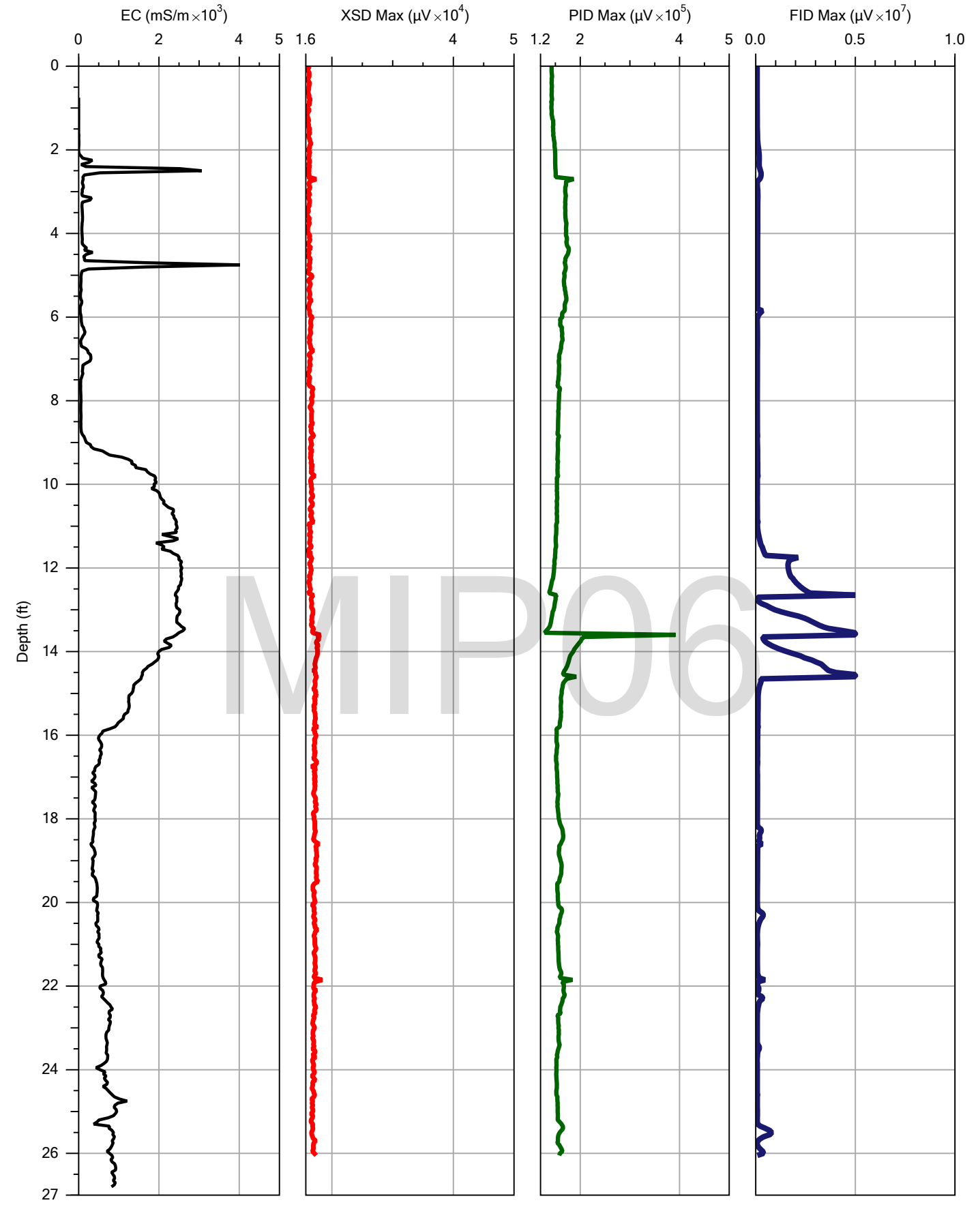
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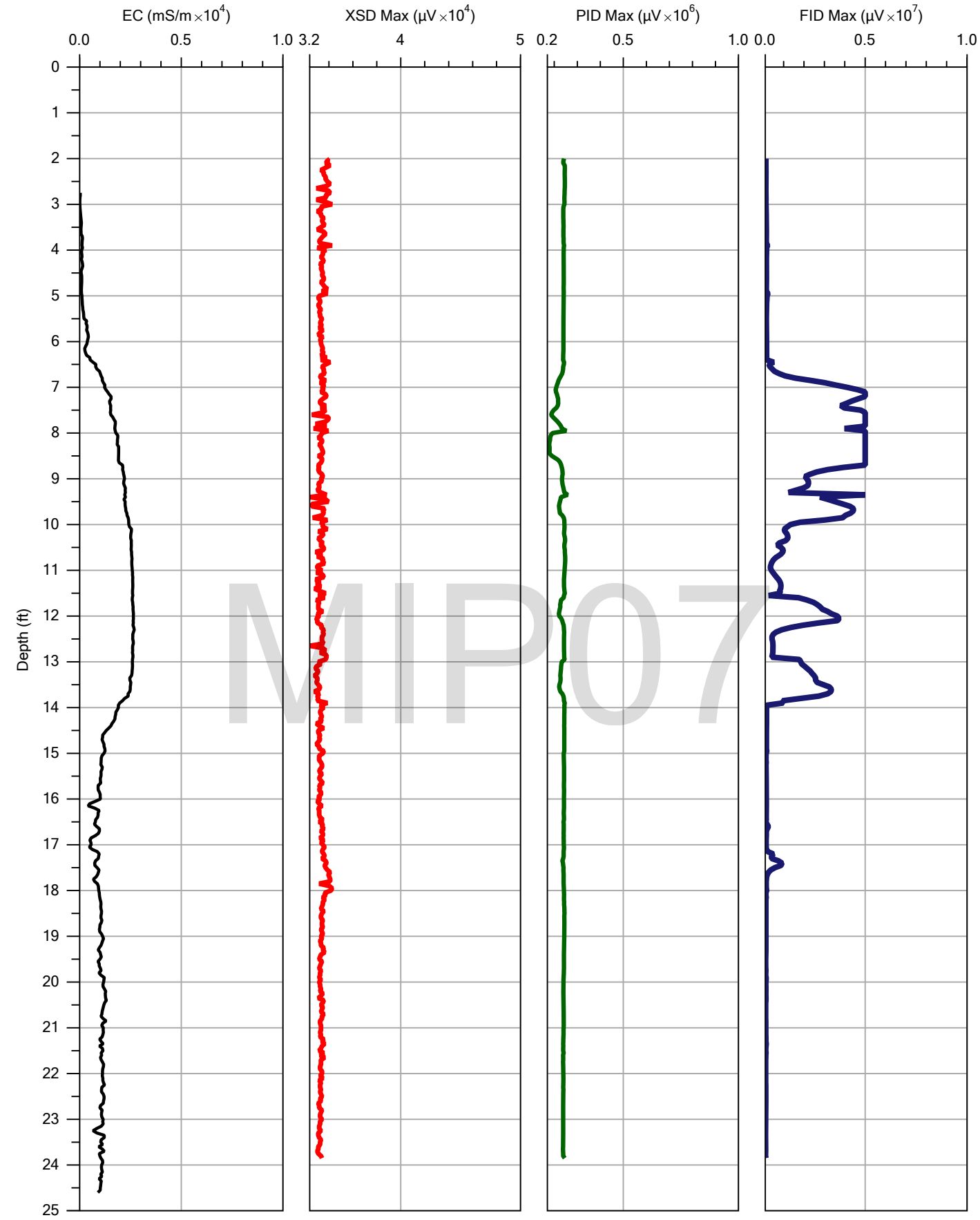
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Project ID: LIRR Arch Street Yard	Client: D&B Engineers and Architects		Location:



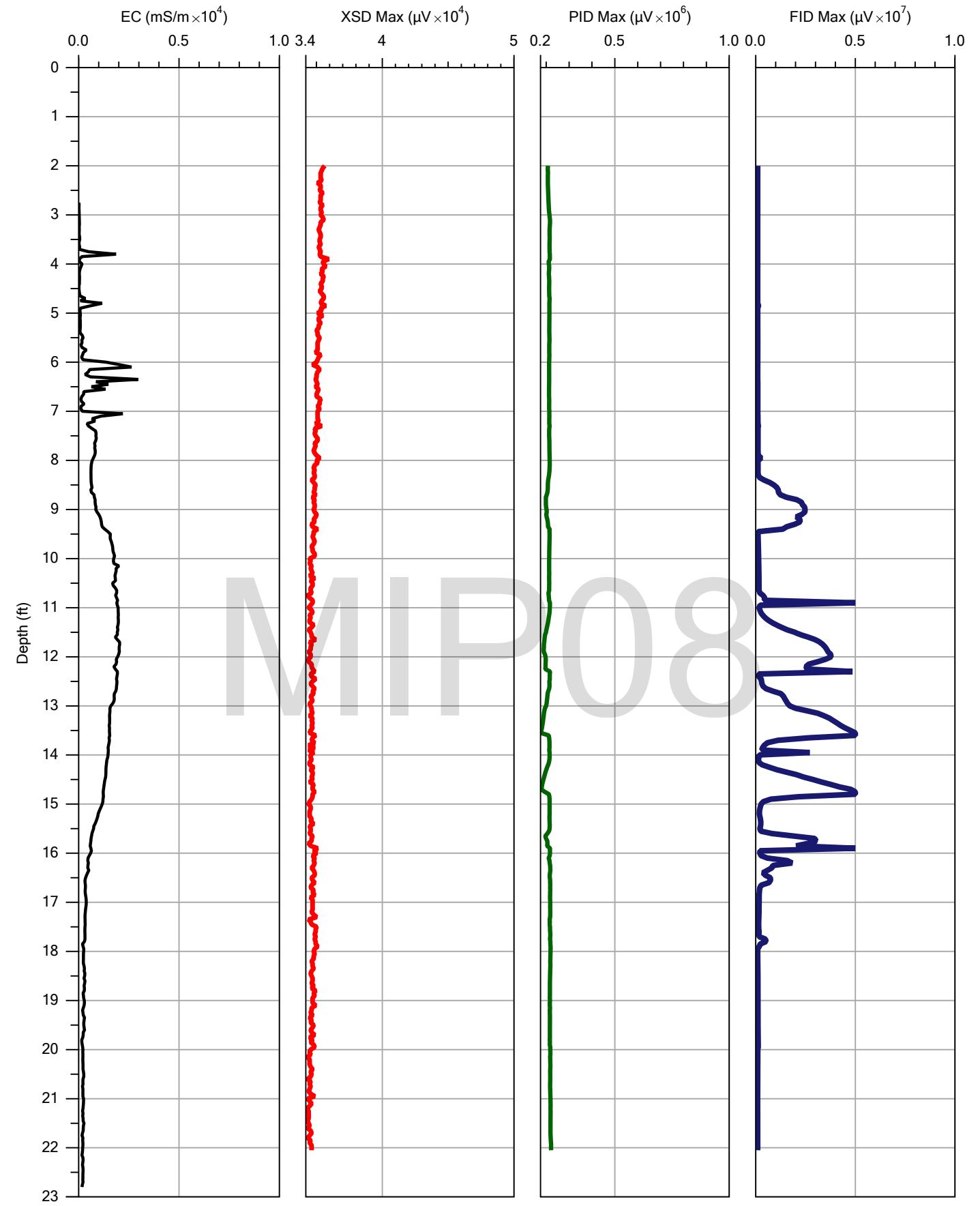
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Project ID: LIRR Arch Street Yard	Client: D&B Engineers and Architects		Location:



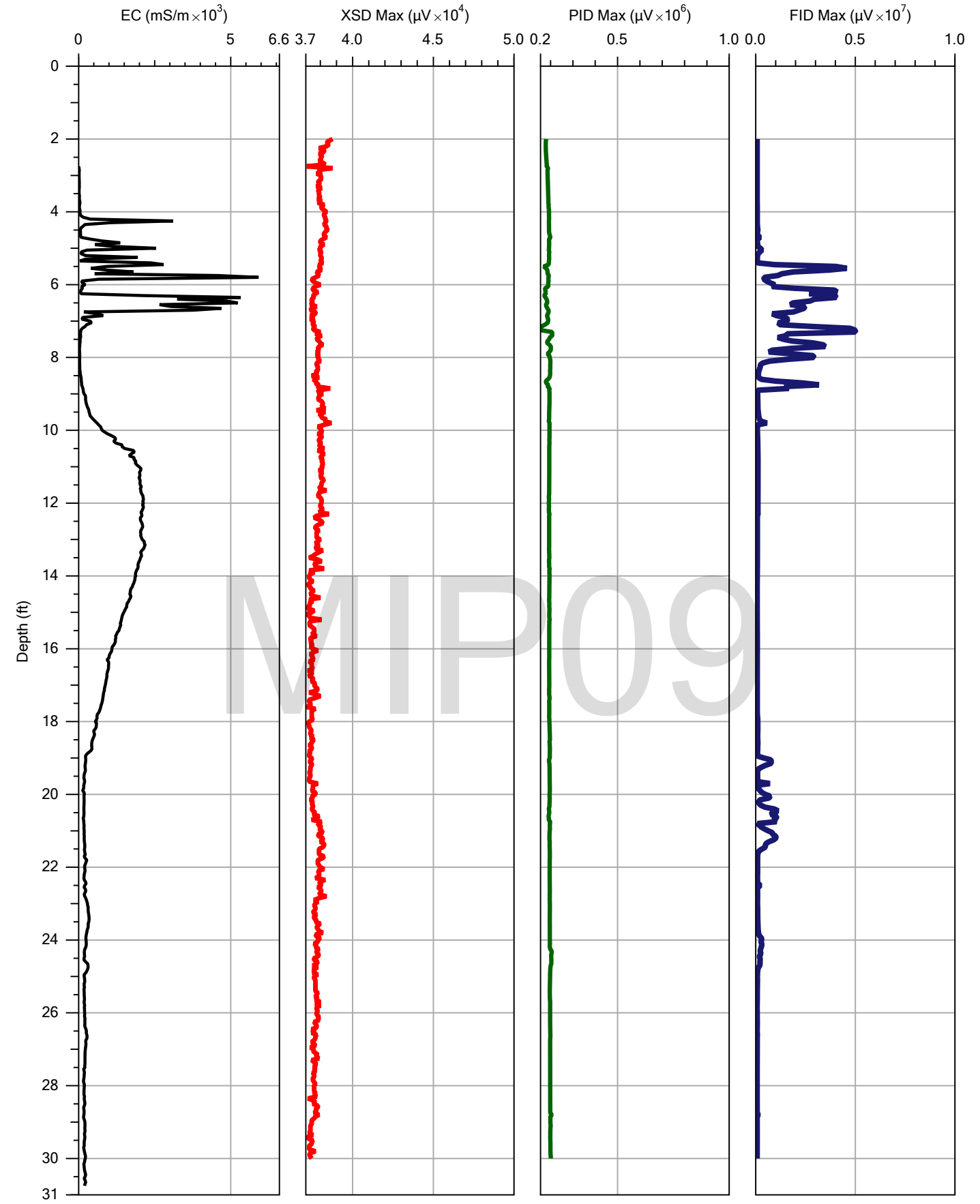
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Project ID: LIRR Arch Street Yard	Client: D&B Engineers and Architects		Location:



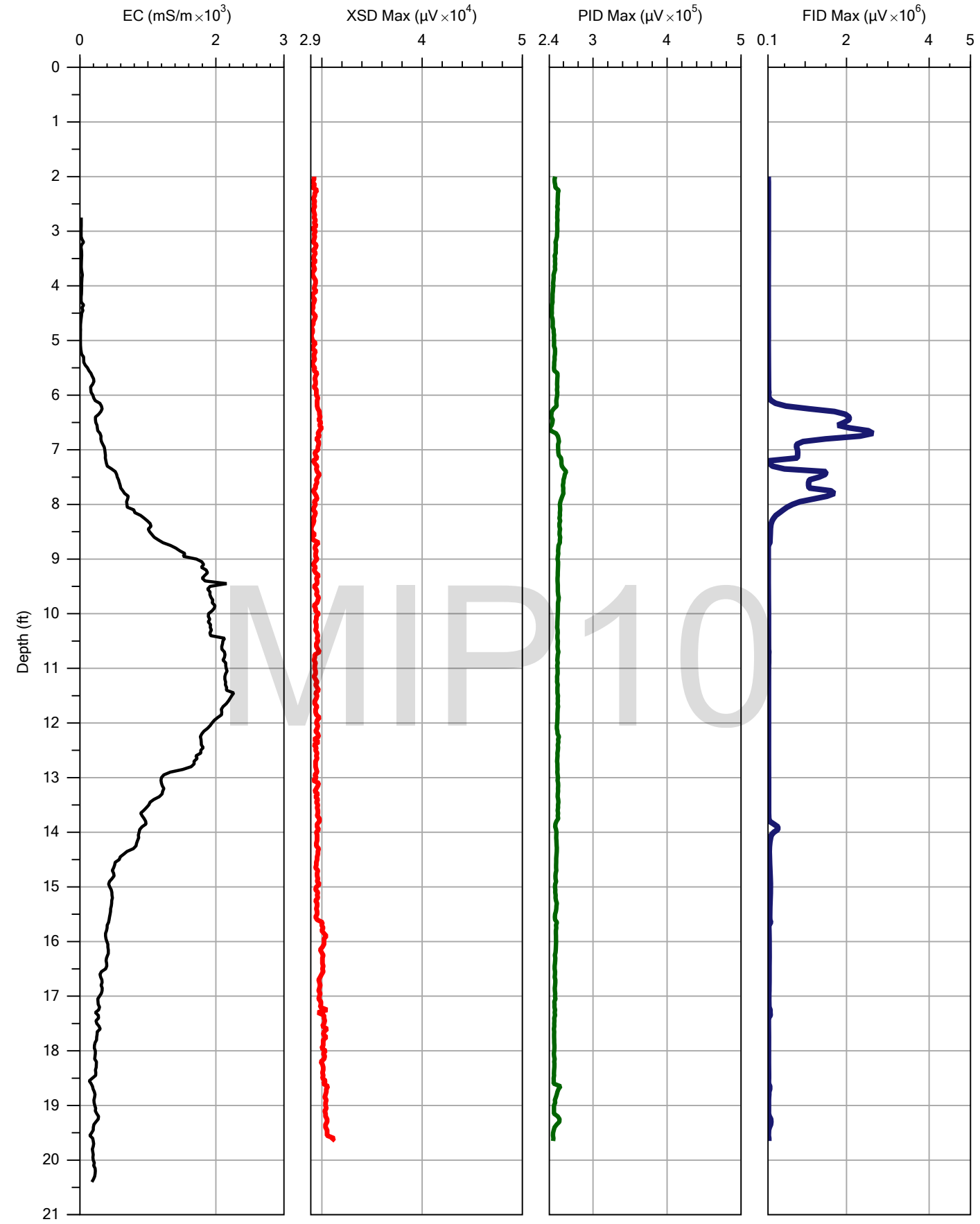
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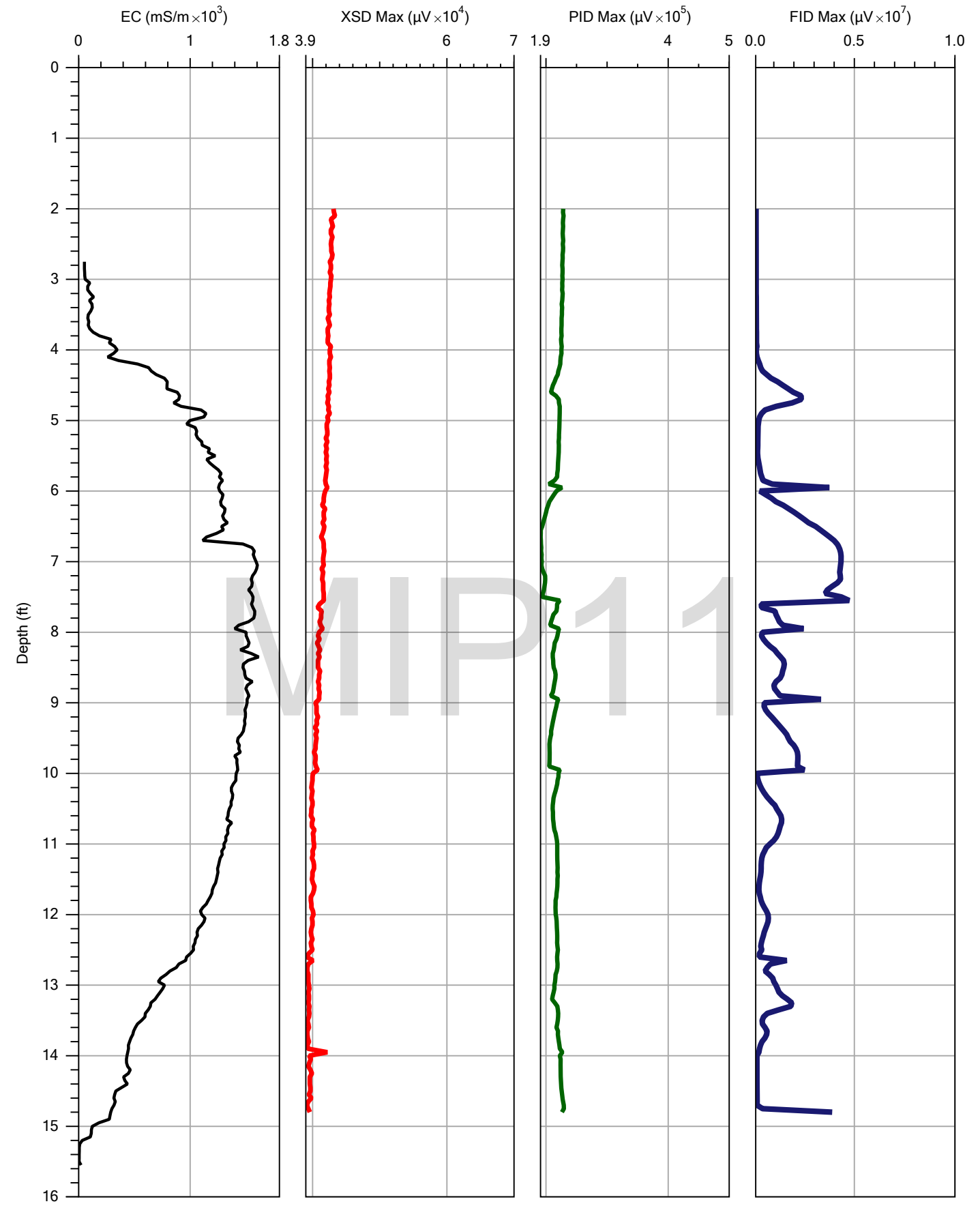
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Project ID: LIRR Arch Street Yard	Client: D&B Engineers and Architects,		Location:



			File: MIP-11.MIP
Company: ZTS	Operator: MR		Date: 10/29/2015
Project ID: LIRR Arch Street Yard	Client: D&B Engineers and Architects,		Location:

APPENDIX B

D&B ENGINEERS AND ARCHITECTS, P.C.	**Project No.:** 3455-2 **Project Name:** LIRR – Arch Street Yard RI	**Boring No.:** VB-01 **Sheet** 1 **of** 1 **By:** Carl Schmidlapp
Drilling Contractor: Zebra **Drill Rig:** Geoprobe 6620DT **Date Started:** 10/30/15	**Geologist:** Carl Schmidlapp **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 10/30/15	**Boring Completion Depth:** 27' **Ground Surface Elevation:** --- **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	HA	60"	0.0 0.7	0-3": Bluestone 3"-60": Dark brown, fine-medium SAND, some fine to medium subangular gravel, trace silt, concrete, medium dense, moist, no odor, no staining.
5'-10'	2	MC	38"	0.0 0.0 62 64	0-11": Dark brown to black, fine to medium SAND, trace subrounded gravel, moist, no odor, no staining. 11"-24": Brown to light brown, medium to fine SAND, trace silt, wet, no odor, no staining. 24"-38": Brown to dark brown, medium to fine SAND, trace silt, wet, no odor, no staining.
10'-15'	3	MC	57"	10 0.0 0.0 150 250 40 0.0	0-7": Black, fine SAND, trace subangular gravel, no odor, slight staining. 7"-24": Dark brown to black, fine SAND, trace subangular gravel, wet, no odor, no staining. 24"-36": Black/gray, fine SAND, trace clay, moist, hydrocarbon-like odor, no staining. 36"-47": Gray, CLAY, slightly plastic, trace organics(shells), moist, no odor, no staining. 47"-57": Gray, CLAY, dense, trace organics (shells), dense, moist, no odor, no staining.
15'-20'	4	MC	29"	0.0 0.0 18 12.5	0-12": Brown, fine SAND, trace SILT, trace fine subangular gravel, wet, loose, no odor, no staining. 12"-24": Gray, CLAY, slightly plastic, dry, no odor, no staining. 24"-29": Gray to black, CLAY, dense to slightly plastic, dry, no odor, no staining.
20'-25'	5	MC	28"	0.0 0.0 0.0 0.0	0-13": Green to brown, fine to medium SAND, trace medium to coarse gravel, dense, dry, no odor, no staining. 13"-28": Green to brown, medium to coarse SAND, trace medium to coarse gravel, dense, moist, no odor, no staining.
25'-30	6	MC	24"	0.0 0.0	0-24": Brown to gray, fine to medium SAND, trace fine to medium subangular gravel, poorly sorted, moist, no odor, no staining.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES: Refusal encountered at 27'
Soil sample VB-01 (13-15') and groundwater samples VB-01 (15-16') and VB-01 (26-27') collected for VOC analysis.

D&B ENGINEERS AND ARCHITECTS, P.C.	**Project No.:** 3455-2 **Project Name:** LIRR – Arch Street Yard RI	**Boring No.:** VB-02 **Sheet** 1 **of** 1 **By:** Carl Schmidlapp
Drilling Contractor: Zebra **Drill Rig:** Geoprobe 6620DT **Date Started:** 10/30/15	**Geologist:** Carl Schmidlapp **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 10/30/15	**Boring Completion Depth:** 26.5' **Ground Surface Elevation:** --- **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	HA	60"	0.0 0.0, 0.0 0.0, 0.0	0-36": Bluestone 36"-60": Dark brown, fine to medium SAND, trace concrete, trace silt, dense, poorly sorted, moist, no odor, no staining.
5'-10'	2	MC	28"	0.0 0.0 0.0 0.0 0.0	0-5": Black-dark brown, medium to coarse SAND, some medium to coarse subangular gravel, moist, no odor, no staining. 5"-19": Black-brown, medium to fine SAND, trace medium to coarse gravel, loose, moist, no odor, no staining. 19"-23": Black-brown, medium to fine SAND, dense, moist, no odor, no staining. 23"-28": Gray, fine to medium SAND, trace SILT, loose, dry, no odor, no staining.
10'-15'	3	MC	32"	0.0, 0.0 0.0, 0.0 0.0 0.0	0"-22": Gray, CLAY, trace organics and peat, slightly plastic, moist, organic odor, no staining. 22"-32": Gray-brown, CLAY, some peat and organics, slightly dense, organic odor, no staining.
15'-20'	4	MC	41"	0.0 0.0, 0.0 0.0 0.0 0.0 0.0	0-9": Dark gray, medium to fine SAND, trace silt, trace subangular medium-fine gravel, moist, no odor, no staining. 9"-27" Gray, CLAY, some peat and organics, plastic, loose, no odor, no staining. 27"-36": Gray, medium to coarse SAND, some medium to coarse subangular gravel, rock fragments 34"-36", poorly sorted, dense, no odor, no staining. 36"-41": Brown-green, medium to coarse SAND, some large rock fragments, dense, poorly sorted, dry, no odor, no staining.
20'-25'	5	MC	42"	0.0, 0.0 0.0, 0.0 0.0 0.0 0.0	0-22": Green-brown, medium to fine SAND, trace subrounded gravel, dense, well sorted, dry, no odor, no staining. 22"-26": Brown-dark brown/green, medium to fine SAND, poorly sorted, dry, no odor, no staining. 26"-42": Green to brown, fine to medium SAND, trace subangular gravel, trace rock fragments, well sorted, dense, dry, no odor, no staining.
25'-30'	6	MC	0"	N/A	No Recovery

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES: Refusal encountered at 26.5'.
Soil sample VB-02 (12-14') and groundwater samples VB-02 (5') and VB-02 (12-14') collected for VOC analysis.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-01 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/15/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/16/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 7.48' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-6"	1	HA	6"	0.0	Bluestone.
6"-1'	2	HA	12"	0.0	Same as above.
1'-2'	3	HA	12"	0.0	Dark gray-brown, medium to coarse SAND and STONE and GRAVEL, trace brick, concrete and wood, dense.
2'-2.5'	4	HA	6"	0.0	Bluestone and felt barrier fabric.
2.5'-3'	5	HA	6"	0.1	Black, silty SAND, organic odor, water encountered at 3' bgs.
3'-5'	6	MC	16"	0.0	Black, fine to medium SAND, some silt, fine to medium gravel, trace slag, fabric, rock fragments, poorly sorted, loose, wet, no staining, organic odor.
5'-10'	7	MC	30"	0.1 0.1	0"-19": Black-dark gray, silty SAND, little fine gravel, poorly sorted, loose, wet, no staining, no odor. 19"-30": Gray-brown, clayey SILT, firm-soft, wet-moist, no staining, organic odor.
10'-15'	8	MC	36"	0.0 0.0	0"-29": Dark gray, CLAY, trace organic material, slightly plastic-firm, moist, no staining, trace organic odor. 29"-36": Dark brown-gray, CLAY, some organic material, soft, damp, no staining, organic odor.
15'-20'	9	MC	38"	0.0 0.0 0.0	0"-19": Gray-silver, silty CLAY, slightly plastic firm, moist. 19"-28": Gray, fine silty SAND, wet. 28"-38": Olive-brown, clayey SILT, trace fine sand, fine subrounded gravel, dense, no staining, no odor.
20'-25'	10	MC	34"	0.0 0.0	0"-24": Olive green-brown, fine to medium SAND, some silt, trace fine subrounded gravel, poorly sorted, medium dense, wet, no staining, no odor. 24"-34": Gray-light gray, fine SAND, trace silt, well sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 13'-15' and 23'-25' submitted for TCL VOC and TCL SVOC analysis.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-02 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/17/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 8.60' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-1'	1	HA	12"	0.0	Bluestone.
1'-2'	2	HA	12"	0.0	Gravel, brick, stone, cobbles, no odor, no staining.
2'-3'	3	HA	12"	0.0	Dark gray, fine to medium SAND, some brick, stone, cobbles, dense gravel, no staining, no odor. Water encountered at 3' bgs.
3'-5'	4	MC	24"	0.0 0.0	0"-6": CONCRETE. 6"-24": Black, fine to medium SAND, some rock, stones, trace silt, fine gravel, trace yellow brick, slag and coal, poorly sorted, loose, wet, no staining, no odor.
5'-10'	5	MC	46"	0.0 0.0 0.0	0"-12": Black-brown, ASH, COAL, and Cinders, poorly sorted, loose, wet, no staining, no odor. 12"-22": Olive-gray, fine to medium SAND, some rock, trace fine gravel, stones, poorly sorted, wet, no staining, no odor. 22"-46": Olive-brown, fine to very fine SAND, little silt, trace fine gravel, well sorted, moist, no staining, no odor.
10'-15'	6	MC	44"	0.0 0.0 0.0	0"-10": Olive-brown, fine to medium SAND, trace silt, fine subrounded gravel and stone, well sorted, wet, no staining, no odor. 10"-18": Olive-brown, medium to coarse SAND, trace subrounded gravel, poorly sorted, loose, wet, no staining, no odor. 18"-44": Gray, CLAY, some organic matter, trace shells, soft, damp-moist, no staining, organic odor.
15'-20'	7	MC	36"	0.0 0.0 0.0 0.0	0"-8": Brown, CLAY, trace sand, soft, moist, no staining, no odor. 8"-22": Gray, CLAY, trace fine gravel, dense-firm, damp, no staining, no odor. 22"-27": Brown-light red, fine SAND, well sorted, wet, no staining, no odor. 27"-36": Olive-brown, SILT, trace clay, dense, damp.
20'-25'	8	MC	36"	0.0 0.0	0"-24"': Brown-olive, silty fine SAND, trace fine gravel, poorly sorted, dense, moist, no staining, no odor. 24"-36": Gray, fine to medium SAND, some silt, trace clay, subrounded gravel, rock, poorly sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 13'-15' and 23'-25' submitted for TCL VOC and TCL SVOC analysis.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-03 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/17/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 8.72' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-6"	1	HA	6"	0.0	Bluestone.
6"-2'	2	HA	1.5"	0.0	Dark gray, fine SAND, some stone, gravel, dense, no staining, no odor.
2'-5'	3	MC	25"	0.0	0"-16": Brown, medium to coarse SAND, some fine gravel, cinders, concrete, poorly sorted, loose, wet at 3' bgs, no staining, no odor.
				0.0	16"-25": Black, fine to medium SAND, some cinders, slag, angular gravel, trace ash, poorly sorted, loose, wet, no staining, no odor.
5'-10'	4	MC	36"	0.0	0"-18": Black, medium to coarse SAND and angular GRAVEL, trace angular rock, brick, poorly sorted, very loose, wet, no staining, no odor.
				0.0	18"-21": Black, fine silty SAND, some gravel, wet.
				0.0	21"-27": Wood.
				0.0	27"-36": Black-gray brown, fine to very fine SAND, trace silt, trace wood, wet, no staining, no odor.
10'-15'	5	MC	36"	0.0	0"-10": Black, coarse SAND and GRAVEL, loose, wet.
				0.0	10"-36": Brown, fine to very fine silty SAND, well sorted, loose, wet, no staining, no odor.
15'-20'	6	MC	39"	0.0	0"-14": Dark gray, CLAY, trace shells, soft, moist, no staining, organic odor.
				0.0	14"-27": Gray-light gray, SILT, trace clay, dense, damp, no staining, no odor.
				0.0	27"-39": Brown-olive, SILT, some fine sand, trace fine gravel, damp, dense, no staining, no odor.
20'-25'	7	MC	36"	0.0	0"-13": Brown, fine to medium SAND, trace silt, subrounded gravel, poorly sorted, medium dense, wet, no staining, no odor.
				0.0	13"-25": Olive-brown, very fine to fine SAND, trace silt, well sorted, moist, no staining, no odor.
				0.0	25"-36": Gray-brown, silty fine SAND, trace subrounded gravel, dense, moist, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 12'-14' and 18'-20' submitted for TCL VOC and TCL SVOC analysis. Soil sample from 12'-14' also submitted for analysis of TAL metals, TCL Pesticides and PCBs.

D&B ENGINEERS AND ARCHITECTS, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-04 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/16/16	**Boring Completion Depth:** 29' **Ground Surface Elevation:** 7.46' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-6"	1	HA	6"	0.0	Bluestone.
6"-1'	2	HA	6"	0.0	Brown, medium to coarse SAND, some gravel, organic matter, trace silt, dry, no odor.
1'-2'	3	HA	12"	0.0	Gray-light black, medium to coarse SAND and GRAVEL, trace cobbles, stone, brick and concrete, very dense, no odor, no staining.
2'-3'	4	HA	12"	0.0	Black, SAND, ROCK and GRAVEL, dense, organic odor, water encountered at 3' bgs.
3'-5'	5	MC	5"	7.8	Black-dark gray, medium to coarse SAND, some fine to coarse gravel, trace silt, trace stone, concrete and rubber, poorly sorted, loose, wet, no staining, very slight sheen on water, petroleum odor.
5'-10'	6	MC	8"	2.3	Black, medium to coarse SAND and subangular GRAVEL, crushed ROCK, trace wood, poorly sorted, loose, wet, no staining, slight petroleum odor.
10'-15'	7	MC	42"	0.0 0.0	0"-33": Dark gray, CLAY, trace organic matter, trace shells, soft, slightly plastic, damp-moist, no staining, organic odor. 33"-42": Dark gray-brown, silty CLAY, some organic matter, firm-dense, slightly plastic, no staining, organic odor, moist-wet.
15'-20'	8	MC	40"	0.0 0.0	0"-21": Gray, clayey SILT, trace fine gravel, organic matter, firm-dense, damp-moist, no staining, no odor. 21"-40": Olive-brown, fine to medium SAND, some silt, subrounded gravel, trace rock, muscovite flakes, poorly sorted, dense-moist, no staining, no odor.
20'-25'	9	MC	6"	0.0	Olive-brown, fine to medium SAND, some silt, subrounded gravel, trace rock, poorly sorted, dense, damp-moist, no staining, no odor. Note large stone stuck in tip of soil sampler.
25'-29'	10	MC	23"	0.0	Gray, fine to medium SAND, trace silt, fine gravel and rock fragments, shale/slate, poorly sorted, loose, wet, no staining, no odor. Encountered refusal at 29'.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 3'-5', 10'-12' and 27'-29' submitted for TCL VOC and TCL SVOC analysis. Soil sample from 3'-5' also submitted for analysis of TAL Metals, TCL Pesticides and PCBs.

D&B ENGINEERS AND ARCHITECTS, P.C.

	Project No.: 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-05 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/16/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 7.94' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-6"	1	HA	6"	0.0	Bluestone.
6"-2'	2	HA	18"	0.0	Gray, medium to coarse SAND and GRAVEL, dense, no staining, no odor.
2'-3'	3	HA	12"	0.0	Dark gray, fine SAND and BRICK, some gravel, no staining, no odor. Water encountered at 3' bgs.
3'-5'	4	MC	21"	0.0	Dark gray-black, medium to coarse SAND, some cinders, slag, brick, trace silt, brick, fine gravel, angular rock, poorly sorted, loose, wet, no staining, no odor.
5'-10'	5	MC	45"	0.0 0.0	0"-18": Black-dark gray, fine to medium SAND, some silt, trace fine gravel, poorly sorted, loose, wet, no staining, organic odor. 18"-45"': Gray-olive, silty fine SAND, well sorted, wet, no staining, organic odor.
10'-15'	6	MC	47"	250 0.0 0.0	0"-12": Black-dark gray, fine to medium SAND, trace silt, fine gravel, poorly sorted, loose, wet, no staining, trace solvent odor. 12"-42": Gray, CLAY, soft-plastic, damp-moist, no staining, trace organic matter. 42"-47": Dark gray-brown, CLAY, soft-slightly plastic, some organic matter, dry-damp, no staining.
15'-20'	7	MC	42"	0.0 0.0 0.0	0"-12": Light gray, CLAY, trace organic matter, dense, moist, no staining, no odor. 12"-24": Gray-dark gray, silty SAND, wet, no staining, no odor. 24"-42": Olive-brown, fine to medium SAND, some silt, subrounded gravel, trace clay, poorly sorted, dense, no odor, no staining.
20'-25'	8	MC	44"	0.0 0.0 0.0	0"-20": Brown-olive, CLAY, trace fine subrounded gravel, rock, dense, damp, no odor, no staining. 20"-32": Olive-brown, silty SAND, some subrounded gravel, stones, poorly sorted, dense, moist, no staining, no odor. 32"-44": Gray, fine SAND, trace silt, well sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES: Soil samples from 10'-11', 11'-13' submitted for TCL VOC and TCL SVOC analysis. Soil sample from 10'-11' also submitted for analysis of TAL metals, TCL Pesticides and PCBs.

D&B ENGINEERS AND ARCHITECTS, P.C.

	Project No.: 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-06 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/17/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 9.23' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-1"	1	HA	1"	0.0	Bluestone.
1"-3'	2	HA	35"	0.0	Dark gray, fine to medium SAND and BRICK, dense, no staining, no odor.
3'-5'	4	MC	13"	0.0	Black-brown, fine to coarse SAND and Stones, Concrete, Gravel, poorly sorted, loose, no staining, no odor. Water encountered at 4.5' bgs.
5'-10'	5	MC	31"	0.0 25	0"-19": Dark brown-black, medium to coarse SAND and CONCRETE, some rock, stone, gravel, trace brick, poorly sorted, loose, wet, no staining, no odor. 19"-31": Dark black, silty fine SAND, trace fine gravel, well sorted, wet, no staining, no odor.
10'-15'	6	MC	21"	5.0 0.0 0.0	0"-4": Black, fine to coarse SAND, trace fine gravel, poorly sorted, wet, no staining, no odor. 4"-16": Dark brown, fine SAND, trace silt, fine gravel, well sorted, wet, no staining, no odor. 16"-21": Black-dark gray, fine SAND, trace silt, well sorted, wet, no staining, no odor.
15'-20'	7	MC	39"	0.0 0.0 0.0	0"-12": Dark gray, CLAY, some organic matter and shells, soft, moist, no staining, trace organic odor. 12"-31": Light gray, SILT, trace clay, subrounded gravel, dense, moist, no staining, no odor. 31"-39": Reddish-brown, silty fine SAND, well sorted, medium dense, wet, no staining, no odor.
20'-25'	8	MC	45"	0.0 0.0 0.0	0"-18": Olive-brown, CLAY and SILT, trace fine sand seams, dense, damp-moist, no staining, no odor. 18"-34": Olive-brown, fine to medium SAND, some silt, trace rock, fine subrounded gravel, poorly sorted, dense, moist, no staining, no door. 34"-45": Light gray-tan, fine SAND, some silt, trace clay, subrounded gravel, medium dense, damp-moist, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 8'-10' and 11'-13' submitted for TCL VOC and TCL SVOC analysis. Soil sample from 8'-10' also submitted for analysis of TAL Metals, TCL Pesticides and PCBs.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-07 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 8.10' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-8"	1	HA	8"	0.0	Bluestone.
8"-20"	2	HA	12"	0.0	Gray-brown, medium to coarse SAND and GRAVEL, trace stone, poorly sorted, loose, moist.
20"-36"	3	HA	16"	0.0	Black-dark gray, SILT and SAND, some gravel, trace cobbles, trace metal, brick and slag, poorly sorted, loose, moist, no staining, no odor.
36"-42"	4	HA	6"	0.0	Gray-brown, SILT and SAND, some gravel, poorly sorted, loose, wet at 3.8' bgs.
3.5'-5'	5	MC	7"	0.0	Bluestone/gravel, wet, loose, no staining, no odor.
5'-10'	6	MC	42"	0.3	Gray-brown, fine to medium SAND, trace fine gravel, trace clayey silt, organic matter, poorly sorted, loose, wet, no staining, no odor.
10'-15'	7	MC	36"	0.2 0.3	0"-8": Gray-brown, fine to medium SAND, trace coarse sand and gravel, well sorted, loose, wet, no staining, no odor. 8"-36": Dark gray, CLAY, some organic matter and shells, soft, damp, no staining, organic odor.
15'-20'	8	MC	34"	0.3 0.3	0"-22": Gray, SILT, trace rock, dense, damp-moist. 22"-34": Brown-olive, silty fine SAND, trace rock and gravel, poorly sorted, dense, moist, no staining, no odor.
20'-25'	9	MC	35"	0.0 0.0	0"-19": Brown-olive, fine to medium SAND, some silt, trace rock, gravel, poorly sorted, dense, moist-wet, no staining, no odor. 19"-35": Gray, fine to very fine SAND, trace fine gravel, well sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 12'-14' and 23'-25' submitted for TCL VOC and TCL SVOC analysis. Soil sample from 12'-14' also submitted for TAL Metals, TCL Pesticides and PCB analysis.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-08 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/14/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/17/16	**Boring Completion Depth:** 25' **Ground Surface Elevation:** 8.62' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-1'	1	HA	12"	0.0	Bluestone.
1'-4'	2	HA	36"	0.0	Dark gray-brown, fine to medium SAND and GRAVEL, no odor, no staining. Water encountered at 4' bgs.
4'-10'	3	MC	36"	56.0	0"-24": Black, medium to coarse SAND and fine GRAVEL, some stone, trace clay, coal, cinders, brick, poorly sorted, wet, loose.
				0.0	24"-36": Dark brown, medium to coarse SAND, Rock and Stones, some gravel, brick, poorly sorted, loose, wet, no staining, no odor.
10'-15'	4	MC	20"	0.0	0"-12": Black, medium to coarse SAND and fine to coarse angular GRAVEL, some rock, concrete, brick, poorly sorted, very loose, wet, no staining, no odor.
				0.0	12"-20": Dark brown-gray, silty SAND, some subrounded gravel, trace stone, poorly sorted, wet, no staining, no odor.
15'-20'	5	MC	52"	0.0	0"-12": Dark gray, CLAY, some organic matter, soft-firm, slightly plastic, moist, no staining, slight organic odor.
				0.0	12"-20": Dark gray-brown, silty CLAY, moist.
				0.0	20"-40": Light gray-blue, SILT, trace clay, dense, damp, no staining, no odor.
				0.0	40"-52": Reddish-olive, silty fine to medium SAND, some fine subrounded gravel, poorly sorted, dense, moist, no staining, no odor.
20'-25'	6	MC	40"	0.0	0"-16": Olive-brown, SILT, little sand, trace fine gravel, dense, damp, no staining, no odor. 16"-40": Olive-brown, silty fine SAND, some subrounded gravel, trace weathered rock, poorly sorted, moist-damp, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 4'-6', 6'-8' and 13'-15' submitted for TCL VOC and TCL SVOC analysis.

D&B ENGINEERS AND ARCHITECTS, P.C.

	Project No.: 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-09 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/18/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 8' **Ground Surface Elevation:** 7.10'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	MC	36"	0.3	0"-12": Brown, medium to coarse SAND, crushed ROCK and GRAVEL, poorly sorted, loose, damp to wet.
				0.0	12"-18": Dark gray, silty SAND and STONE, poorly sorted, loose, no staining, no odor.
				0.0	18"-21": Concrete, dry, no staining, no odor.
				0.0	21"-42": Black, fine SAND, SLAG and COAL, trace silt, lumber, poorly sorted, very loose, wet, no staining, no odor.
				0.0	42"-46": Olive-brown, fine SAND, some fine angular gravel, wet, no staining, no odor.
5'-8'	2	MC	34"	0.3	0"-21": Dark gray, fine to medium SAND, trace fine gravel, well sorted, wet, no staining, no odor.
				0.3	21"-30": Brown-olive, fine to medium SAND, trace fine gravel, wet, no staining, no odor.
				0.3	30"-34": Dark gray, very fine SAND, trace silt, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3', 4'-5' and 7'-8' submitted for PCBs analysis.

Boring log begins approximately 2 ft. below bluestone.
*Ground surface elevation is from top of bluestone.

D&B ENGINEERS AND ARCHITECTS, P.C.

	Project No.: 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-10 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/18/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 8' **Ground Surface Elevation:** 7.21'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-1'	1	HA	12"	0.0	Dark gray, medium to fine SAND, some brick, rock, no staining, no odor.
1.5'-5'	2	HA	35"	0.3 0.3	0"-17": Black, medium to coarse SAND, SLAG and GRAVEL, poorly sorted, loose, wet, no staining, no odor. 17"-35": Black, fine to medium SAND and crushed ROCK, trace gravel, lumber, poorly sorted, wet, no staining, no odor.
5'-8'	3	MC	27"	0.2 0.2	0"-18": Black, medium to coarse SAND, fine GRAVEL, SLAG and COAL fragments, poorly sorted, loose, wet, no staining, no odor. 18"-27": Olive-brown, fine SAND, wet, well sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 2'-3', 4'-5' and 7'-8' submitted for PCBs analysis.

Boring log begins approximately 18" below the bluestone.
*Ground surface elevation is from top of bluestone.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-11 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/18/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 8' **Ground Surface Elevation:** 7.39'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	MC	35"	0.2 0.2	0"-15": Black, medium to coarse SILT, GRAVEL and STONE, trace brick, poorly sorted, loose, wet, no staining, no odor. 15"-35": Olive-brown, fine to medium SAND, some silt, crushed stone, rock, gravel, compacted, dense, wet, no staining, no odor.
5'-8'	2	MC	24"	0.6 0.6	0"-12": Black-dark gray, medium to coarse SAND, STONE, ROCK and GRAVEL, poorly sorted, loose, wet, no staining, no odor. 12"-24": Brown-gray, organic CLAY and PEAT, damp, slightly plastic, soft, no staining, some organic odors.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3', 4'-5' and 7'-8' submitted for PCBs analysis.

Boring log begins approximately 24" below bluestone.
*Ground surface elevation is from top of bluestone.

D&B ENGINEERS AND ARCHITECTS, P.C.

Project No.: 3455-2D
Project Name: LIRR – Arch Street

Boring No.: SB-12
Sheet 1 **of** 1
By: Keith Robins

Drilling Contractor: AARCO
Drill Rig: Geoprobe 7822DT
Date Started: 3/21/16

Geologist: Keith Robins
Drilling Method: Macrocore
Drive Hammer Weight: N/A
Date Completed: 3/21/16

Boring Completion Depth: 6'
Ground Surface Elevation: 6.89'*
Boring Diameter: 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	HA/ MC	44"	0.5 0.5 0.5	0"-16": Gray, medium-coarse SAND, GRAVEL, STONES, trace brick, concrete, poorly sorted, loose. 16"-39": Black, fine to medium SAND, some slag, trace coal, cinders, gravel, poorly sorted, loose, wet, no staining, no odor. 39"-44": Black-brown, fine to medium SAND, trace gravel, well sorted, wet, no staining, no odor.
5'-6'	2	MC	12"	0.5	Dark gray, organic CLAY, soft-slightly plastic, organic odor, moist.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3' and 5'-6' submitted for PCBs analysis.

Boring log begins approximately 3" below bluestone.
*Ground surface elevation is from top of bluestone.

D&B ENGINEERS AND ARCHITECTS, P.C.

	Project No.: 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-13 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/21/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/21/16	**Boring Completion Depth:** 6' **Ground Surface Elevation:** 7.12'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	MC	50"	0.4	0"-12": Dark brown-gray, medium to coarse SAND and STONES, some angular gravel, trace concrete, poorly sorted, damp-moist, no staining, no odor.
				0.4	12"-29": Black, medium to coarse SAND, some coarse gravel, slag, poorly sorted, loose, wet, no staining, no odor.
				0.4	29"-50": Dark gray-olive, organic CLAY, soft-slightly plastic, moist, organic odor.
5'-6'	2	MC	10"	0.4	Gray, CLAY, some organic material, soft-slightly plastic, moist, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3' and 5'-6' submitted for PCBs analysis.

Boring log begins approximately 24" below bluestone.
*Ground surface elevation is from top of bluestone.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-14 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/21/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/21/16	**Boring Completion Depth:** 6' **Ground Surface Elevation:** 7.76'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	HA/ MC	35"	0.3 0.3	0"-17": Black-dark gray, medium to coarse SAND, some fine gravel, silt, slag, trace silt, brick, poorly sorted, loose, no staining, no odor. 17"-35": Brown-light orange, medium SAND, trace fine gravel, well sorted, compacted, wet, no staining, no odor.
5'-6'	2	MC	10"	0.3	Light gray, fine to medium SAND, trace silt, gravel, well sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3' and 5'-6' submitted for PCBs analysis.

Boring log begins approximately 24 " below bluestone.
*Ground surface elevation is from top of bluestone.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-15 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/18/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 6' **Ground Surface Elevation:** 6.94'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
1'-5'	1	HA/ MC	36"	0.1 0.1	0"-31": Black-dark gray, medium to coarse SAND, some angular gravel, trace silt, cinders, slag, crushed rock poorly sorted, loose, wet, no staining, no odor. 31"-36": Olive green-brown, fine to coarse SAND, trace subrounded-flat gravel, well sorted, wet, no staining, no odor.
5'-6'	2	MC	8"	0.1	Olive-brown, SILT, dense, moist, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3' and 5'-6' submitted for PCBs analysis.

Boring log begins approximately 24" below bluestone.
*Ground surface elevation is from top of bluestone.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-16 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/18/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 6' **Ground Surface Elevation:** 7.13'* **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-5'	1	HA/ MC	31"	0.3	Black-light gray, fine to medium SAND, some silt, stones, concrete, trace brick, damp-moist, no staining, no odor.
5'-6'	2	MC	10"	0.3	Olive-light black, medium to coarse SAND, some gravel, poorly sorted, medium-loose, moist-wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0'-1', 2'-3' and 5'-6' submitted for PCBs analysis.

Boring log begins approximately 12" below bluestone.
*Ground surface elevation is from top of bluestone.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** SB-17 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe 7822DT **Date Started:** 3/18/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/18/16	**Boring Completion Depth:** 6‘ **Ground Surface Elevation:** 6.41’* **Boring Diameter:** 2”

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0’-1’	1	HA	12”	0.0	Black-dark brown, SAND and GRAVEL, trace brick, wet.
1’-2’	2	HA	12”	0.0	Black, SAND and GRAVEL, poorly sorted, wet.
2’-3’	3	HA	12”	0.0	Black, medium to coarse SAND and subangular GRAVEL, poorly sorted, loose, wet, no staining, no odor.
3’-5’	4	HA	24”	0.0	Black-dark gray, fine to medium SAND, trace gravel, wet, no staining, no odor.
5’-6’	5	HA	12”	0.0	Gray-brown, SILT, some fine to coarse sand, poorly sorted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 0’-1’, 2’-3’ and 5’-6’ submitted for PCBs analysis.
Boring log begins approximately 12” below bluestone.
*Ground surface elevation is from top of bluestone.

D&B ENGINEERS AND ARCHITECTS, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** GW-01 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe **Date Started:** 3/15/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/21/16	**Boring Completion Depth:** 20' **Ground Surface Elevation:** 9.85' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-6"	1	HA	6"	0.0	Bluestone.
6"-1'	2	HA	6"	0.0	Dark brown, medium to coarse SAND, GRAVEL and STONE, dry-damp.
1'-3'	3	HA	2"	0.0	Dark brown-brown, medium to coarse SAND, GRAVEL and STONE, trace brick, concrete, tile, wood, glass, poorly sorted, dense, no staining, no odor.
3'-5'	4	HA	24"	0.0	Black-dark brown, medium to coarse SAND, GRAVEL and STONE, trace silt, trace slag, cinders, poorly sorted, dense, no staining, no odor. Water encountered at 4.5' bgs.
5'-10'	5	MC	39"	0.4 0.4	0"-19": Black, medium to coarse SAND and SLAG, ASH, fine to coarse GRAVEL, trace brick, fill material, poorly sorted, very loose, wet, no staining, no odor. 19"-39": Olive green-light black, fine to medium SAND, trace silt, rock fragments, trace fill material, poorly sorted, wet, no staining, no odor.
10'-15'	6	MC	43"	0.5 0.5 0.5 0.5	0"-11": Black, fine to medium SAND, trace silt, well sorted, no staining, no odor. 11"-32": Olive-brown, clayey SILT, slightly firm-soft, slightly plastic, wet, no staining, no odor. 32"-40": Olive green-brown, fine SAND, well sorted, wet. 40"-43": Black, fine SAND, trace silt, well sorted, wet, no staining, no odor.
15'-20'	7	MC	42"	0.4 0.4 0.4	0"-16": Dark gray, CLAY, trace shells, slightly plastic, soft, damp-moist, no staining, no odor. 16"-34": Gray-light gray, clayey SILT, trace fine subrounded gravel, firm-dense, moist. 34"-42": Olive green-brown, silty fine SAND, trace fine gravel, poorly sorted, compacted-dense, moist-wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 4'-5', 13'-15' and 18'-20' submitted for TCL VOC and TCL SVOC analysis.

D&B ENGINEERS AND ARCHITECTS, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** GW-03 **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe **Date Started:** 3/15/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/21/16	**Boring Completion Depth:** 20' **Ground Surface Elevation:** 8.23' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-1'	1	HA	12"	0.0	Bluestone.
1'-3'	2	HA	24"	0.0	Black-dark brown, medium to coarse SAND, STONE and GRAVEL, trace concrete, wood, poorly sorted, dense, no staining, no odor.
3'-5'	3	HA	29"	0.7 0.7 0.7	0"-12": Black, medium to coarse SAND, some gravel, trace silt, poorly sorted, loose, wet, no staining, no odor. 12"-23": Black, fine to medium SAND, some fine to coarse angular gravel, rock, poorly sorted, very loose, wet, no staining, no odor. 23"-29": Dark brown, medium SAND, trace fine gravel, well sorted, dense, wet, no staining, no odor.
5'-10'	4	MC	52"	0.6	Dark brown-gray, fine to medium SAND, trace silt, coarse subrounded gravel, well sorted, medium compaction, wet, no staining, no odor.
10'-15'	5	MC	52"	0.5 2.2 2.2	0"-5": Dark gray-brown, fine to medium SAND, trace fine gravel, coarse sand, poorly sorted, wet, no staining, no odor. 5"-48": Dark gray, CLAY, some organic matter, trace shells, firm, slightly plastic, damp-moist, some organic odor. 48"-52": Dark brown-red, Organic Clay and PEAT, slightly plastic, organic odor, damp.
15'-20'	6	MC	48"	0.6 0.6	0"-30": Gray, silty CLAY, trace subrounded gravel, soft-firm, slightly plastic, damp-moist. 30"-48": Dark brown, SILT and fine SAND, trace black gravel, rock, muscovite flakes, poorly sorted, compacted, wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 3'-4', 12'-14' and 18'-20' submitted for TCL VOC and TCL SVOC analysis.

D&B Engineers and Architects, P.C.	**Project No.:** 3455-2D **Project Name:** LIRR – Arch Street	**Boring No.:** GW-04D **Sheet** 1 **of** 1 **By:** Keith Robins
Drilling Contractor: AARCO **Drill Rig:** Geoprobe **Date Started:** 3/15/16	**Geologist:** Keith Robins **Drilling Method:** Macrocore **Drive Hammer Weight:** N/A **Date Completed:** 3/23/16	**Boring Completion Depth:** 19' **Ground Surface Elevation:** 7.31' **Boring Diameter:** 2"

Depth (ft.)	No.	Type	Rec.	PID Per 6" (ppm)	Sample Description
0'-2'	1	HA	24"	0.0	Bluestone. Encountered water at 2 feet.
2'-4'	2	HA	24"	0.0	0"-6": Dark gray, medium to coarse SAND, some silt, gravel and stone, poorly sorted, damp, no staining, no odor.
				0.0	6"-12": Black, fine to medium SAND, trace fine gravel, cobbles, trace brick, poorly sorted, damp-moist, no staining, no odor.
				0.0	12"-18": Olive-brown, medium SAND, well sorted, moist-wet.
				0.0	18"-24": Black, fine to medium SAND, some silt, trace gravel, poorly sorted, dense, moist-wet, no staining, no odor.
4'-5'	3	HA	12"	0.0	Olive green-brown, silty fine SAND, some fine gravel, compacted, well sorted, wet, no staining, no odor.
5'-10'	4	MC	48"	0.2	0"-19": Olive-dark brown, medium SAND, trace coarse sand, fine to coarse gravel, well sorted, wet, no staining, no odor.
				0.2	19"-40": Brown, SILT, trace fine sand, well sorted, compacted-dense, wet, no staining, no odor.
				0.2	40"-48": Dark gray, CLAY, some organic material, slightly plastic-soft, organic odor, moist.
10'-15'	5	MC	45"	0.2	0"-32": Gray, CLAY, some organic material, trace shells, firm, slightly plastic, no staining, organic odor.
				0.2	32"-45": Gray-light gray, clayey SILT, trace subrounded stone, slightly plastic-soft, wet-moist, no staining, no odor.
15'-19'	6	MC	48"	0.2	0"-40": Dark brown-light gray, medium to coarse SAND, well sorted, loose, wet, no staining, no odor.
				0.2	40"-48": Gray-brown, SILT, trace fine gravel, compact-dense, moist-wet, no staining, no odor.

Sample Types:
HA = Hand Auger
MC = Macrocore

NOTES:
Soil samples from 2'-3', 12'-14' and 16'-18' submitted for TCL VOC and TCL SVOC analysis. Refusal at 19' below top of bluestone.

APPENDIX C

D&B ENGINEERS AND ARCHITECTS, P.C.

Well Construction Log

Site LIRR – Arch Street Job Number 3455 Well No. GW-01

Total Depth 20’ Surface Elevation 12.57’ Top Riser Elevation 12.20’

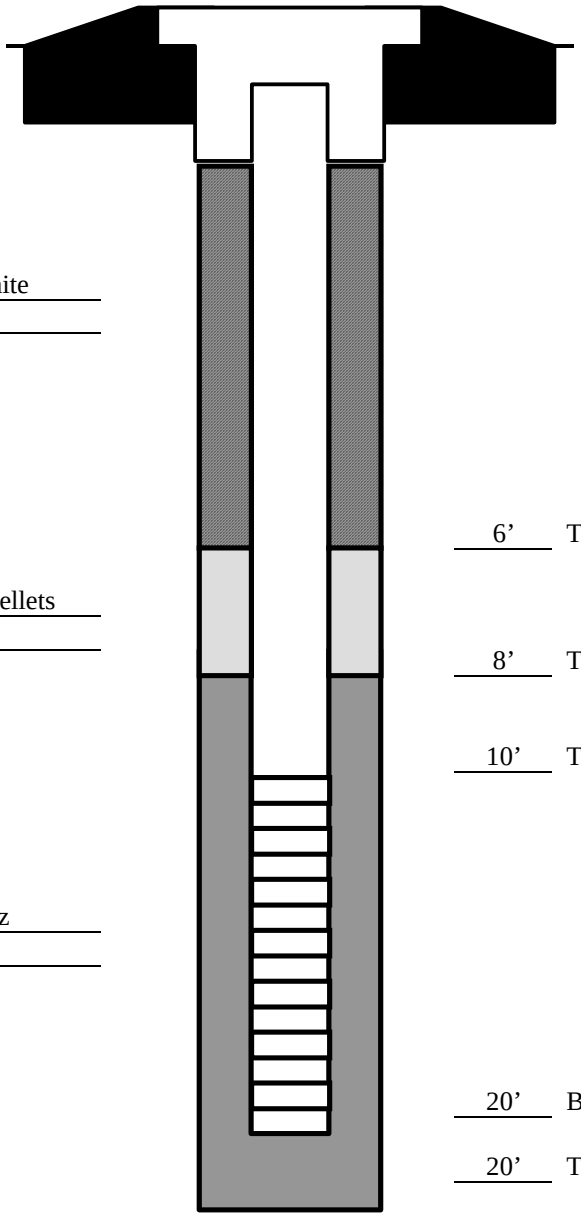
Water Levels (Depth, Date, Time) 7.65, 4/27/16, 0725 Date Installed 3/22/16

Riser Dia. 1” Material PVC Length 12’

Screen Dia. 1” Material PVC Length 10’ Slot Size 0.010

SCHEMATIC

Surface Seal Type
Concrete
Stickup



Grout Type Cement/bentonite

6’ Top Seal

Seal Type Bentonite pellets

8’ Top Sand Pack

10’ Top Screen

Sand Pack Type Silica quartz
Size #2/ #1/ #00

20’ Bottom Screen

20’ Total Depth of Boring

D&B ENGINEERS AND ARCHITECTS, P.C.

Well Construction Log

Site LIRR – Arch Street Job Number 3455 Well No. GW-02S

Total Depth 7’ Surface Elevation 11.15’ Top Riser Elevation 10.65’

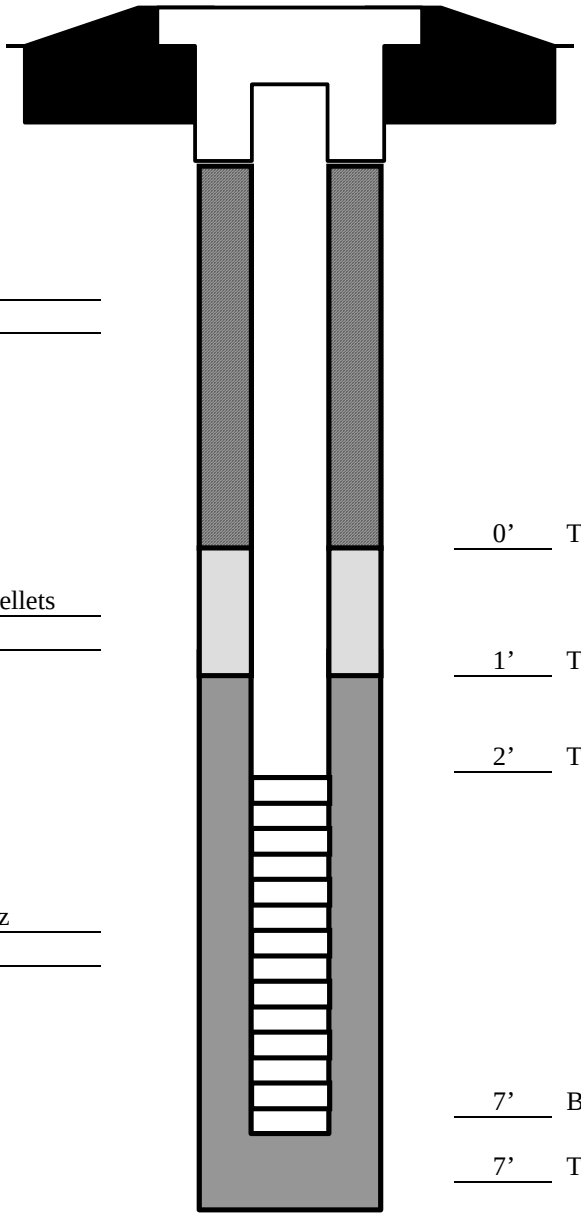
Water Levels (Depth, Date, Time) 6.15’, 4/27/16, 0726 Date Installed 3/22/16

Riser Dia. 1” Material PVC Length 4’

Screen Dia. 1” Material PVC Length 5’ Slot Size 0.010

SCHEMATIC

Surface Seal Type
Concrete
Stickup



Grout Type --

0’ Top Seal

Seal Type Bentonite pellets

1’ Top Sand Pack

2’ Top Screen

Sand Pack Type Silica quartz
Size #2/ #1/ #00

7’ Bottom Screen

7’ Total Depth of Boring

D&B ENGINEERS AND ARCHITECTS, P.C.

Well Construction Log

Site LIRR – Arch Street Job Number 3455 Well No. GW-02D

Total Depth 20’ Surface Elevation 11.49’ Top Riser Elevation 11.05’

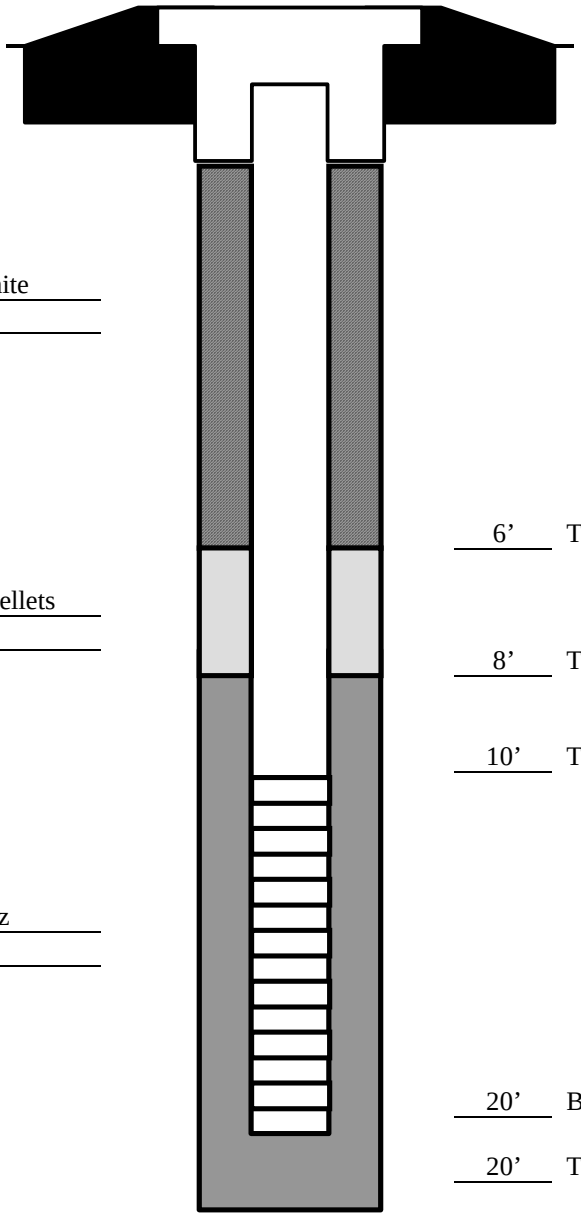
Water Levels (Depth, Date, Time) 10.71’, 4/27/16, 0726 Date Installed 3/22/16

Riser Dia. 1” Material PVC Length 12’

Screen Dia. 1” Material PVC Length 10’ Slot Size 0.010

SCHEMATIC

Surface Seal Type
Concrete
Stickup



Grout Type Cement/bentonite

6’ Top Seal

Seal Type Bentonite pellets

8’ Top Sand Pack

10’ Top Screen

Sand Pack Type Silica quartz
Size #2/ #1/ #00

20’ Bottom Screen

20’ Total Depth of Boring

D&B ENGINEERS AND ARCHITECTS, P.C.

Well Construction Log

Site LIRR – Arch Street Job Number 3455 Well No. GW-03

Total Depth 19’ Surface Elevation 10.88’ Top Riser Elevation 10.41’

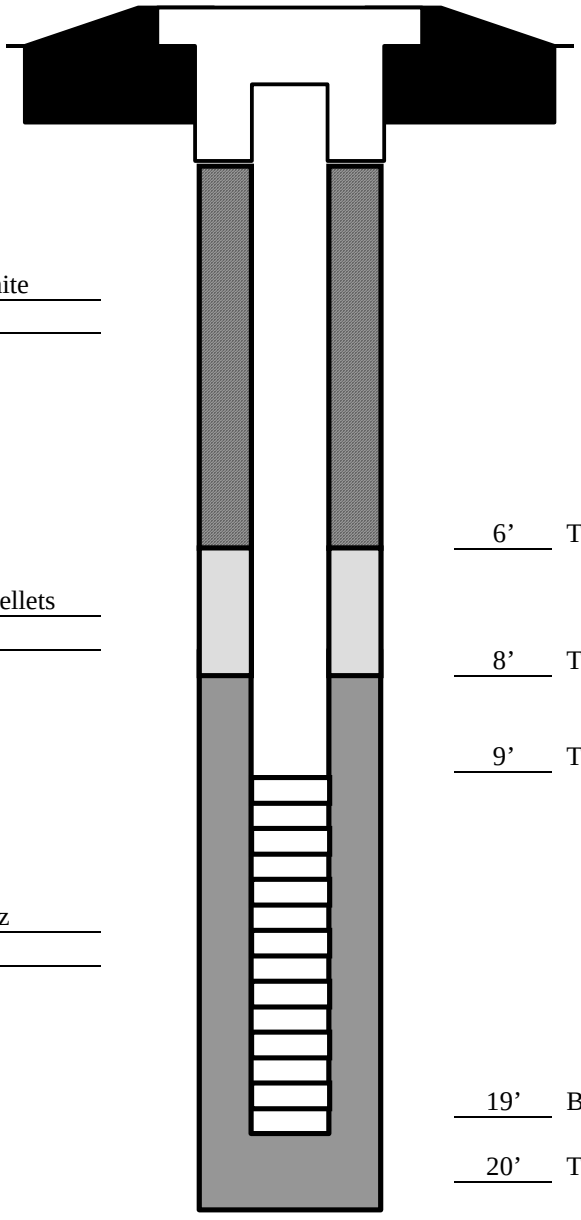
Water Levels (Depth, Date, Time) 12.13’, 4/27/16, 0730 Date Installed 3/21/16

Riser Dia. 1” Material PVC Length 11’

Screen Dia. 1” Material PVC Length 10’ Slot Size 0.010

SCHEMATIC

Surface Seal Type
Concrete
Stickup



Grout Type Cement/bentonite

6’ Top Seal

Seal Type Bentonite pellets

8’ Top Sand Pack

9’ Top Screen

Sand Pack Type Silica quartz
Size #2/ #1/ #00

19’ Bottom Screen

20’ Total Depth of Boring

D&B ENGINEERS AND ARCHITECTS, P.C.

Well Construction Log

Site LIRR – Arch Street Job Number 3455 Well No. GW-04S

Total Depth 8’ Surface Elevation 7.32’ Top Riser Elevation 7.01’

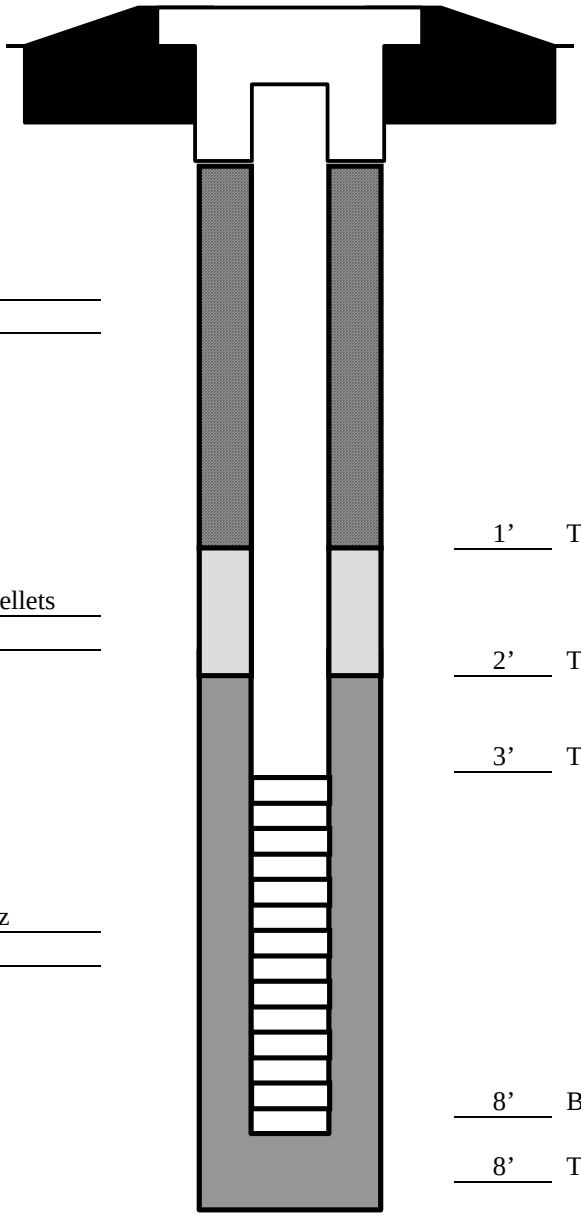
Water Levels (Depth, Date, Time) 3.28’, 4/27/16, 0730 Date Installed 3/23/16

Riser Dia. 1” Material PVC Length 3’

Screen Dia. 1” Material PVC Length 5’ Slot Size 0.010

SCHEMATIC

Surface Seal Type
Concrete
Flush-mounted



Grout Type --

1’ Top Seal

Seal Type Bentonite pellets

2’ Top Sand Pack

3’ Top Screen

Sand Pack Type Silica quartz
Size #2/ #1/ #00

8’ Bottom Screen

8’ Total Depth of Boring

D&B ENGINEERS AND ARCHITECTS, P.C.

Well Construction Log

Site LIRR – Arch Street Job Number 3455 Well No. GW-04D

Total Depth 18’ Surface Elevation 7.32’ Top Riser Elevation 7.12’

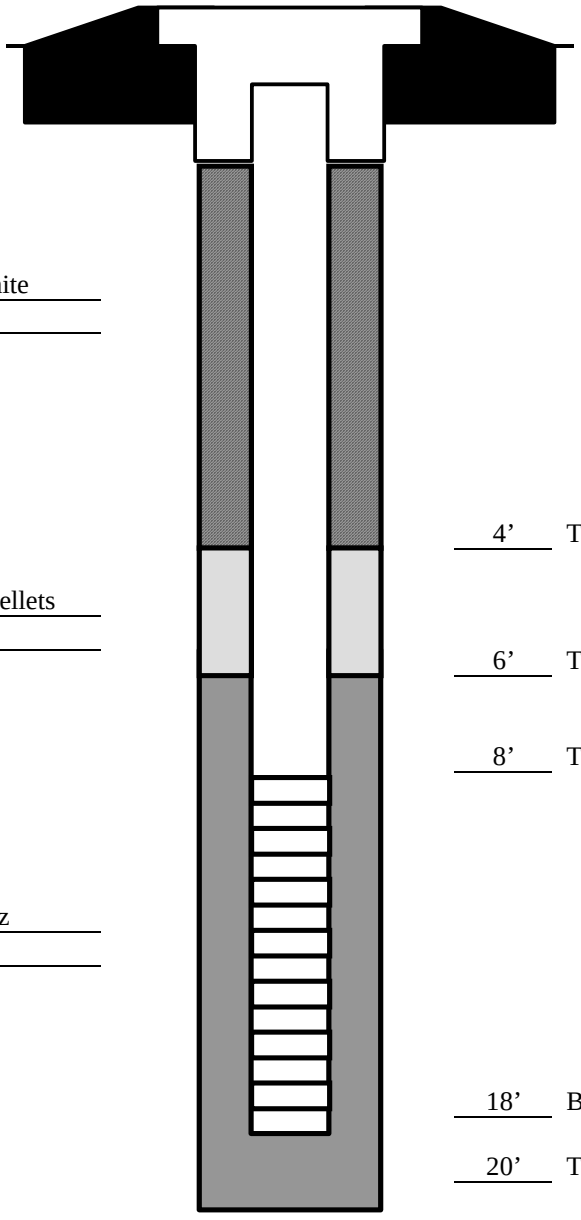
Water Levels (Depth, Date, Time) 9.18’, 4/27/16, 0728 Date Installed 3/23/16

Riser Dia. 1” Material PVC Length 8’

Screen Dia. 1” Material PVC Length 10’ Slot Size 0.010

SCHEMATIC

Surface Seal Type
Concrete
Flush mounted



Grout Type Cement/bentonite

4’ Top Seal

Seal Type Bentonite pellets

6’ Top Sand Pack

8’ Top Screen

Sand Pack Type Silica quartz
Size #2/ #1/ #00

18’ Bottom Screen

20’ Total Depth of Boring

APPENDIX D

New York State Department of Environmental Conservation

Voluntary Cleanup Program

Citizen Participation Plan

for

Long Island Rail Road – Arch Street Yard Site

South Side of Jackson Avenue, Opposite 21st Street
Long Island City
Queens, New York 11101

Prepared by Long Island Rail Road

October 2013

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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 investigation and cleanup process.

Volunteer: **Long Island Rail Road**
Site Name: **Arch Street Yard**
Site Address: **South Side of Jackson, Opposite 21st Street**
Site County: **Queens**
Site Number: **V00733**

1. What is New York's Voluntary Cleanup Program?

New York established its Voluntary Cleanup Program (VCP) to address the environmental, legal and financial barriers that often hinder the redevelopment and reuse of contaminated properties. The Voluntary Cleanup Program was developed to enhance private sector cleanup of Brownfield Sites by enabling parties to remediate sites using private rather than public funds and to reduce the development pressures on "greenfield" sites.

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.

Under the Voluntary Cleanup Program, a volunteer performs remedial activities pursuant to one or more Department approved work plans. The volunteer agrees to remediate the site to a level which is protective of public health and the environment for the present or intended use of the property. Investigation and remediation is carried out under the oversight of the Department and the New York State Department of Health (DOH) and the volunteer pays the State's oversight costs. When the volunteer completes work, a release from liability from the Department is provided with standard reservations.

Note: Applications are no longer being accepted for participation in the VCP, because it has been replaced by the Brownfield Cleanup Program. However, a number of sites, including the site identified above, remain in the VCP at different stages in the site investigation and cleanup process.

For more information about the VCP, go online at: http://www.dec.ny.gov/chemical/8442.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 interest 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 Volunteer.

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 web site. 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.

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 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.

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Requirements (Activities)	Timing of CP Activity(ies)
Before Start of Remedial Investigation (RI):	
• Prepare site contact list • Establish document repository • Prepare Citizen Participation (CP) Plan • Place approved RI Work Plan in document repository • Distribute fact sheet to site contact list that announces availability of RI Work Plan and describes upcoming RI field work	Before the start of RI field work.
When NYSDEC Approves Remedial Investigation Report:	
• Distribute fact sheet to site contact list that describes RI results • Place approved RI Report in document repository	When NYSDEC approves RI Report.
Before NYSDEC Approves Remedial Action Work Plan (RAWP):	
• Place draft RAWP in document repository • Distribute fact sheet to site contact list that describes draft RAWP and announces 30-day public comment period • Conduct 30-day public comment period • Public meeting by NYSDEC about draft RAWP if public raises significant, substantive issues about RAWP	Before NYSDEC approves draft RAWP.
• Place approved RAWP and final Decision Document in document repository	When NYSDEC approves RAWP and finalizes Decision Document.
Before Volunteer Starts Cleanup Action:	
• Distribute fact sheet to site contact list that describes upcoming cleanup action	Before the start of cleanup action.
After Volunteer Completes Cleanup Action:	
• Distribute fact sheet to site contact list that announces that cleanup action has been completed and that Closure Letter has been issued	Within 10 days after NYSDEC issues Closure Letter.

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.

The Site is located within an Environmental Justice Area. 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 that has a Hispanic American population. Therefore, all future fact sheets will be translated into Spanish. In addition, the Volunteer will fill out the Scoping Sheet for Major Issues of Public Concern.

At this time, the LIRR expects no issues of public concern.

4. Site Information

The Arch Street Yard is located south of Jackson Avenue, opposite 21st Street in Long Island City, Queens, New York. The entire yard and is approximately eight acres in size, however the area of concern (AOC) is about 0.3 acres. Appendix C contains a site location map and a site plan, showing the AOC. The site is owned by the LIRR and currently houses a train repair facility (shop) that is not operational. In addition, several sets of train tracks traverse the site. Historically, the yard has been used as a rail yard for commuter and freight trains.
In December 2003, an LIRR contractor discovered contaminated soil while excavating a utility trench under the 21st Street Bridge at the site. The soil exhibited a chemical/petroleum odor and dark staining. Samples of the soil indicated elevated levels of tetrachloroethene and other chemical compounds associated with cleaning solvents. To date, the LIRR does not know how this material was contributed to the subsurface. Upon discovery of the contamination, New York State Department of Environmental Conservation (NYSDEC) was notified and Spill No. 0310802 was opened.

Between 2004 and 2009, the LIRR conducted a few minor environmental investigations at the site in an attempt to determine the extent of the contamination. Based on the results of these investigations, it was determined that the majority of the impacted surface/shallow subsurface soil had been excavated and removed during the utility trenching. However, several contaminants were still present in the groundwater. While some horizontal delineation of the contamination had been accomplished, additional sampling was needed to further define the impacted zone. Due to the tendency of chlorinated solvents to sink in groundwater, further vertical delineation of groundwater contamination was particularly necessary.

Further remedial investigations at the site between 2015 and 2021 found further evidence of chlorinated volatile organic compounds (VOCs) associated with cleaning solvents. Chemicals of concern (COC) at the site are 1,1-Dichloroethene, cis-1,2-dichloroethylene, tetrachloroethene,

trichloroethene, trans-1,2-dichloroethene, and vinyl chloride. COCs were detected at levels above Protection of Groundwater Soil Cleanup Objectives (SCOs), Restricted Residential Use SCOs, and/or Industrial Use SCOs, in subsurface soil and groundwater samples at the site. COCs were detected in sub-surface soil samples collected from 8 to 15 feet below grade surface. COCs were not detected at concentrations above SCOs in surface soil samples collected from the site.

5. Investigation and Cleanup Process

Application

The Volunteer previously applied for and was accepted to participate in the Voluntary Cleanup Program. The Volunteer in its Application proposes that the site will be used for restricted purposes.

To achieve this goal, the Volunteer will conduct investigation, and if necessary, cleanup and/or groundwater remediation activities at the site with oversight provided by NYSDEC. The Voluntary Cleanup Agreement executed by NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Volunteer will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Volunteer must develop a remedial investigation workplan that sets forth the investigation activities.

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.

When the investigation is complete, the Volunteer 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.

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 Volunteer may recommend in its investigation report that no action is necessary at the

site. If an investigation is completed satisfactorily and NYSDEC determines that no cleanup is needed, NYSDEC may issue the Volunteer a "Closure Letter" (described below) that provides a release from liability. This Closure Letter would declare that the volunteer has met its obligations and that NYSDEC would not require the Volunteer to perform additional investigation or cleanup at the site, subject to certain conditions. The Volunteer would be eligible to redevelop the site after it receives a Closure Letter.

Or

2. Alternately, the Volunteer may recommend in its investigation report that action needs to be taken to address site contamination. NYSDEC may review the report and determine that cleanup of site contamination is necessary. The Volunteer then can choose to end its agreement with NYSDEC or work with NYSDEC to develop an acceptable cleanup plan. The LIRR intends to continue using the site as a railroad yard and facility, and as responsible stewards of the environment, will continue to work with NYSDEC to develop an acceptable cleanup plan. The draft cleanup plan is called a "Remedial Action Work Plan". The goal of the plan is to describe the actions that will be performed to clean up the site to protect public health and the environment for the use the Volunteer proposed in its application. If impacts from the site are found to be migrating from the site, the cleanup plan also will propose actions to clean up those areas to protect public health and the environment. NYSDEC and the New York State Department of Health (NYSDOH) would review the draft cleanup plan to determine if the plan is acceptable. Once the draft cleanup plan is determined to be acceptable, NYSDEC would present it to the public for its review and comment during a 30-day 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 Volunteer may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Volunteer 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.

Closure Letter

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 Closure Letter to the Volunteer. The Closure Letter would declare that the Volunteer has met its obligations and that NYSDEC would not require the Volunteer to perform additional investigation or cleanup at the site, subject to certain conditions. The Closure Letter would allow for redevelopment of the site.

Site Management

Site management is the last phase of the site cleanup program. This phase begins when the Closure Letter is issued. Site management may be conducted by the Volunteer under NYSDEC oversight, if contamination will remain in place. 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 is pumping and treating 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 investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Hasan Ahmed
Project Manager
NYSDEC Region 2
Division of Environmental Remediation
47-40 21st St., First Fl.
Long Island City, NY 11104
(718) 482-4065

Thomas V. Panzone, MPA
Citizen Participation Specialist
NYSDEC - Region 2
Division of Public Affairs & Education
47-40 21st St., First Fl.
Long Island City, NY 11104
(718) 482-4953

New York State Department of Health (NYSDOH):
Bridget Callaghan
Project Manager
NYSDOH
Empire State Plaza
Corning Tower, Room 1787
Albany, NY 12237
Email: BEEI@health.state.ny.us

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

Queens Library
Long Island City branch
37-44 21st Street
Long Island City, NY 11101.
(718) 752-3700

Hasan Ahmed
NYSDEC Region 2
Division of Environmental Remediation
47-40 21st St., First Fl.
Long Island City, NY 11104
(718) 482-4065
Hours: 8am – 4pm **(**call for appointment)

Appendix B - Site Contact List

NYC Public Advocate Honorable Jumaane Williams 1 Centre Street, 15th Floor, North New York, NY 10007-1602 212-669-7200	Honorable Catherine Nolan New York State Assembly District 37 41-02 Queens Blvd. Suite 2B Sunnyside, NY 11104 718-784-3194
Honorable Eric Adams New York City Mayor City Hall New York, NY 10007 212-639-9675	Community Board 2, Queens Attn: Joseph Conley, Chair Debra Markell-Kleinert, District Manager 43-22 50th St. Woodside, NY 11377 718-533-8773
Honorable Julie Won New York City Council District #26 47-01 Queens Blvd., Suite 205 Sunnyside, NY 11104 718-383-9076	Honorable Adrienne Adams City Council Speaker City Hall, New York, NY 10007 212-788-7210
Honorable Donovan Richards Jr. President of the Borough of Queens 125-55 Queens Blvd. Kew Gardens, NY 11424 718-286-3000	Honorable Michael Gianaris New York State Senate District 12 21-77 31st Street Astoria, NY 11105 718-545-9706
Honorable Alexandria Ocasio-Cortez Member of US Congress 74-0- 37th Avenue Jackson Heights, New York 11372 718-779-1400	Honorable Carolyn B. Maloney Member of US Congress 31-19 Newtown Avenue Astoria, NY 11105
Honorable Charles E. Schumer Unites States Senate 757 Third Avenue, Room 17-20 New York, NY 10017 212-486-4430	Honorable Kirsten Gillibrand United States Senate 780 Third Avenue Suite 2601 New York, NY 10017 212-688-6262
Dr. Robert Kulikowski Director NYC Office of Environmental Coordination 100 Gold Street – 2nd Floor New York, NY 10038	John Wuthenow Office of Environmental Assessment & Planning NYC Dept. of Environmental Protection 96-05 Horace Harding Expressway Flushing, NY 11373
Audrey Pheffer Queens County Clerk 88-11 Sutphin Boulevard, 1st Floor Jamaica, NY 11439	MTA Long Island Rail Road Phillip Eng, President Jamaica Station Jamaica, NY 11435-4380

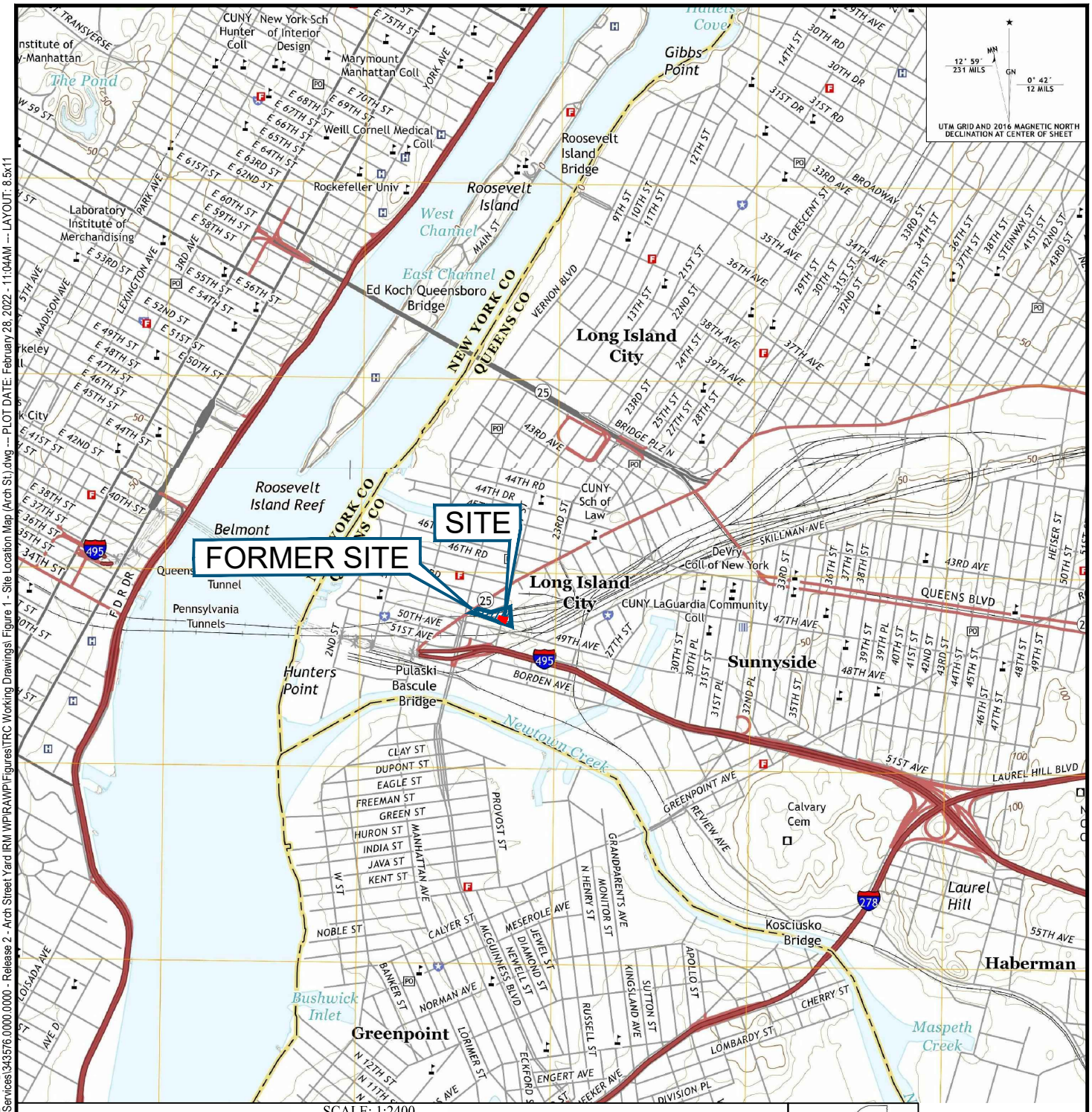
Public Water Supplier: Hon. Rohit T. Aggarwala, Commissioner NYC Dept. of Environmental Protection 59-17 Junction Boulevard Flushing, NY 11373	
Community, Civic, Religious and other Education Institutions:	
Robert F. Wagner, Jr. Institute For Arts & Technology 47-07 30th Place Long Island City, NY 11101 Stephania Vu Principal 718-472-5671	International High School at LaGuardia 45-35 Van Dam Street Long Island City, New York 11101 Jackie Valane, Principal 718-482-5455
Queens Vocational & Technical High School 37-02 47th Avenue Long Island City, NY 11101 Melissa Burg, Principal 718-937-3010	Herbert G. Birch Daycare Center 10-24 49th Avenue Long Island City, NY 11101 Attn: Director
The School of Applied Communication 30-20 Thomson Avenue, (5th Floor) Long Island City, NY 11101 Daniel Korb, Principal 718-389-3163	St. Mary's Senior Center 10-15 49th Avenue Long Island City, NY 11101
Queens Chamber of Commerce 75-20 Astoria Blvd., Suite 140 Jackson Heights, NY 11372 Attn: Jack Friedman	Long Island City Business Development Corporation (LICBDC) 1 MetLife Plaza 27-01 Queens Plaza North, 9th Floor Long Island City, NY 11101
Information Technology High School 21-16 44th Road Long Island City, NY 11101 Joseph Reed, Principal 718-937-4270	Middle College High School 45-35 Van Dam St. Long Island City, NY 11101 Linda Siegmund, Principal
Ridgewood High School 24-30 Skillman Avenue Long island City, NY 11101	

Local Media Outlets:	
Queens Chronicle P.O. Box 74-7769 Rego Park, NY 11374	LIC/Astoria Journal 69-60 Grand Avenue Maspeth, NY 11378
Queens Courier Schneps Publications Inc. 38-15 Bell Blvd. Bayside, NY 11361	New York Newsday 235 Pinelawn Road Melville, NY 11747
New York Post 1211 Avenue of the Americas New York, NY 10036	Queens Tribune 150-50 14th Road Whitestone, NY 11357
New York Daily News 4 New York Plaza New York, NY 10004	Western Queens Gazette 42-16 34th Avenue Long Island City, NY 11101
Times-Ledger Newspapers 41-02 Bell Boulevard, 2nf Floor Bayside, NY 11361	

{Instruction to preparer: Arrange names, addresses, and email addresses (if applicable) of individuals and organizations as identified in Sections 2. and 3. and through other means.

Please note that the names, addresses, and email addresses of adjacent property owners and residents on the contact list should not be placed in versions of this document available to the public. Instead, they should be maintained confidentially in the NYSDEC project manager's files.}

Appendix C - Site Location Map



MAP INCLUDES INFORMATION FROM THE FOLLOWING MAP SHEET(S):
TP, BROOKLYN, NY, 7.5 MINUTE DATED 2016,
N, CENTRAL PARK, NY, 7.5 MINUTE DATED 2016.

MAP OBTAINED THROUGH USE OF TOPOVIEW WITH THE INTERFACE CREATED BY THE NATIONAL GEOLOGIC MAP DATABASE PROJECT (NGMDB), IN SUPPORT OF THE TOPOGRAPHIC MAPPING PROGRAM, MANAGED BY THE USGS NATIONAL GEOSPATIAL PROGRAM (NGP).

TRC
1430 Broadway, 10th Floor
New York, NY 10018
Phone: 212.221.7822
www.TRCcompanies.com

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SITE LOCATION MAP

DRAWN BY:	B. SCHLAFF
CHECKED BY:	E. EBERT
APPROVED BY:	K. MYERS
DATE:	MARCH 2022
PROJ. NO.:	343576
FILE:	Figure 1 - Site Location Map (Arch St.).dwg

FIGURE 1

8.5x11 -- ATTACHED XREFS: -- ATTACHED IMAGES: NY_Brooklyn_20160824_TM, NY_Central_Park_20160824_TM;
DRAWING NAME: \\nyc-fp1\shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 1 - Site Location Map (Arch St.).dwg -- PLOT DATE: February 28, 2022 - 11:04AM -- LAYOUT: 8.5x11

APPENDIX E

SITE-SPECIFIC
HEALTH AND SAFETY PLAN
Long Island Rail Road

Remedial Action Work Plan
at Arch St. Yard
Jackson Avenue and 21st St
Long Island City, New York
LIRR Contract No. 6052A-9-5, R-B
NYSDEC Site No. 241222

Prepared for:

Long Island Rail Road

Prepared by:

TRC Engineers, Inc.
New York, New York

March 2022

SITE-SPECIFIC
HEALTH AND SAFETY PLAN
Long Island Rail Road

Remedial Action Work Plan
at Arch St. Yard
Jackson Avenue and 21st St
Long Island City, New York
LIRR Contract No. 6052A-9-5, R-B
NYSDEC Site No. 241222

Prepared by:

TRC Engineers, Inc.
New York, New York

March 2022

Signed and Approved by:



Wes Lindemuth, CHMM, CSP

REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

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H COVID-19 Guidelines for Field Activities

INTRODUCTION

1.0 INTRODUCTION

This Health and Safety Plan (HASP or Plan) was specifically designed to prevent occupational injuries and prevent chemical exposure during activities associated with the remedial actions at Arch St. Yard located in Long Island City, New York. All on-site personnel are required to read, review and strictly comply with the HASP. It is the responsibility of the Project Manager (PM) to ensure that the Plan is implemented and enforced. Like other site-specific documents, the Plan may contain sensitive or confidential information and therefore should not generally be disclosed to other than those working on-site. This Plan was prepared for the MTA Long Island Rail Road (LIRR), the agency responsible for this project. This HASP was prepared in accordance with requirements established by the Occupational Safety and Health Administration, the National Institute of Occupational Safety and Health, and the Environmental Protection Agency. This plan was also prepared to comply with 29 CFR 1910.120 and 1926.65, and to meet the standards required by the Site-specific Technical Statement of Work (TSOW) provided by LIRR.

1.1 Best Management Practices

Contractors working on the Site must adhere to Best Management Practices for construction. This includes recognizing that soil and groundwater may contain elevated concentrations of volatile organic compounds (VOCs) [specifically chlorinated volatile organic compounds (CVOCs)]. As a result, soil cuttings and groundwater from drilling procedures may contain elevated concentrations of these chemical compounds. The best way to reduce exposure to these materials is to minimize direct contact and wash exposed skin whenever possible. It is recommended that all workers in direct contact with the soil change shoes and dirty clothing before leaving the site.

All contractors are responsible for the protection and safety of their workers and must provide a safe work environment during this project. This includes restricting smoking, eating and drinking in work areas and providing opportunities for workers to change dirty clothes, work boots and wash exposed skin. Included as part of the Best Management Practices is proper dust control measures to minimize on-site and off-site impact. Examples of proper dust control include fine misting with

water, wetting travel areas, using dust stabilizers such as calcium chloride and working more deliberately.

It is important to note that elevated CVOCs concentrations are noted in soil at least 8 feet below grade surface and therefore the exposure to contaminants in subsurface soils does not pose a significant potential route of exposure to site workers and visitors during routine operations.

1.2 Remedial Action Work Plan

Based on the NYSDEC-approved Remedial Investigation Report (RIR) prepared by D&B Engineers in May 2017, a localized "hot-spot" of CVOCs was identified in the subsurface soil and groundwater. The "hot spot" covers an area of approximately 680 square feet (sf), located approximately 8 to 16 feet below grade surface (bgs). The RIR also indicates that the groundwater contamination is not migrating downgradient.

D&B Engineers began to draft the Interim Remedial Measures Work Plan (RAWP) however it has not been finalized. TRC Engineers, Inc. will be preparing the Remedial Action Work Plan (RAWP) instead of the IRMWP on behalf of LIRR. The RAWP will be approved by the NYSDEC before implementation.

Generally, the work plan will involve the following tasks, however the HASP will be updated when the RAWP is finalized and approved:

- Pre-design investigation to delineate the CVOCs "hot spot";
- Construction of temporary amendment mixing and staging area.
- Direct-push injection of zero-valent iron (or similar) to promote abiotic reduction of chlorinated ethenes.
- Direct-push injection of controlled-release carbon source [e.g., guar, emulsified vegetable oil (EVO), etc.] and bioaugmentation cultures (i.e., *Dehalococcoides* spp.) to promote biological reduction of chlorinated ethenes.
- Post-injection groundwater monitoring.

- Environmental Easement and Site Management Plan (SMP), as necessary.
- Long-term groundwater monitoring, as necessary.
- Groundwater monitoring well abandonment.

Direct contact with soil and groundwater should be minimized as much as possible and based on air monitoring results, respirators may be necessary during direct contact.

1.3 Site Description

The Arch Street Yard is located under the 21st Street Bridge at 49th Avenue in Long Island City, Queens, New York. Historically, the yard operated as a maintenance area for the LIRR until 2009. Currently, the Site is occupied by the LIRR for storage and operation of an electric substation. A map showing the site location is included as Figure 1-1 (as provided in the RIR prepared by D&B Engineers and revised in May 2017).

The site is an active rail yard and all work around active rail lines must be performed in accordance with the LIRR Contractor Safety Training. All site workers will be required to be thoroughly familiar with this HASP and the LIRR Worker Protection Manual (latest edition). Any and all needs for flagging personnel while working on site will be provided by LIRR.

2.0 ASSIGNMENT OF RESPONSIBILITIES

2.1 General

All activities on or around the site which either have a potential for exposure to soil or groundwater or which pose the potential for injury due to physical hazards are subject to this health and safety plan. These activities include but are not limited to: pre-design investigations, injection of amendments, and groundwater monitoring well abandonment. All personnel, including subcontract personnel (if applicable), will be responsible for continuous adherence to the safety procedures during the performance of this work. Deviations from the procedures or intent of the health and safety plan will not be allowed without express consent of the responsible Site Health and Safety Officer (SHSO) who shall coordinate all significant changes with the Project Manager. After due warnings, personnel who violate health and safety procedures will be dismissed from the site operations. It must be remembered that the person most responsible for the health and safety of an individual is the individual himself.

2.2 Certified Safety Professional (CSP)

The CSP, Mr. Wes Lindemuth, will be responsible for providing overall technical and administrative oversight of the health and safety program both on-site and off-site. He will review and approve the specific health and safety program and any significant changes to the plan must be approved by him. In addition, the SHSO shall report to the CSP on all safety-related matters.

2.3 Site Safety Health Officer (SHSO)

Joe Menniti of TRC will be the SHSO for this project as well as the on-site project manager. The primary duties of the SHSO will include:

1. Directing and implementing the HASP
2. Ensuring all project personnel have been adequately trained in the recognition and avoidance of unsafe conditions, this HASP and the regulations applicable to the work environment to control or eliminate any hazards or other exposure to illness or injury.

3. Authorizing Stop Work Orders which shall be executed upon the determination of an imminent health and safety concern.
4. Contacting LIRR safety management personnel and the LIRR Project Manager on the issuance of a Stop Work Order when the SHSO has made the determination of an imminent health and safety concern.
5. Authorizing work to resume upon approval from the LIRR.
6. Directing activities as defined in this HASP during emergency situations.

The SHSO will be on-site during all site activities related to the health and safety plan. The SHSO will be the designated on-Site safety representative. This person will be responsible for assessing the site activities to assure compliance with all provisions of the SSHSP. Should any deviations occur they will be corrected, noted, and reported to the Project Manager and the LIRR Representative. The SHSO is responsible for enforcing this Safety Plan and monitoring compliance with the plan. The SHSO or designee will conduct air monitoring, maintain site logs and document compliance. The SHSO will conduct daily toolbox safety meetings and initiate evacuation procedures when necessary.

2.4 Project Manager

The TRC Project Manager for this project is Daniel Warren. The Project Manager is responsible for ensuring that all project personnel abide by the requirements set forth in this plan and the overall project.

2.5 Staff Organization

Project Manager, LIRR

Contact: Kathleen Green, 631-921-1597

Appendix B lists the TRC staff working on this and project. TRC will not obtain subcontractors for the remedial actions until the RAWP is approved. Once the RAWP is approved, the HASP will be updated to include site contracts for each subcontractor.

ASSIGNMENT OF RESPONSIBILITIES

Safety and Environmental Oversight, TRC:
Wes Lindemuth, 212-221-7822

Project Manager, TRC:
Daniel Warren, 917-232-9837

Site Personnel, TRC:
Joe Menniti, 516-417-7819

2.6 Underground Utilities and Facilities

The implementation of the RAWP will require working near underground utilities, including the following activities: pre-design investigation activities (e.g., advancement of soil borings, sample collection, etc.) and injection of amendments. The following precautions will be taken to avoid damage to underground utilities:

- Contact one-call center for mark-out of public utilities on public streets prior to drilling,
- Obtain drawings of city water and sewer lines,
- Request LIRR utility markout,
- Utility clearance utilizing appropriate geophysical survey methods, and
- Pre-clear drilling locations to five feet bgs utilizing a Vactron unit, or equivalent.

Subcontractors will be obtained to perform geophysical surveys and the pre-clear the drilling locations prior to any drilling.

2.7 Site Hazard Assessment

Safety data sheets (SDS) for the principal constituents of concern (various CVOCs) are included in **Appendix C**. Any and all needs for flagging personnel while working on site will be provided

by LIRR.

2.8 Health Risks

Potential health risks are exposure to soil and groundwater contaminants of concern (e.g., CVOCs) via inhalation of dusts or dermal contact and general physical hazards associated with the remedial investigation. Chemical health concerns related to this project are expected to be low since the areas of concern have been identified as at least 8 feet bgs. Dust control measures will need to be implemented during soil disturbing activities to keep the inhalation hazard low.

Train movement and traffic will be a concern throughout the onsite activities. Any and all needs for flagging personnel while working on site will be provided by LIRR.

2.9 Fire Safety Hazards

There are low to moderate fire hazards currently present on site. Vapor and combustible gas monitoring will be necessary during on-site activities in order to measure the potential for flammable hazards.

2.10 Site Access

Access will be controlled through the primary entrance on Jackson Avenue. All personnel will be required to sign in daily. Orange safety fencing will be installed around work areas as needed. The site is somewhat isolated and site security is not expected to be a significant issue. All access to the site is controlled by the LIRR.

2.11 Biological Hazards

COVID-19 - The 2019 novel coronavirus, or COVID-19, is a new respiratory virus first identified in Wuhan, Hubei Province, China. It's called a "novel" — or new — coronavirus, because it is a coronavirus that has not been previously identified. Use the following precautions to avoid

contracting COVID-19:

- Social distancing (at least 6 feet away from other individuals),
- When social distancing (at least 6 feet away from other individuals) is not possible, face coverings/masks shall be worn.
- When using a portable restroom at the Site, personnel shall wear a face covering/mask and wipe down door handles and other touched surfaces.
- Hand hygiene,
- Cover mouth and nose when coughing or sneezing,
- Avoid touching eyes, nose, or mouth,
- Frequently disinfect areas that are likely to have frequent hand contact using a List N: Disinfectant for use against SARS-CoV-2 (COVID-19). https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2-covid-19

Prior to the start of work each day at the Site, as part of the daily safety tool-box talk, the COVID-19 Questionnaire for Onsite Workers must be completed. See Appendix D for TRC Document No. CP052 Rev 9, COVID-19 Guidelines for Field Activities. **TRC COVID-19 Questionnaire included in Appendix H will be completed daily by all on-site personnel.**

3.0 STANDARD OPERATING PROCEDURES

The following work practices and engineering controls may be used during each phase of the project. The work practices are Standard Operating Procedures, and will not be deviated from without consent of the SHSO.

Hazards associated with site work such as, confined space entry, bonding and grounding, heat stress, and cold stress are covered under this Site-Specific Health and Safety Plan.

Work Practices

1. The following Personal Protective Equipment (PPE) will be inspected prior to use:
    - A. Chemical Protective Gloves: Chemical protective gloves will be chosen with assistance from the CSP according to the chemical hazards present.
    - B. Hearing Protection: Hearing protection will be worn by all personnel exposed to at least 85 dB of sound during the workday. It is not expected that noise exposure will exceed 85 dB but hearing protection will be provided if needed.
    - C. Safety Boots: Steel-toe and steel shank safety boots will be worn by all personnel during this project.
    - D. Eye Protection: Eye protection will be worn when personnel are exposed to flying debris, chemical vapors or particulates.
        - i. Chemical splash goggles will be worn for protection against chemical gases, vapors or particulates;
        - ii. Safety glasses will be worn for protection against flying objects.

E. Hard Hats: Appropriately rated hard hats will be worn by personnel for protection against overhead hazards. Hard hats should clearly identify the company the individual is working for in order to quickly identify site personnel since multiple contractors could be working on site.

2. When handling Compressed Gas Cylinders, if applicable:

A. Valve protection caps must be in place whenever cylinders are moved, transported or stored.

B. Cylinder valves will remain closed whenever cylinders are not in use.

C. Cylinders will be maintained in an upright position at all times, except when being hoisted or carried for short periods of time.

D. Hoisted cylinders will be secured on a cradle, sling board or pallet.

E. Cylinders will never be hoisted by use of magnets or choker slings.

F. Cylinders will be stored at least 20' from welding and cutting operations or shielded.

G. Cylinders will be located so they cannot become part of an electric circuit.

H. Cylinders will never be lifted by the valve.

I. Frozen valves will never be hammered, pried or wedged open, even with the use of a wrench. If the valve will not open by hand, call the distributor.

J. Fuel gas cylinders will be stored a minimum of 20' from:

i. Welding and cutting operations;

ii. Highly combustible material; and

iii. Oxygen cylinders.

K. Cylinders will be chained to the storage rack, cart or post when being transported by truck.

i. When moving cylinders, remove regulators and replace valve-protection caps, unless cylinders are secured on a special hand truck.

L. Cylinder storage areas will be marked with appropriate warning signs.

M. Emergency firefighting equipment will be readily available, recently inspected and tagged.

N. Cylinders will be segregated according to characteristic hazards.

O. Cylinders will be legibly marked with stenciling, stamping, or labeling that is not readily removable.

3. To avoid falling objects:

A. Do not walk or stand under suspended/overhead loads (including scaffolding).

B. Be aware of falling objects in the work area.

C. Secure overhead objects.

4. When using hand tools:

A. Hand tools will meet the manufacturer's safety standards.

B. Hand tools will not be altered in any way.

C. Makeshift tools will not be used.

D. At a minimum, eye protection will be used when working with hand tools.

E. Wrenches, including adjustable, pipe, end and socket wrenches, will not be used when jaws are sprung to the point that slippage occurs.

F. Impact tools such as drift pins, wedges and chisels, will be kept free of mushroom heads.

G. Wooden handles will be free of splinters or cracks and secured tightly to the tool.

5. Housekeeping:

A. The work areas will be kept neat and orderly as possible.

B. Walking surfaces will be kept free of debris or loose objects.

C. Aisles, stairways and walkways will be kept clear at all times.

D. Clean, store and maintain tools and machinery.

6. Lighting:

A. Lighting, when necessary, will be provided so that a sufficient amount of light will illuminate the work area, as required by Table H 120.1 in 40 CFR 1910.120.

B. All electrical lighting will be protected with a Ground Fault Circuit Interrupter (GFCI).

C. In areas where flammable or combustible vapors or dust are encountered, all lighting will be approved for use in Class 1, Division 1 hazardous locations.

7. Overhead Wires:

A. If contact is possible (i.e., drilling equipment, etc.) one or more of the following will be done:

i. Power sources will be disconnected by the utility;

ii. Power sources will be shielded by the utility;

iii. Object will get no closer than 12' to overhead wires to prevent arcing.

8. Use of Power Tools:

A. All power tools will be inspected regularly and used in accordance with the manufacturer's instructions and its capabilities.

B. Electrical tools will not be used in flammable areas, unless they are approved for that purpose.

C. Portable electric tools will be used only with a GFCI.

D. Proper eye protection will be worn when working with power tools.

E. Personnel will be trained in the proper use of the specific tool.

F. Any defective power tools will be immediately tagged and removed from service.

G. Tools will be stored properly after use.

9. Slips, Trips and Falls:

A. Proper lighting will be maintained at all times.

B. Walkways will remain clear and unobstructed at all times.

C. When possible, cords, hoses, lines, etc. will be raised to reduce or eliminate trip hazards.

D. Use appropriate climbing equipment.

10. Ground Fault Circuit Interrupters and Electrical Cords:
    A. GFCIs will be used on all 120 Volt, single phase, 15 and 20 ampere receptacle outlets when electrical equipment is used on site.
    B. Electrical cords will be inspected for cracks, tears, or general wear to the outer protective casing. If the wiring of the cord is exposed, the cord will be repaired, if possible, or disposed of.
    C. All extension cords will contain a grounding prong. If the grounding prong is missing, or if the cord was designed to contain only 2 prongs, the cord will not be allowed for use and is to be red tagged until repaired. These cords are dangerous and can not be grounded through the use of a GFCI.

11. Communication: Visual contact will be maintained while work activities are being conducted. Hand signals will be used during times verbal communication is not possible. This includes times of loud noise or when the wearing of respiratory protection makes oral communication difficult.

12. Subsurface Investigation Activities Safety:
    A. All drilling locations will be cleared of subsurface utilities via the appropriate geophysical and pre-investigation methods.
    B. Dig safe permits will be obtained (Call Before You Dig) prior to the start of drilling operations to ensure that all utilities have been properly located. "Call Before You Dig" may not demarcate private underground lines. Potential utilities include underground water, sewer and electrical lines. These lines will be identified before digging in the area.
    C. <u>DRILL RIG SAFETY</u>
        i. The following will be applicable to work around the drilling equipment and any other heavy equipment. Prior to work of this nature, a review of these principles shall be given to workers by the SHSO.
            1. Pay attention at all times.

2. Use common sense.
3. Hard hats shall be worn on-site at all times.
4. When noise makes verbal communication difficult, hand signals should be established. One person should be responsible for hand signals to heavy equipment operators.

13. Heavy Lifting and Equipment
    A. When lifting objects, use your legs, not your back.
    B. Use appropriate equipment to move heavy objects.
        1. Only qualified operators shall use heavy equipment.
        2. Maintain visual contact at all times.
        3. Be aware of footing at all times.
        4. Never walk in the vicinity of heavy equipment without confirming first that the operator is aware of your intended path.
        5. Be aware of all underground and overhead power lines, gas lines, etc.
        6. Make sure that gas cylinders are secured.

14. Grounding and Bonding:
    A. All handling of flammable liquids will not be performed unless all containers and transport vehicles have been properly grounded and bonded during product removal operations. Under no circumstances will transfer of product be allowed without proper bonding and grounding. If a common ground is not available, it will be necessary to drive a low resistance grounding rod (copper pipe at least 6 feet into the ground) for use as a ground.
    B. If necessary to off-load product from tanks on site, use of pressurized air to speed up the process will not be permitted. Use of pressurized air increases the build-up of static electricity, which will cause an explosion if the right concentration of air to vapor is present. Only a double diaphragm pump, bonded and grounded, will be permitted during transfer of flammable liquids.

15. Confined Space Entry: Confined space entry is not anticipated for this project but if necessary, all confined space entries will be made in accordance with OSHA requirements at 29CFR 1910.146, Confined Space Entry.

16. Ventilation: Mechanical ventilation will be utilized to reduce the concentration of flammable/explosive vapors within the work areas if appropriate. The blower will be bonded and grounded to reduce the static charge, and exhausted away from potential ignition sources. The exhaust area will be monitored to assure that flammable vapors do not accumulate in low-lying areas. If a combustible gas concentration of 10% of the lower explosive limit (LEL) or greater is detected, the ventilation will be shut down, all ignition sources within 50 feet of the site will be shut down, and the vapors will be allowed to dissipate before continuing.

17. Work Area: The size of the work area is dependent upon how much space is available for setting up equipment and if the area contains any inherent hazards. Therefore, the Project Manager will determine the size of the work area based on the latest available information. If the Project Manager believes unacceptable risks may exist, then the Project Manager will contact the SHSO for assistance. There may be multiple work areas and each will be designated by the Project Manager.

PERSONAL PROTECTIVE EQUIPMENT

4.0 PERSONAL PROTECTIVE EQUIPMENT

Personal safety protection will be required during all site activities at most of the site locations unless information is obtained indicating that contaminants are not present. Conditions that develop that would require increased protective measures would require the SHSO to stop operations and evaluate the situation. It is anticipated that most work will be performed under Level D protection which consists of the following:

Level D

1. Work uniform (long pants, long sleeves)
2. Steel-toe work boots
3. Hard hat
4. Safety glasses
5. Hearing protection
6. Gloves
7. Tear-away safety vest

If excessive vapors are detected or direct contact with contaminated media is expected workers may need to upgrade to Level C protection. Level C Protection consists at a minimum of the following:

Level C

1. Full body disposable suits appropriate for CVOCs exposure
2. Steel-toe work boots
3. Hard hat
4. Safety glasses
5. Hearing protection
6. Gloves
7. Half or full-face Air Purifying Respirator

8. Tear-away safety vest

If entry into a confined space is to be performed, a full-body harness with life line, attached to an extraction unit will be part of the required PPE. This will be performed in compliance with Confined Space Standard 29 CFR 1910.146. Confined spaces are not expected to be encountered during investigation activities.

It is recommended that all workers change clothes at the end of the work shift to minimize bringing potentially contaminated soil off site and to reduce cumulative build-up in personal vehicles. Boots should be changed prior to leaving the site to reduce tracking of soil off-site. This procedure prevents workers from bringing impacted materials off-site. If disposable coveralls are used, they should be disposed of in accordance with applicable regulations.

Levels of Protection to be utilized by on-site personnel will be continually evaluated by the SHSO, with assistance from the CSP. The levels of protection may be modified, as necessary, with approval by the CSP. Any change in the level of protection must be documented.

5.0 TRAINING

5.1 Site Training Requirements

All workers will be required to have site-specific training for this project. Workers will be informed on the chemical and physical hazards associated with the project. All workers must have attended 40-hour hazardous waste operations and emergency response (HAZWOPER) training as defined in OSHA 29 CFR 1910.120. All workers must have attended an 8-hour refresher class within the past year in order to stay current in the HAZWOPER Standard training requirements. The SHSO and PM and other supervisory personnel must have appropriate training to:

- Ensure maximum regard for the health and safety of all employees, the public, and the environment;
- Comply with all laws, rules, and regulations required for safeguarding the health and safety of all employees, the public, and the environment;
- Increase the ability of employees to react responsibly and safely under normal conditions and during emergency situations;
- Educate personnel relative to potential site hazards, adverse chemical effects, and the importance of good safety and industrial hygiene practices; and
- All TRC and subcontractor personnel must have LIRR Roadway Worker Protection (RWP) training before working on LIRR property. The RWP training must be renewed on an annual basis.

Mandatory safety training programs must be held periodically to refresh employee health and safety awareness. Certificates of completion of this training must be presented to the SHSO and kept on site for the duration of the project. The training certificate checklist is in **Appendix D**. Workers with supervisory responsibility must have an additional 8 hours of supervisory training in addition to the initial 40-hour training and annual refresher.

5.2 On-Site Safety Training

In addition to the 40-hour OSHA safety training, specific safety training will be given in the

field. This on-site training is to be divided into two separate parts. First, general comprehensive safety training will be given to each employee prior to conducting any field work. The SHSO will be responsible for this training which will consist of, at a minimum, the following:

1. Each employee will be provided access to a copy of the HASP and the plan will be reviewed with each employee performing work on-site.
2. If necessary, each employee assigned a respirator shall have been fit tested with their individual respirator. Fit testing will be performed in accordance with 29 CFR 1910.134. On-site fit checking will consist of a qualitative check test such as the negative pressure test or positive pressure test:
    a. In conducting the negative pressure test, the employee will be told to close off the inlet of the canister, cartridge(s), or filter(s) by covering them with their palms or by squeezing the breathing tube so it doesn't pass air. They will then be told to inhale gently so the face piece collapses slightly and then to hold their breath for ten seconds. If the face piece remains slightly collapsed and no inward leakage of air is detected, the fit is considered to be satisfactory.
    b. In conducting the positive pressure test, the employees will be told to close off the exhalation valve and then to exhale gently into the face piece. If a slight positive pressure can be built up inside the face piece without any outward leakage, the fit is considered to be satisfactory.
3. On-site personal hygiene will be reviewed to prevent contaminants from being brought off site on clothing or foot wear.
4. Decontamination procedures will be reviewed and demonstrated.
5. Emergency procedures, including emergency exits, will be reviewed.
6. Individual medical data sheets will be collected. Sample data sheets are included as **Appendix E.**
7. A review of the area(s) that will be classified as restricted access area(s) and the methods employed to designate these areas.
8. A review of LIRR safety procedures and requirements for worker protection.

5.3 Daily Safety Meeting

Prior to the start of site activities each day, a meeting will be held to detail the new day's activities, answer any questions that might arise, and to reiterate health and safety procedures.

5.4 Daily Safety Inspections

In order to maintain a safe working environment, the SHSO will conduct safety inspections at least on a daily basis. Any deviations from the HASP will be noted and addressed. The inspections shall include an evaluation of work practices and the work area as they relate to safety. A form is included in **Appendix A**.

SITE AIR MONITORING

6.0 SITE AIR MONITORING

A key component in maintaining low exposure to site workers is through air monitoring of work operations. If dusts are generated during the investigation, dust monitoring will be necessary. Dust-monitoring will consist of real-time measurements using a particulate meter (e.g., Dust Trak or similar instrument). Air monitoring for CVOCs will be conducted in the immediate work area during all ground-intrusive activities. A photoionization detector (PID) will be used to detect CVOCs. Sampling will be performed upwind and downwind of the work area and will be recorded in the site log and used to determine if excessive levels are present in the work area.

6.1 Community Air Monitoring Requirements

TRC will implement community air monitoring, in accordance with the NYSDOH generic CAMP, during ground intrusive work. This subsection of the HASP explains the community air monitoring requirements for the RAWP implementation. As mentioned, the HASP may be revised to include additional conditions after the RAWP is finalized.

6.1.1 VOC Monitoring, Response Levels, and Actions

VOCs will be monitored continuously at the upwind and downwind locations of the perimeter of the Site at temporary particulate monitoring stations. VOC monitoring equipment will be calibrated daily and will 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 exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will 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 persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will 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 work area 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.

6.1.2 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind locations of the perimeter of the Site at temporary particulate monitoring stations. The particulate monitoring will 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 will be equipped with an audible alarm to indicate exceedance of the action level. In addition, fugitive dust migration will be visually assessed during all work activities.

1. If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ 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 $\mu g/m^3$ above the upwind level, work will be stopped and a re-evaluation of activities will be initiated. Work will be able to be resumed provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate

concentration to within 150 µg/m^3 of the upwind level and in preventing visible dust migration.

Based on the air monitoring results dust suppression may need to be implemented. This could include the following:

- Applying water
- Wetting equipment
- Spraying work area
- Utilizing alternate methods

EMERGENCY PROCEDURES

7.0 EMERGENCY PROCEDURES

IN EMERGENCY CALL 911.

Should outside assistance be needed for accidents, fire, or release of hazardous substances, the emergency numbers will be available and posted at the site (see **Appendix B**) where a readily accessible telephone is made available for emergency use.

Also, in the event of an incident where a team member becomes exposed or suffers from an acute symptom from contact with site materials and has to be taken to a hospital, a short medical data sheet for that individual will be made available to the attending physician. The medical data sheet will include the following:

1. Name, address, home phone
2. Age, height, weight
3. Name of person to be notified in case of an accident
4. Allergies
5. Particular sensitivities
6. Does he/she wear contact lenses?
7. Short checklist of previous illness
8. Name of personal physician and phone
9. Name of company physician and phone
10. Prescription and non-prescription medications currently used.

A sample medical data sheet is included in **Appendix E**. A map showing the directions to the nearest hospital is included as **Figure 2**.

7.1 Emergency Site Evacuation Procedure

Evacuation Plan

In the event that an emergency situation arises, including but not limited to fire, explosion or

significant toxic gas release into the ambient atmosphere, an air horn will be sounded on the site. The horn will sound continuously for approximately 15 seconds, indicating immediate evacuation of all personnel is necessary due to immediate or impending danger. All personnel will evacuate the Site and assemble at the designated meeting location which is the security gate at entrance of Jackson Avenue. To the extent that this becomes a danger to the health and safety of those at the designated assembly point, another designated location of assembly will be established. The SHSO will provide instructions and will authorize staff to resume their normal duties after the emergency has been resolved.

In order to quickly mobilize the manpower resources and equipment necessary to cope with a fire or other emergency, a clear definition of the authority to initiate action has been established. For the purposes of this plan, the SHSO will have the authority to initiate proper action in any emergency situation for the duration of this project. It will be the responsibility of the SHSO to report immediately to the scene of the fire or emergency, assess the seriousness of the situation and direct fire fighting and containment efforts should they be necessary until arrival of the local fire fighters, should they be necessary. The SHSO may also order the closure of the site for an indefinite period as long as the SHSO deems it necessary.

Under no circumstances will incoming visitors be allowed to proceed to the fire area once the alarm has been sounded. Visitors or other persons present in the area of the emergency shall be instructed to evacuate the area. Upon the sound of the alarm, the SHSO will ensure that access roads are not obstructed and will remain on-site to provide stand-by assistance upon arrival of emergency apparatus.

Upon initiation of any alarm, someone will be designated by the SHSO to attend the designated emergency telephone for the duration of the emergency. All project personnel will be instructed on proper emergency response and emergency telephone numbers.

It may be necessary to control traffic in the event of a fire or explosion. Persons trained in traffic

control procedures will be utilized to perform this function. Proper reflection warning vests will be worn by those persons controlling traffic.

Front-end loaders or other internal combustion apparatus shall be shut down once an alarm has been sounded. Operators will then proceed to the designated assembly site immediately for further instructions from the SHSO.

Should an accident occur during ground-intrusive activities in which personnel are injured or exposed, the following actions will be taken. The site SHSO will assume control and will assign someone to notify emergency personnel from the emergency telephone. Companion personnel who are unaffected by the incident or personnel partially dressed in protective gear but outside the work zone will be alerted to rescue any workers whose health or safety is endangered. The buddy system will be enforced. Victims will be located and their conditions will be assessed. If possible, the hazardous situation will be brought under complete or temporary control and victims will be assisted or removed from the area. The SHSO will determine, based on the type and severity of the illness or injury, whether or not to decontaminate the victim, and whether the victim needs to be stabilized.

8.0 MEDICAL PROCEDURES

8.1 Physical Examination Documents

Documentation of medical physical examinations must be submitted and maintained for workers with the potential to wear respirators. This must also include a signed statement by a board-certified or board-eligible licensed physician who practices occupational medicine that the employee is approved for the wearing of Personal Protective Equipment (PPE) including respiratory protection. Physical examinations must be current within one year of the date of intended site work.

8.2 Physical Examination

Employees whose work assignments require their presence at a hazardous work site are required to have a baseline medical evaluation prior to commencement of hazardous work activity. The baseline medical evaluation consists of the following [*=Required; •=Preferred]:

* * Medical and Occupational History
* * Physical Examination
* * Pulmonary Function
* • Urinalysis
* • CBC (with differential and RCB) Chem 24 (SMAC)
* • RBC Cholinesterase
* • Urine Heavy Metal Panel
* • Blood Lead with zpp
* • Chest X-Ray (2-view)
* * EKG (over 40 years of age)
* • Audiometry

The annual medical evaluation consists of the following [*=Required; •=Preferred]:

* Physical Examination and History
* Pulmonary Function
- Urinalysis
- CBC (with differential and RCB) Chem 24 (SMAC)
- RBC Cholinesterase
- Blood Lead with zpp
- EKG (Over 40 years of age)
- Audiometry

Additional tests which may be performed as part of the annual examination include the following [*=Required; •=Preferred]:

- Cholinesterase - plasma
- Urine - heavy metal
- Blood – PCB
- Chest X-Ray (2-view)

Based upon examination and a review of the employee's job description, the physician identifies any medical restrictions which would affect an employee's ability to safely perform his/her job. If no restrictions are imposed, the physician certifies the employee as capable of full participation in the work program.

If an employee suspects exposure to a toxic chemical or other hazard while performing project tasks, additional tests are ordered immediately following the exposure period. Individuals are encouraged to discuss changes in their health status with the Company Health and Safety Director and/or physician.

8.3 Emergency First Aid

An individual, preferably the SHSO, who has a current certificate for emergency first aid and cardiopulmonary resuscitation will be on site at all times during the project.

MEDICAL PROCEDURES

A general first aid shall be made available on the Site and the location will be clearly reviewed with all on-Site staff.

In the event of a medical emergency the SHSO must immediately call 911 and request an ambulance or emergency medical team. The SHSO should designate a person to flag down the ambulance and direct it to the injured person. The SHSO should initiate first aid procedures until arrival.

8.4 Heat Stress

Heat stress is a result of a build-up of heat in the body, which occurs when the body produces heat at a greater rate than it is dispersed by conduction, radiation, and evaporation of sweat from the surface of the skin. When heat build-up occurs, the body temperature is raised, causing a fever. When this condition persists, it produces a cycle which further aggravates the situation. The fever causes certain body functions to accelerate. This generates excess heat which must be dispersed in addition to the normal heat generated by a person's body. Heat loss from the body is slow during conditions of high temperature and high humidity, such as a hot, humid day. These conditions, however, can be artificially caused by the wearing of non-porous, protective clothing. Therefore, caution should be exercised during field activities performed within high temperature environments.

Based on the allowable work periods (minutes per hour), a work/rest regimen should be established based upon ambient conditions at the start of the job, and the acclimatization of the workforce in those conditions. Temperature extremes, as determined by a globe thermometer device (WBGT or equivalent), may require scaling back work cycles within the regimen. Greater active work times are allowable, so long as no symptoms of heat stress are noted. Heat stress symptoms are discussed in detail below.

There are three classes or types of heat stress: heat exhaustion, heat cramps, and heat stroke.

8.4.1 Heat Exhaustion

Heat exhaustion is brought about by the concentration of blood in the vessels of the skin. This condition may lead to an inadequate return of blood to the heart and, eventually, to physical collapse. The symptoms are:

- General weakness
- Excessive perspiration
- Dizziness
- Appearance of having fainted
- Pale and clammy skin
- Weak pulse
- Rapid and shallow breathing

To treat for heat exhaustion, place the individual in a cool place and remove as much clothing as possible. The individual should drink cool water or a sports drink with electrolytes (e.g., "Gatorade"). The individual should be fanned, however, do not over cool or allow chilling. Treat the individual for shock and remove to medical facility if condition persists.

8.4.2 Heat Cramps

Heat cramps are usually caused by loss of salt when an individual has perspired a great deal. Cramps usually in the leg and abdominal muscles can also be caused by drinking iced liquids quickly or in large amounts. The symptoms of heat cramps are as follows:

- Pain and cramps in legs or abdomen
- Faintness
- Profuse perspiration

8.4.3 Heat Stroke

Heat stroke is a breakdown of the body heat-regulating mechanism causing high fever and collapse. This condition can result in unconsciousness, convulsions, and even death. Persons in poor physical condition or of advanced age are particularly susceptible. The symptoms of heat stroke are:

- Muscle twitching or convulsions
- Dry hot skin
- Flushed skin
- Suddenness of condition
- High body temperature
- Loss of consciousness
- Deep breathing, then shallow or absent
- Dilated pupils

Heat stroke is a serious condition for which an individual should be transported to a medical facility as soon as possible. In the interim the following steps can be taken:

1. The individual should be removed to a cool environment and the body temperature should be reduced promptly by dousing the body with water or by wrapping in a wet sheet.
2. If ice is available, it should be placed under the arms and around the neck and ankles.
3. Drinking water should be provided. Intake of these liquids will be monitored by the SHSO so as not to be excessive.
4. Steps should be taken to protect patient from injury during convulsions, especially from biting the tongue.

To avoid problems from heat stress during conditions of high temperature and humidity, the SHSO should insure that the employees drink plenty of fluids; should provide breaks in accordance with the previously outlined guidance and monitoring; and should revise work schedules as necessary to take advantage of the cooler parts of the day. Some basic guidelines for maintaining workers' body fluids at normal levels during conditions of high temperature and humidity are as follows:

- have workers drink 16 ounces of fluid before beginning work.
- have workers drink 4 to 8 ounces of fluid every 15 to 20 minutes, or at each scheduled break. A total of 1 to 1.6 gallons of fluid per day are recommended, but more may be necessary to maintain body weight.

To measure the effectiveness of the heat recovery rest periods, the employee heart rate should be monitored as follows:

- Count the pulse rate for the last 30 seconds of the first minute of a three-minute period, the last 30 seconds of the second minute, and the last 30 seconds of the third minute.
- Double the count to obtain an equivalent one-minute rate.

If the first rate is less than 100 beats/minute and the second two readings are at least 10 beats/minute less than the previous reading than the rest periods should be considered adequate. Otherwise, the rest periods should be extended.

If heat stress may be a factor due to ambient temperature and humidity, then it is recommended that both methods be used. Also, these tests should be performed in the morning prior to any work to establish a background level.

8.5 Cold Stress

Fatal exposures to cold among workers have almost always resulted from accidental exposures involving failure to escape from low environmental air temperatures or from immersion in low temperature water. The single most important aspect of life-threatening hypothermia (cold stress) is the fall in the deep core temperature of the body. Workers should be protected from exposure to cold so that the deep core temperature does not fall below 36°C (96.8°F); lower body temperatures will very likely result in reduced mental alertness, reduction in rational decision making, or loss of consciousness with the threat of fatal consequences.

Pain in the extremities may be the first early warning of danger to cold stress. During exposure to cold, maximum severe shivering develops when the body temperature has fallen to 35°C (95°F). This must be taken as a sign of danger to the workers and exposure to cold should be immediately terminated for all workers when severe shivering becomes evident. Useful physical or mental work

is limited when severe shivering occurs.

Since prolonged exposure to cold air or to immersion in cold water, at temperatures well above freezing can lead to dangerous hypothermia, whole body protection must be provided. Adequate insulating clothing to maintain core temperatures above 36ºC must be provided to workers if work is performed in air temperatures below 4ºC (40ºF). In addition, it should be kept in mind that, the higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.

Special protection of the hands is required to maintain manual dexterity for the prevention of accidents:

1. If fine work is to be performed with bare hands for more than 10-20 minutes in an environment below 16ºC (60ºF), special provisions should be established for keeping the workers' hands warm. Metal handles or tools and control bars should be covered with thermal insulating material at temperatures below -1ºC (30ºF).
2. If the air temperature falls below 16ºC (60ºF) for sedentary, 4ºC (40ºF) for light, -7ºC (20ºF) for moderate work and fine manual dexterity is not required, then gloves must be used by the workers. Winter "Monkey-grip" gloves consisting of a cotton lining with a textured PVC coating are typically used in cold weather. To prevent contact frostbite, the workers should wear anti-contact gloves.

Provisions for additional body protection is required if work is performed in an environment at or below 4ºC (40ºF). The workers shall wear cold protective clothing appropriate for the level of cold and physical activity:

1. If the air velocity at the job sites is increased by wind, draft, or artificial ventilating equipment, the cooling effect of the wind shall be reduced by shielding the work area, or by wearing an easily removable outer windbreak layer garment.

2. If only light work is involved and if the clothing on the worker may become wet on the job site, the outer layer of the clothing in use may be of a type impermeable to water. With more severe work under such conditions, the outer layer should be water repellent and the outerwear should be changed as it becomes wetted. The SHSO should assure that adequate replacement garments are available for use by the employees.

3. If the available clothing does not give adequate protection to prevent hypothermia or frostbite, the SHSO can suspend work on the site until adequate clothing is available or until weather conditions improve.

4. Workers handling evaporative liquids (gasoline, alcohols, solvents, etc.) at air temperatures below 4ºC (40ºF) shall take special precautions to avoid soaking of clothing or gloves with the liquids because of the added danger of cold injury due to evaporative cooling.

8.6 Emergency Medical Procedures

All accidents or incidents will be dealt with in a manner to minimize further injury to the individual or others. In the event that an accident does occur, the following general procedures should be followed:

- First aid and other appropriate action shall be given by the qualified individual closest to the event.
- Contact hospital and arrange for ambulance if necessary.
- As soon as practicable, the incident shall be reported to the SHSO. The SHSO shall be responsible for making all decisions concerning treatment, and/or other appropriate action.
- The appropriate reports/forms will be completed and forwarded to SHSO where they will be kept on file. The incident will also be noted in the site field log.

8.7 Accident and Injury Report Forms

8.7.1 Accident Report

All injuries, no matter how slight, shall be reported to the SHSO. An accident report will be filled out on all accidents by the SHSO. Project personnel will be instructed on the location of the first aid station, hospital, doctor, and ambulance service near the job. The emergency phone numbers will be conspicuously posted. First aid supplies will be centrally located and conspicuously posted between restricted and non-restricted areas so that they are readily accessible to all on the site.

8.7.2 First Aid Treatment Record

The First Aid form (**Appendix E**) will be used for recording all non-lost time injuries treated by the project first-aid attendant, local physician or hospital. "Minor" treatment of scratches, cuts, etc. will receive the same recording attention as treatment of more severe injuries.

8.7.3 Occupational Injuries & Illnesses Form (OSHA 101)

All recordable occupational injuries and illnesses as required by the regulations issued under the Occupational Safety and Health Act (OSHA) shall be recorded on the form attached in **Appendix F**. Occupational injuries and illnesses shall be recorded within 48 hours of a recordable case as required by statute. This is the responsibility of the employer and will be recorded by the site SHSO in so far as reportable injuries/illnesses happen to on site employees.

9.0 DEMARCATION OF ZONES

This subsection of the HASP explains the demarcation zones to utilized during RAWP implementation. As mentioned, the HASP may be revised to include additional conditions after the RAWP is finalized.

9.1 Exclusion (Work) Zone

Work zones for all activities will be demarcated with appropriate barriers. Only authorized personnel will be allowed access into the work zones. All appropriate safety criteria associated with these zones will be followed.

9.2 Decontamination Zone

Decontamination areas where personnel and equipment decontamination procedures will be performed, if appropriate, will be located as close as possible to work areas. These areas will be demarcated by appropriate barriers and signs and all unauthorized personnel will be excluded. Decontamination could be necessary if contaminated materials are uncovered or spills occur.

DECONTAMINATION PROCEDURES

10.0 DECONTAMINATION PROCEDURES

The decontamination of personnel, portable equipment, tools and sampling equipment will take place in designated decontamination areas. Specific personnel and equipment decontamination procedures are provided in the next sections.

All heavy equipment will be decontaminated at the designated heavy equipment decontamination area. The decontamination will also include necessary equipment, including but not limited to the following:

Decon Equipment Checklist

- Plastic garbage barrels;
- Trash bags;
- Alconox detergent concentrate;
- Hand pump sprayers;
- Water Jugs;
- Long-handled soft bristle brushes;
- Large sponges;
- Wipes for respirators;
- Small stools or chairs;
- Folding tables;
- Duct tape;
- Liquid detergent and paper towels;
- Rolled plastic and or polyethylene tarps; and
- Decontamination fluids.

10.1 Specific Procedures

The following describes procedures to be employed for personnel and equipment decontamination. This subsection of the HASP explains the specific decontamination

procedures to be utilized during RAWP implementation. As mentioned, the HASP may be revised to include additional conditions after the RAWP is finalized.

PERSONNEL DECONTAMINATION PROCEDURES FOR LEVEL D PROTECTION

Station 1:	Segregated Equipment Drop	1.	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clip-boards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Glove Removal	2.	Remove outer gloves and deposit in waste container.
Station 3:	Tyvek Removal	3.	With assistance of helper, remove splash suit. Deposit in container with plastic liner.
Station 4:	Inner Glove Wash	4.	Wash inner gloves with decon solution.
Station 5:	Inner Glove Rinse	5.	Rinse inner gloves with water.
Station 6:	Inner Glove Removal	6.	Remove inner gloves and deposit in container with liner.
Station 7:	Inner Clothing Removal	7.	If inner clothing has become contaminated, remove it and place it into a poly bag.
Station 8:	Field Wash (as necessary)	8.	Shower if highly toxic, skin- corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face.
Station 9:	Re-dress (as necessary)	9.	Put on clean clothes.

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION PROCEDURES FOR LEVEL C PROTECTION

Station 1:	Segregated Equipment Drop	1.	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clip-boards, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop reduces the probability of cross-contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Boot/Boot Cover and Glove Wash	2.	Scrub outer boot covers and gloves with decon solution or detergent/ water.
Station 3:	Boot/Boot Cover and Glove Rinse	3.	Rinse off decon solution from Station 2.
Station 4:	Tape Removal	4.	Remove tape around boots and gloves and deposit in waste container.
Station 5:	Boot Cover Removal	5.	Remove boot covers and deposit in waste container.
Station 6:	Outer Glove Removal	6.	Remove outer gloves and deposit in waste container.
Station 7:	Canister or Mask Change	7.	If worker leaves the exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, and joints taped. Worker returns to duty.
Station 8:	Safety Boot Removal	8.	Remove safety boots and place in area with

			plastic liner.
Station 9:	Tyvek Removal	9.	With assistance of helper, remove splash suit. Deposit in waste container.
Station 10:	Inner Glove Wash	10.	Wash inner gloves with decon solution.
Station 11:	Inner Glove Rinse	11.	Rinse inner gloves with water.
Station 12:	Respirator Removal	12.	Remove respirator. Deposit in container with plastic liner. Avoid touching face with fingers.
Station 13:	Inner Glove Removal	13.	Remove inner gloves and deposit in waste container.
Station 14:	Inner Clothing Removal (as necessary)	14.	If inner clothing has become contaminated, remove it and place it into a poly bag.
Station 15:	Field Wash	15.	Shower if highly toxic, skin-corrosive or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Station 16:	Re-dress (as necessary)	16.	Put on clean clothes.

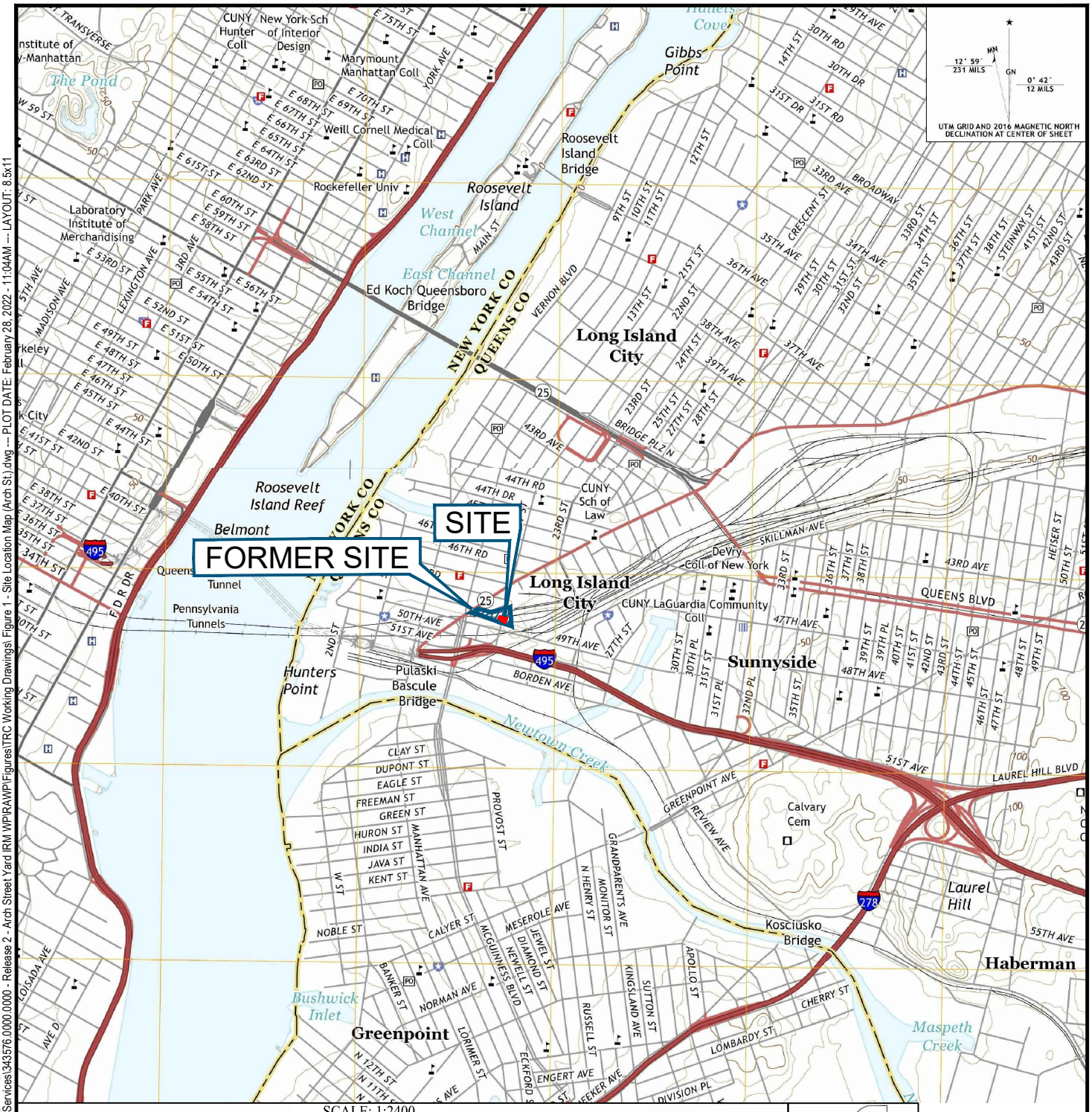
Heavy Equipment (e.g., Drill Rig, Trucking)

A separate area will be designated for the decontamination of heavy equipment if deemed necessary by the SHSO. A water source will be used to clean the under-carriage, wheels, track, and bucket before leaving the site, as necessary. The SHSO will designate an area that can be used for equipment storage and decontamination. This area will be prepared to contain decontamination runoff and to protect the watershed.

In order to minimize spreading potentially contaminated soil, a gross decontamination of the drilling equipment will take place at the individual sites prior to transporting them to the decontamination area. This will involve on-site removal of loose soil from the tools and rig,

and containerizing tools in the back of a truck (e.g., wrap in plastic) while transporting them to the decontamination area.

FIGURES



MAP INCLUDES INFORMATION FROM THE FOLLOWING MAP SHEET(S):
TP, BROOKLYN, NY, 7.5 MINUTE DATED 2016,
N, CENTRAL PARK, NY, 7.5 MINUTE DATED 2016.

MAP OBTAINED THROUGH USE OF TOPOVIEW WITH THE INTERFACE CREATED BY THE NATIONAL GEOLOGIC MAP DATABASE PROJECT (NGMDB), IN SUPPORT OF THE TOPOGRAPHIC MAPPING PROGRAM, MANAGED BY THE USGS NATIONAL GEOSPATIAL PROGRAM (NGP).

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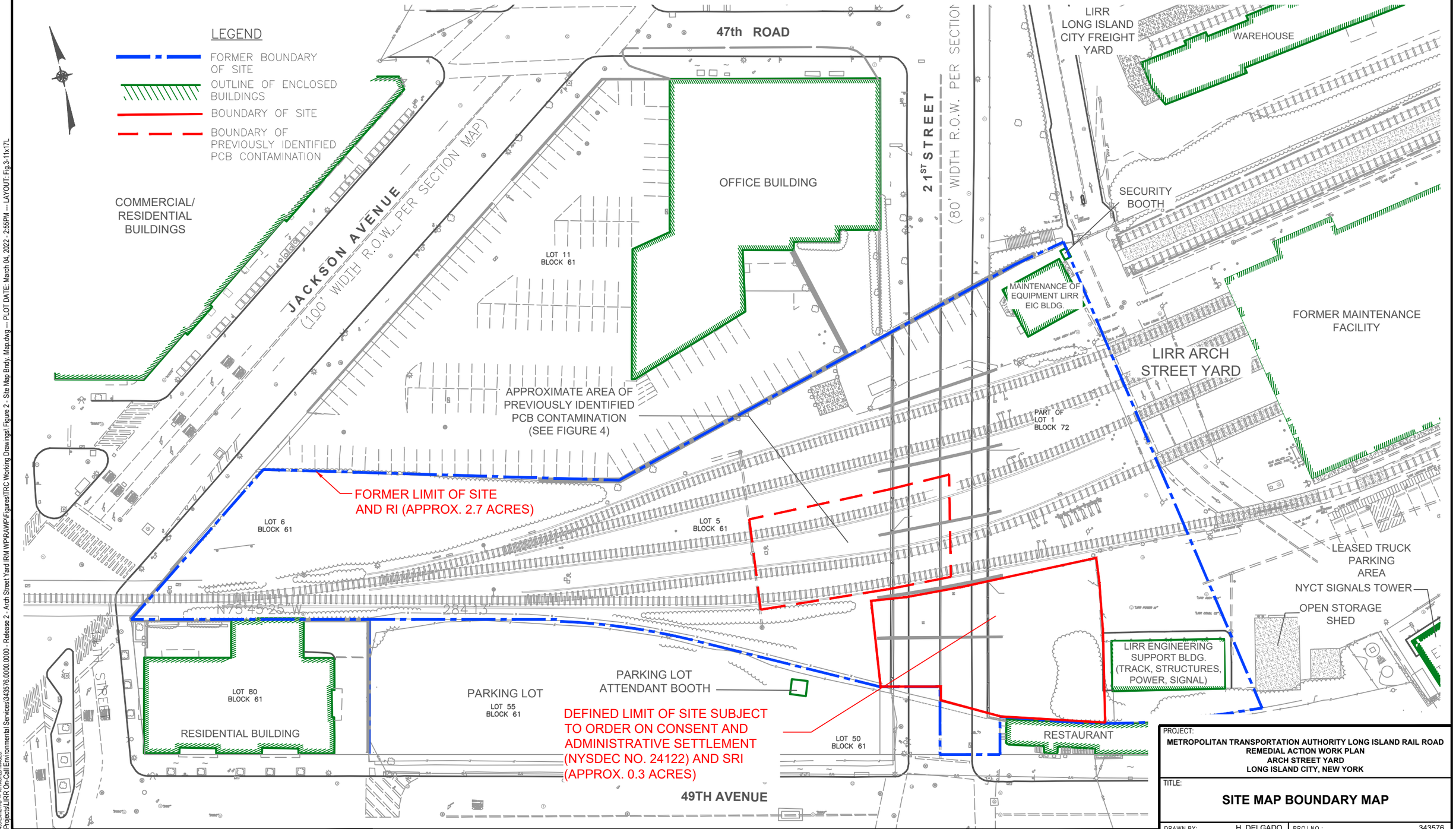
PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SITE LOCATION MAP

DRAWN BY:	B. SCHLAFF
CHECKED BY:	E. EBERT
APPROVED BY:	K. MYERS
DATE:	MARCH 2022
PROJ. NO.:	343576
FILE:	Figure 1 - Site Location Map (Arch St.).dwg

FIGURE 1

8.5x11 -- ATTACHED XREFS: -- ATTACHED IMAGES: NY_Brooklyn_20160824_TM, NY_Central_Park_20160824_TM;
DRAWING NAME: \\nyc-fp1\shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 1 - Site Location Map (Arch St.).dwg -- PLOT DATE: February 28, 2022 - 11:04AM -- LAYOUT: 8.5x11



NOTE:

1. DRAWING SOURCE FROM INTERIM REMEDIAL MEASURES WORK PLAN REPORT FIGURE A-2 "SITE PLAN SHOWING DEFINED BOUNDARIES OF PROJECT SITE" PROVIDED BY D & B ENGINEERS AND ARCHITECTS, P.C. DATED DECEMBER 2018.

0 60' 120'

SCALE: 1" = 60'
SHEET SIZE: 11" BY 17"

PROJECT:
METROPOLITAN TRANSPORTATION AUTHORITY LONG ISLAND RAIL ROAD
REMEDIAL ACTION WORK PLAN
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

TITLE:
SITE MAP BOUNDARY MAP

DRAWN BY:	H. DELGADO	PROJ NO.:	343576
CHECKED BY:	E. EBERT		**FIGURE 2**
APPROVED BY:	K. MYERS		
DATE:	MARCH 2022		

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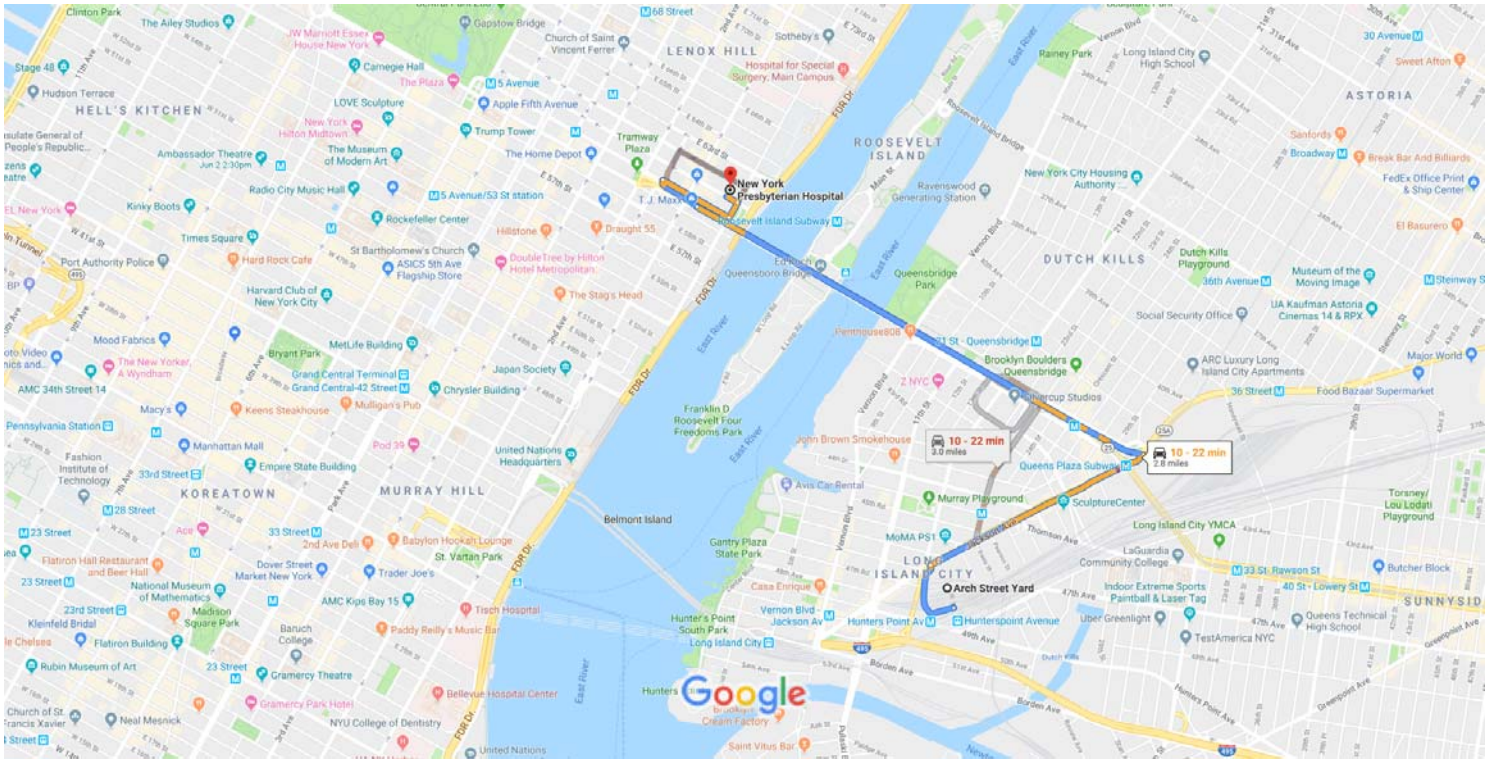
FILE NO.: Figure 2 - Site Map Bndy. Map.dwg

11x17 -- USER: RSchiff -- ATTACHED XREFS: 3456 EXHIBIT.P -- ATTACHED IMAGES:
DRAWING NAME: \\nyc-fp1\Shared\Projects\LIRR On-Call Environmental Services\343576.0000.0000 - Release 2 - Arch Street Yard IRM WP\RAWP\Figures\TRC Working Drawings\ Figure 2 - Site Map Bndy. Map.dwg -- PLOT DATE: March 04, 2022 - 2:55PM -- LAYOUT: Fig.3-11x17L
Version: 2017-10-21

Google Maps

Arch Street Yard, Long Island City, NY to New York Presbyterian Hospital

Drive 2.8 miles, 10 - 22 min



Map data ©2019 Google 1000 ft

Arch Street Yard

Long Island City, NY 11101

1. Head west on Arch St toward Jackson Ave

52 s (0.2 mi)

Follow Jackson Ave and Ed Koch Queensboro Bridge Lower Roadway to E 60th St in Manhattan. Take the exit toward 1 Avenue N/FDR Drive from Ed Koch Queensboro Bridge Lower Roadway

10 min (2.3 mi)

2. Turn right onto Jackson Ave

0.6 mi

3. Continue onto Northern Blvd/Quees Plaza E

331 ft

4. Turn left onto Ed Koch Queensboro Bridge Lower Roadway (signs for State Rte 25A)

1.5 mi

5. Take the exit toward 1 Avenue N/FDR Drive

0.1 mi

Continue on E 60th St. Drive to E 61st St

3 min (0.3 mi)

6. Turn right onto E 60th St

0.2 mi

7. Turn left onto York Ave

262 ft

8. Turn left onto E 61st St

Destination will be on the right

194 ft

New York Presbyterian Hospital

425 E 61st St, New York, NY 10065

These directions are for planning purposes only. You may find that construction projects, traffic, weather, or other events may cause conditions to differ from the map results, and you should plan your route accordingly. You must obey all signs or notices regarding your route.

APPENDIX A
SAFETY INSPECTION FORM

TRC SAFETY INSPECTION FORM

Date of Inspection _____ Inspector(s)_____

Description of Job _____

Building No. _____ Location within building _____

Area Location/Description (if outdoors) _____

Item	Y	N	N/A	Comments / Remarks
I. Personal Protective Equipment				
Hard hats are being worn when overhead, falling or flying hazards exist;				
Safety glasses or face shields are used for welding, cutting, nailing (including pneumatic), or when working with concrete and/or harmful chemicals;				
Proper shoes or boots are worn to lessen slipping hazards and prevent toe crushing and nail punctures; and				
Safety belts and/or harness systems are in use for fall protection				
II. Housekeeping & Access Around Site				
Walkways and stairways are kept clear of trash/debris and other materials such as tools and supplies to prevent tripping.				
Boxes, scrap lumber and other materials are picked up and put in a dumpster or trash/debris area to prevent fire and tripping hazards				
Enough light is provided to allow workers to see and to prevent accidents				

Item	Y	N	N/A	Comments / Remarks
III. Stairs & Ladders				
Permanent or temporary guardrails are installed on stairs, before stairs are used for general access, between levels to prevent someone from falling or stepping off edges.				
Manufactured and job-made ladders are kept in good condition and free of defects.				
Ladders are inspected before use for broken rungs or other defects so falls do not happen. Defective ladders are discarded or repaired				
III. Stairs & Ladders				
Ladders are secured near the top or at the bottom to prevent them from slipping and causing falls				
Ladders are secured on a stable and level surface, when they cannot be tied off, so they cannot be knocked over or their bottoms kicked out.				
Ladders are extended at least 3 feet above the landing to provide a handhold or for balance when getting on and off the ladder from other surfaces				
Ladders are only used for what they were made and not as a platform, runway, or as scaffold planks				
IV. Scaffolds & Other Work Platforms				
Ladders or stairs are provided to get on and off scaffolds and work platforms safely.				

Item	Y	N	N/A	Comments / Remarks
Scaffolds and work platforms are kept free of debris. Tools and materials are kept as neat as possible on scaffolds and platforms. This will help prevent materials from falling and workers from tripping.				
Scaffolds are erected on firm and level foundations.				
First consider the use of finished floors to support the load and provide a stable base.				
Place scaffold legs on firm footing and secured from movement or tipping, especially surfaces on dirt or similar surfaces				
Erect and dismantle scaffolds under the supervision of a competent person.				
The competent person must inspect scaffolds before each use.				
Do not use blocks, bricks, or pieces of lumber to level or stabilize the footings. Manufactured base plates or "mud sills" made of hardwood or equivalent can be used.				
V. Planking				
Fully plank or use manufactured decking to provide a full work platform on scaffolds. The platform decking and/or scaffold planks must be scaffold grade and not have any visible defects.				

Item	Y	N	N/A	Comments / Remarks
V. Planking				
Extend planks or decking material at least 6" over the edge or cleat them to prevent movement. The work platform or planks must not extend more than 12" beyond the end supports to prevent tipping when stepping or working.				
Be sure that manufactured scaffold planks are the proper size and that the end hooks are attached to the scaffold frame.				
VI. Scaffold Guardrails				
Guard scaffold platforms that are more than 10 feet above the ground or floor surface with a standard guardrail. If guardrails are not practical, use other fall protection devices such as safety belts/harnesses and lanyards.				
Place the toprail approximately 42" above the work platform or planking with a midrail about half that high at 21".				
Install toe boards when other workers are below the scaffold.				
VII. Fall Protection - Floor and Wall Openings				
Install guardrails around open floors and walls when the fall distance is 6 feet or more. Be sure the toprails can withstand a 200 lb load.				
Construct guardrails with a toprail approximately 42" high with a midrail about half that high at 21".				
Install toeboards when other workers are below the work area.				
Cover floor openings larger than 2x2 (inches) with material to safely support the working load..				

Item	Y	N	N/A	Comments / Remarks
Use other fall protection systems like slide guards, roof anchors or alternative safe work practices when a guardrail system cannot be used.				
Wear proper shoes or footwear to lessen slipping hazards.				
Train workers on safe work practices before performing work on foundation walls, roofs, trusses, or where performing exterior wall erections and floor installations.				
VIII. Work on Roofs				
Inspect for and remove frost and other slipping hazards before getting onto roof surfaces.				
Wear Cover and secure all skylights and openings, or install guardrails to keep workers from falling through the openings.				
Install slide guards along the roof eave after the first 3 rows of roofing material are installed when the roof pitch is over 4:12 and up to 6:12..				
Use a safety harness system with a solid anchor point on steep roofs with pitch greater than 8:12 or if the ground to eave height exceeds 25 feet.				
Stop roofing operations when storms, high winds or other adverse weather conditions create unsafe conditions.				
IX. Excavations & Trenching - General				
Find the location of all underground utilities by contacting the local utility locating service before digging.				
Keep workers away from digging equipment and never allow workers in an excavation when equipment is in use.				

Item	Y	N	N/A	Comments / Remarks
Keep workers from getting between equipment in use and other obstacles and machinery that can cause crushing hazards				
Keep equipment and the excavated dirt (spoils pile) back 2 feet from the edge of the excavation.				
Have a competent person conduct daily inspections and correct any hazards before workers enter a trench or excavation.				
Provide workers a way to get into and out of a trench or excavation. Ladders and ramps can be used and must be within 25 feet of the worker.				
For excavations and utility trenches over 5 feet deep, use shoring, shields (trench boxes), benching, or slope back the sides. Unless soil analysis has been completed, the earth's slope must be at least 1 1/2 horizontal to 1 vertical.				
Keep water out of trenches with a pump or drainage system, and inspect the area for soil movement and potential cave-ins.				
IX. Excavations & Trenching - General				
Keep drivers in the cab and workers away when dirt and other debris are being loaded into dump trucks. Workers must never be allowed under any load and must stay clear of the back of vehicles.				
X. Foundations				
After the foundation walls are constructed, special precautions must be taken to prevent injury from cave-ins in the area between the excavation wall and the foundation wall				

Item	Y	N	N/A	Comments / Remarks
The depth of the foundation/basement trench cannot exceed 7 1/2 feet deep unless other cave-in protection is provided. .				
Keep the horizontal width of the foundation trench at least 2 feet wide. Make sure there is no earth vibration while workers are in the trench.				
Plan the foundation trench work to minimize the number of workers in the trench and the length of time they spend there.				
XI. Tools & Equipment				
Maintain all hand tools and equipment in safe condition and check regularly for defects. Broken or damaged tools and equipment must be removed from the jobsite.				
Use double insulated tools, or ensure the tools are grounded.				
Plan the foundation trench work to minimize the number of workers in the trench and the length of time they spend there.				
Use double insulated tools, or ensure the tools are grounded.				
Equip all power saws (circular, skill, table, etc.) with blade guards. Saws must be turned off when unattended.				
Provide training for workers before pneumatic or powder-actuated tools are used.				
Pneumatic and powder-actuated tools must only be used by trained and experienced personnel. Require proper eye protection for workers.				
Never leave cartridges for pneumatic or powder-actuated tools unattended. Keep equipment in a safe place, according to the manufacturers' instructions.				

Item	Y	N	N/A	Comments / Remarks
XII. Vehicles & Mobile Equipment				
Inform workers verbally and provide training to stay clear of backing and turning vehicles and equipment with rotating cabs.				
Maintain back-up alarms for equipment with limited rear view or use someone to help guide them back.				
Verify experience or provide training to crane and heavy equipment operators.				
Maintain at least a 10 foot clearance from overhead power lines when operating equipment.				
Block up the raised bed when inspecting or repairing dump trucks.				
Use a tag line to control materials moved by a crane.				
Provide flagmen with orange and red warning garments while working in vehicular traffic.				
XIII. Electrical				
Prohibit work on new and existing energized (hot) electrical circuits until all power is shut off and a positive "Lockout/Tagout System" is in place.				
Maintain all electrical tools and equipment in safe condition and check regularly for defects.				
Broken or damaged tools and equipment must be removed from the jobsite.				
Protect all temporary power (including extension cords) with Ground Fault Circuit Interrupters (GFCIs). Plug into a GFCI protected temporary power pole, a GFCI protected generator, or use a GFCI extension cord to protect against shocks.				

Item	Y	N	N/A	Comments / Remarks
Locate and identify overhead electrical power lines. Make sure that ladders, scaffolds, equipment or materials never come within 10 feet of electrical power lines.				
XIV. Fire Prevention				
Provide fire extinguishers near all welding, soldering, or other sources of ignition.				
Avoid spraying of paint, solvents or other types of flammable materials in rooms with poor ventilation. Buildup of fumes and vapors can cause explosions or fires.				
Store gasoline and other flammable materials in a safety can outdoors or in an approved storage facility.				
Provide one fire extinguisher within 100 feet of employees for each 3,000 square feet of building.				
XV. Asbestos				
Conduct air monitoring where there may be asbestos exposure				

Item	Y	N	N/A	Comments / Remarks
Where employees may be exposed to asbestos, establish a program which includes: a. Awareness training b. Health effects of asbestos exposure c. Caution labels and signs d. Use of appropriate respiratory protection e. Protective clothing f. Change areas for storage of work and street clothes g. Medical surveillance h. Recordkeeping i. Personnel certifications j. Contractor licensing				
Establish regulated areas if the permissible exposure limit (PEL) is likely to be exceeded				
Employ the following engineering controls to minimize asbestos fiber release: a. Local ventilation exhaust b. HEPA filtration and vacuuming c. Work area isolation d. Wet handling methods				
XV. Asbestos				

Item	Y	N	N/A	Comments / Remarks
Ensure all activities are being conducted in accordance with USEPA, USOSHA, USDOT, NYSDOL, NYCDEP, and NYCDOS rules and regulations.				
Ensure all power tools are equipped with HEPA filtered local exhaust ventilation.				
Ensure all asbestos waste is properly labeled and disposed of.				
XVI. Dusts, Gases, Fumes, and Mists				
Ensure material safety data sheets (MSDS) are maintained on each product in use at the construction site.				
Provide adequate ventilation				
Ensure proper protective equipment is used to protect against overexposure				
XVII. Silica				
Provide adequate exhaust to remove silica particles from the work area				
Provide respirators for employees who may be overexposed to silica dust particles				
XVIII. Noise				
Provide hearing protectors when noise levels exceed 90 decibels on the A weighted scale (dbA)				
Enforce the use of hearing protective equipment				
Establish administrative controls to reduce or eliminate excessive noise				
XIX. Respiratory Protection				

Item	Y	N	N/A	Comments / Remarks
Have a written respiratory protection program in effect in accordance with 29 CFR 1910.134				
Selection of respirators should be based on the amount and type of toxin present, and should be comfortable to the user				
The issuance of respiratory equipment should include the following: a. Instruction in the proper use of respiratory equipment b. Allowing the user to become familiar with the equipment prior to use c. Qualitative or quantitative fit testing d. Positive and negative pressure field testing prior to each use e. Maintenance of fit test records				
Ensure workers are properly trained in the use of respiratory protective equipment, and are familiar with the written respiratory protection program				
Ensure workers are familiar with the following: a. Cleaning of the respirator b. Storage of the respirator c. Inspecting of the respirator d. Procedures for ordering and installing replacement parts				
Ensure all workers who wear respirators have been medically cleared to wear such equipment				
Procedures are in place to monitor the work area environment to ensure proper respiratory equipment has been selected				

Item	Y	N	N/A	Comments / Remarks
XX. Hazardous Materials				
Store flammable and combustible liquids in approved containers, and in approved fire cabinets when not in use				
Keep flammable and combustible liquids (except for storage in approved fire cabinets) at least 25 feet from any ignition source (smoking materials, open flames, electrical power, grinders, etc.)				
Use bonding straps on bare metal of containers when transferring flammable or combustible liquids between containers				
Use grounding straps on flammable or combustible liquid metal drums (when transferring liquid)				
Paint spray equipment that is bonded and grounded				
Store caustics, acids, flammables and combustibles, and oxidizers separately				
Compressed gas cylinders should be strapped in storage and transport, segregated by full or empty, and secured against falls				
Compressed gas cylinders should be tagged “empty” or “MT” when spent				
Hazardous material and chemical containers should be properly labeled (including squeeze bottles)				
Prohibit eating, smoking, drinking and applying cosmetics in hazardous materials storage and use areas				
Ensure a spill control and response program is in effect				

Item	Y	N	N/A	Comments / Remarks
Store waste chemicals (including waste paint, solvents, etc), contaminated rags, debris (including paint cans, stir sticks, paper, plastic, etc) in accumulated storage as designated by the SHSO and as follows: a. Segregated containers labeled “Hazardous Waste” with a description of the waste b. Keep lids closed on containers c. Date full containers and arrange for removal from the site				
If waste water is being generated, ensure the following: a. Label containers as described above b. Store tanks in secondary contained areas as approved by the SHSO c. Date full containers and arrange for removal from the site d. Do not overfill tanks or mishandle the waste water				
Obtain MSDS for all new materials brought onto the site				
XXI. Confined Spaces				
Provide training for employees in confined space entry				
Provide proper and appropriate equipment				

Item	Y	N	N/A	Comments / Remarks
XXI. Confined Spaces				
In manholes, ensure that vehicular exhaust or carbon monoxide cannot permeate into the space				
Examine the space for decaying vegetation or animal matter which may produce methane				
Survey the space for possible industrial waste which may contribute to the accumulation of a toxic or combustible atmosphere				
If there is inadequate natural air movement and forced ventilation is not provided, test the atmosphere for combustible gases and air contaminants				
Ensure the space is ventilated to safe levels of toxic or combustible gases before employees enter				
If ventilation is not sufficient to remove the hazardous atmosphere, ensure the employees entering the space wear the proper and approved respiratory protective equipment prior to entering the space				
Ensure that employees are trained in the use of respirators				
Ensure that the confined space entry program is in effect, and that entry permits have been filled out				
Ensure constant communication with employees in the immediate vicinity who are not within the confined space				
Ensure that the internal atmosphere is tested for toxic and combustible gases				

APPENDIX B
KEY PERSONNEL AND EMERGENCY PHONE NUMBERS

Key Personnel and Emergency Phone Numbers

Contact Name	Phone Number
New York City Police Department	911
New York City Fire Department	911
Emergency Medical Service (Ambulance)	911
New York Presbyterian Hospital 425 East 61st Street New York, NY 10065	(646)-962-2399
LIRR Movement Bureau	(718)-558-8204
Kathleen Green, Manager of Corporate Project EHS Compliance	(631)-921-1597
Joseph Menniti, Site Health and Safety Officer	Cellular: (516)-417-7819
Daniel Warren, TRC Project Manager	Office: (860)-298-6378 Cellular: (917)-232-9837
Wes Lindemuth, TRC Health and Safety Officer	Office: (917)-794-3107 Cellular: (347)-738-1452
Hasan Ahmed., NYSDEC Project Manager	(718)-482-6405
National Response Center	(800)-424-8802
NYSDEC Spill Hotline	(800)-457-7362

APPENDIX C
SAFETY DATA SHEETS
(SDS)

SAFETY DATA SHEET

Creation Date 22-Sep-2009 **Revision Date** 25-Apr-2019 **Revision Number** 6

1. Identification

Product Name **Vinylidene chloride, stabilized**

Cat No. : **AC172290000; AC172290010; AC172290025; AC172290250**

CAS-No 75-35-4
Synonyms 1,1-Dichloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 1
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 4
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 2
Specific target organ toxicity - (repeated exposure)	Category 2

Label Elements

Signal Word
Danger

Hazard Statements
Extremely flammable liquid and vapor
Harmful if swallowed
Causes serious eye irritation
Harmful if inhaled

Suspected of causing cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Vinylidene chloride	75-35-4	>95
4-Methoxyphenol	150-76-5	0.02

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.
Ingestion	Do not induce vomiting. Obtain medical attention.
Most important symptoms and effects	Breathing difficulties. . Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO_2). Dry chemical. Use water spray to cool unopened containers. Chemical foam. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	-25 °C / -13 °F
Method -	No information available
Autoignition Temperature	520 °C / 968 °F

Explosion Limits

Upper	16.5%
Lower	8.4%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Extremely flammable. Vapors may travel to source of ignition and flash back. Vapors may form explosive mixture with air. Containers may explode when heated. Vapors may form explosive mixtures with air.

Hazardous Combustion Products
Hydrogen chloride gas Carbon monoxide (CO) Carbon dioxide (CO_2) Formaldehyde peroxides
Protective Equipment and Precautions for Firefighters
Vapors are heavier than air and may spread along floors. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	4	1	N/A

6. Accidental release measures

Personal Precautions	Remove all sources of ignition. Take precautionary measures against static discharges.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Ensure adequate ventilation. Wear personal protective equipment. Avoid contact with skin and eyes. Take precautionary measures against static discharges. Do not ingest. Use only

in area provided with appropriate exhaust ventilation. Use explosion-proof equipment. Use only non-sparking tools. Avoid shock and friction. Avoid breathing dust/fume/gas/mist/vapors/spray. Keep away from open flames, hot surfaces and sources of ignition. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.

Storage

Refrigerator/flammables. Keep away from heat and sources of ignition. Protect from light. May form explosive peroxides on prolonged storage. Keep under nitrogen. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Vinylidene chloride	TWA: 5 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 4 mg/m^3		TWA: 5 ppm
4-Methoxyphenol	TWA: 5 mg/m^3	(Vacated) TWA: 5 mg/m^3	TWA: 5 mg/m^3	TWA: 5 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use explosion-proof electrical/ventilating/lighting/equipment. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	7 2.5 g/l aq.sol
Melting Point/Range	-122 °C / -187.6 °F
Boiling Point/Range	31.2 - 32 °C / 88.2 - 89.6 °F @ 760 mmHg
Flash Point	-25 °C / -13 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	16.5%
Lower	8.4%
Vapor Pressure	665 mbar @ 20 °C
Vapor Density	3.4 (Air = 1.0)

Specific Gravity	1.218
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	520 °C / 968 °F
Decomposition Temperature	No information available
Viscosity	.377 mPa.s at 15 °C
Molecular Formula	C2 H2 Cl2
Molecular Weight	96.94

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability May form explosive peroxides. Hazardous polymerization may occur upon depletion of inhibitor. Moisture sensitive. Air sensitive. Light sensitive.

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Excess heat. Exposure to air. Exposure to light. Incompatible products. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Powdered metal salts, oxygen, Peroxides, Metals, copper, Powdered metals, Acids

Hazardous Decomposition Products Hydrogen chloride gas, Carbon monoxide (CO), Carbon dioxide (CO_2), Formaldehyde, peroxides

Hazardous Polymerization Hazardous polymerization may occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50 Category 4. ATE = 300 - 2000 mg/kg.

Vapor LC50 Category 4. ATE = 10 - 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Vinylidene chloride	LD50 = 1500 mg/kg (Rat) LD50 = 200 mg/kg (Rat)	Not listed	LC50 = 1.66 mg/L (Rat) 4 h LC50 = 6350 ppm (Rat) 4 h
4-Methoxyphenol	1600 mg/kg (Rat)	LD50 > 2000 mg/kg (Rabbit)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation May cause eye, skin, and respiratory tract irritation

Sensitization No information available

Carcinogenicity Limited evidence of a carcinogenic effect. The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Vinylidene chloride	75-35-4	Group 2B	Not listed	Not listed	X	Not listed
4-Methoxyphenol	150-76-5	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects Ames test: positive.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Vinylidene chloride	Not listed	LC50: 85 - 117 mg/L, 96h flow-through (Pimephales promelas) LC50: 161 - 179 mg/L, 96h static (Pimephales promelas) LC50: 57 - 91 mg/L, 96h static (Lepomis macrochirus)	EC50 > 2000 mg/L 17 h	LC50: 62 - 110 mg/L, 48h Static (Daphnia magna) LC50: 9.0 - 14.0 mg/L, 48h Static (Daphnia magna)
4-Methoxyphenol	Not listed	LC50: = 84.3 mg/L, 96h flow-through (Pimephales promelas) LC50: = 28.5 mg/L, 96h flow-through (Oncorhynchus mykiss)	EC50 = 3.66 mg/L 5 min EC50 = 4.30 mg/L 15 min EC50 = 4.61 mg/L 30 min	Not listed

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Vinylidene chloride	2.02
4-Methoxyphenol	1.3

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Vinylidene chloride - 75-35-4	U078	-

14. Transport information

DOT

UN-No UN1303

Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Packing Group I

TDG
UN-No UN1303
Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Packing Group I

IATA
UN-No UN1303
Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Packing Group I

IMDG/IMO
UN-No UN1303
Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Subsidiary Hazard Class P
Packing Group I

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Vinylidene chloride	75-35-4	X	ACTIVE	-
4-Methoxyphenol	150-76-5	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Vinylidene chloride	75-35-4	X	-	200-864-0	X	X	X	X	KE-10122
4-Methoxyphenol	150-76-5	X	-	205-769-8	X	X	X	X	KE-23353

U.S. Federal Regulations

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Vinylidene chloride	75-35-4	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Vinylidene chloride	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Vinylidene chloride	X		-

OSHA - Occupational Safety and Health Administration: Not applicable

CERCLA: This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Vinylidene chloride	100 lb 1 lb	-

California Proposition 65: This product does not contain any Proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Vinylidene chloride	75-35-4	Carcinogen	0.88 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Vinylidene chloride	X	X	X	X	X
4-Methoxyphenol	X	X	X	-	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security: This product contains the following DHS chemicals:
Legend - STQs = Screening Threshold Quantities, APA = A placarded amount

Component	DHS Chemical Facility Anti-Terrorism Standard
Vinylidene chloride	Release STQs - 10000lb

Other International Regulations

Mexico - Grade: No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 22-Sep-2009
Revision Date 25-Apr-2019
Print Date 25-Apr-2019
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 04-Feb-2010 **Revision Date** 18-Jan-2018 **Revision Number** 6

1. Identification

Product Name 1,2-Dichloroethane

Cat No. : E175-4; E175-20; E175-500; E175RS-19; E175RS-50; E190-4

CAS-No 107-06-2
Synonyms Ethylene dichloride; Ethylene chloride (Certified ACS/Spectranalyzed)

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 3
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system, Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if swallowed
Causes skin irritation
Causes serious eye irritation

Toxic if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Ethylene dichloride	107-06-2	>95

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms and effects Breathing difficulties. May cause cardiac arrhythmia. May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.

Unsuitable Extinguishing Media Water may be ineffective

Flash Point 13 °C / 55.4 °F

Method - No information available

Autoignition Temperature 440 °C / 824 °F

Explosion Limits

Upper 15.9 vol %

Lower 6.2 vol %

Sensitivity to Mechanical Impact No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Keep product and empty container away from heat and sources of ignition. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO_2) Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	3	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Take precautionary measures against static discharges.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Ethylene dichloride	TWA: 10 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 4 mg/m^3 Ceiling: 100 ppm (Vacated) STEL: 2 ppm (Vacated) STEL: 8 mg/m^3 TWA: 50 ppm	IDLH: 50 ppm TWA: 1 ppm TWA: 4 mg/m^3 STEL: 2 ppm STEL: 8 mg/m^3	TWA: 10 ppm TWA: 40 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tightly fitting safety goggles. Face-shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	sweet
Odor Threshold	400 ppm
pH	No information available
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	81 - 85 °C / 177.8 - 185 °F
Flash Point	13 °C / 55.4 °F
Evaporation Rate	6.5 (Butyl Acetate = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.9 vol %
Lower	6.2 vol %
Vapor Pressure	65 mmHg @ 29 °C
Vapor Density	3.4
Specific Gravity	1.250
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	0.8 mPa s at 20 °C
Molecular Formula	C2 H4 Cl2
Molecular Weight	98.96

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents, Bases, Alkali metals

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ethylene dichloride	625 mg/kg (Rat) 413 mg/kg (Mouse)	2800 mg/kg (Rabbit)	28.79 mg/L (Rat) 1h 7.8 mg/l (Rat) 4h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Ethylene dichloride	107-06-2	Group 2B	Reasonably Anticipated	Not listed	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Ethylene dichloride	EC50: = 166 mg/L, 96h static (Desmodesmus subspicatus) EC50: > 433 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 110 - 123 mg/L, 96h flow-through (Pimephales promelas) LC50: 230 - 710 mg/L, 96h flow-through (Lepomis macrochirus) LC50: = 225 mg/L, 96h static (Oncorhynchus mykiss)	Not listed	EC50: 140 - 190 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Ethylene dichloride	1.45

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Ethylene dichloride - 107-06-2	U077	-

14. Transport information

DOT

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

TDG

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IATA

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IMDG/IMO

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Ethylene dichloride	X	X	-	203-458-1	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Component	TSCA 12(b)
Ethylene dichloride	Section 4

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Ethylene dichloride	107-06-2	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Ethylene dichloride	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Ethylene dichloride	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Ethylene dichloride	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Ethylene dichloride	107-06-2	Carcinogen	10 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Ethylene dichloride	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 04-Feb-2010
Revision Date 18-Jan-2018
Print Date 18-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 24-Nov-2010 **Revision Date** 18-Jan-2018 **Revision Number** 3

1. Identification

Product Name **Carbon tetrachloride**

Cat No. : **AC148170000; AC148170010; AC148170025**

Synonyms Tetrachloromethane

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 3
Acute dermal toxicity	Category 3
Acute Inhalation Toxicity - Dusts and Mists	Category 3
Carcinogenicity	Category 2
Specific target organ toxicity - (repeated exposure)	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
Toxic if swallowed
Toxic in contact with skin
Toxic if inhaled
May cause cancer
Causes damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician
Skin
IF ON SKIN: Wash with plenty of soap and water
Call a POISON CENTER or doctor/physician if you feel unwell
Remove/Take off immediately all contaminated clothing
Wash contaminated clothing before reuse
Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Rinse mouth
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
Harms public health and the environment by destroying ozone in the upper atmosphere
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Carbon tetrachloride	56-23-5	>95

4. First-aid measures

Eye Contact Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. If not breathing, give artificial respiration.

Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Drowsiness. Dizziness. Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	982 °C / 1799.6 °F
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Hydrogen chloride gas Carbon monoxide (CO) Carbon dioxide (CO_2) Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation. Avoid contact with the skin and the eyes. Keep people away from and upwind of spill/leak.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Ensure adequate ventilation. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Carbon tetrachloride	TWA: 5 ppm STEL: 10 ppm Skin	(Vacated) TWA: 2 ppm (Vacated) TWA: 12.6 mg/m^3 Ceiling: 25 ppm TWA: 10 ppm	IDLH: 200 ppm STEL: 2 ppm STEL: 12.6 mg/m^3	TWA: 5 ppm TWA: 30 mg/m^3 STEL: 20 ppm STEL: 126 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	No information available
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-23 °C / -9.4 °F
Boiling Point/Range	76 °C / 168.8 °F
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	121 mbar @ 20 °C
Vapor Density	No information available
Specific Gravity	1.594
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	982 °C / 1799.6 °F
Decomposition Temperature	> 100°C
Viscosity	0.97 mPa.s at 20 °C
Molecular Formula	C Cl4
Molecular Weight	153.82

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products.

Incompatible Materials Strong oxidizing agents, Fluorine, Metals

Hazardous Decomposition Products Hydrogen chloride gas, Carbon monoxide (CO), Carbon dioxide (CO_2), Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbon tetrachloride	LD50 = 2350 mg/kg (Rat)	LD50 = 5070 mg/kg (Rat)	LC50 = 8000 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. Limited evidence of a carcinogenic effect.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Carbon tetrachloride	56-23-5	Group 2B	Reasonably Anticipated	A2	X	A2

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Carbon tetrachloride	EC50: = 830 mg/L, 24h	LC50: 9.68 - 11.3 mg/L, 96h	EC50 = 34 mg/L 10 min	EC50: = 28 mg/L, 24h

	(Tetrahymena pyriformis)	static (Pimephales promelas) LC50: 23 - 33 mg/L, 96h static (Lepomis macrochirus) LC50: 36.3 - 47.3 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 5.6 mg/L 5 min	(Daphnia magna) EC50: = 29 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Carbon tetrachloride	2.75

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Carbon tetrachloride - 56-23-5	U211	-

14. Transport information

DOT
- **UN-No** 1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

TDG
- **UN-No** 1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

IATA
- **UN-No** UN1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

IMDG/IMO
- **UN-No** UN1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Carbon tetrachloride	X	X	-	200-262-8	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Carbon tetrachloride	56-23-5	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Carbon tetrachloride	X	10 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Carbon tetrachloride	X	X	-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Carbon tetrachloride	10 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Carbon tetrachloride	56-23-5	Carcinogen	5 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Carbon tetrachloride	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	24-Nov-2010
Revision Date	18-Jan-2018
Print Date	18-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 22-Sep-2009 **Revision Date** 25-Apr-2019 **Revision Number** 6

1. Identification

Product Name **Vinylidene chloride, stabilized**

Cat No. : **AC172290000; AC172290010; AC172290025; AC172290250**

CAS-No 75-35-4
Synonyms 1,1-Dichloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 1
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 4
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 2
Specific target organ toxicity - (repeated exposure)	Category 2

Label Elements

Signal Word
Danger

Hazard Statements
Extremely flammable liquid and vapor
Harmful if swallowed
Causes serious eye irritation
Harmful if inhaled

Suspected of causing cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Vinylidene chloride	75-35-4	>95
4-Methoxyphenol	150-76-5	0.02

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.
Ingestion	Do not induce vomiting. Obtain medical attention.
Most important symptoms and effects	Breathing difficulties. . Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO_2). Dry chemical. Use water spray to cool unopened containers. Chemical foam. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	-25 °C / -13 °F
Method -	No information available
Autoignition Temperature	520 °C / 968 °F

Explosion Limits

Upper	16.5%
Lower	8.4%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Extremely flammable. Vapors may travel to source of ignition and flash back. Vapors may form explosive mixture with air. Containers may explode when heated. Vapors may form explosive mixtures with air.

Hazardous Combustion Products
Hydrogen chloride gas Carbon monoxide (CO) Carbon dioxide (CO_2) Formaldehyde peroxides
Protective Equipment and Precautions for Firefighters
Vapors are heavier than air and may spread along floors. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	4	1	N/A

6. Accidental release measures

Personal Precautions	Remove all sources of ignition. Take precautionary measures against static discharges.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Ensure adequate ventilation. Wear personal protective equipment. Avoid contact with skin and eyes. Take precautionary measures against static discharges. Do not ingest. Use only

in area provided with appropriate exhaust ventilation. Use explosion-proof equipment. Use only non-sparking tools. Avoid shock and friction. Avoid breathing dust/fume/gas/mist/vapors/spray. Keep away from open flames, hot surfaces and sources of ignition. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.

Storage

Refrigerator/flammables. Keep away from heat and sources of ignition. Protect from light. May form explosive peroxides on prolonged storage. Keep under nitrogen. Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Vinylidene chloride	TWA: 5 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 4 mg/m^3		TWA: 5 ppm
4-Methoxyphenol	TWA: 5 mg/m^3	(Vacated) TWA: 5 mg/m^3	TWA: 5 mg/m^3	TWA: 5 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures

Use explosion-proof electrical/ventilating/lighting/equipment. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection

Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection

Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	7 2.5 g/l aq.sol
Melting Point/Range	-122 °C / -187.6 °F
Boiling Point/Range	31.2 - 32 °C / 88.2 - 89.6 °F @ 760 mmHg
Flash Point	-25 °C / -13 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	16.5%
Lower	8.4%
Vapor Pressure	665 mbar @ 20 °C
Vapor Density	3.4 (Air = 1.0)

Specific Gravity	1.218
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	520 °C / 968 °F
Decomposition Temperature	No information available
Viscosity	.377 mPa.s at 15 °C
Molecular Formula	C2 H2 Cl2
Molecular Weight	96.94

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability May form explosive peroxides. Hazardous polymerization may occur upon depletion of inhibitor. Moisture sensitive. Air sensitive. Light sensitive.

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Excess heat. Exposure to air. Exposure to light. Incompatible products. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Powdered metal salts, oxygen, Peroxides, Metals, copper, Powdered metals, Acids

Hazardous Decomposition Products Hydrogen chloride gas, Carbon monoxide (CO), Carbon dioxide (CO_2), Formaldehyde, peroxides

Hazardous Polymerization Hazardous polymerization may occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50 Category 4. ATE = 300 - 2000 mg/kg.

Vapor LC50 Category 4. ATE = 10 - 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Vinylidene chloride	LD50 = 1500 mg/kg (Rat) LD50 = 200 mg/kg (Rat)	Not listed	LC50 = 1.66 mg/L (Rat) 4 h LC50 = 6350 ppm (Rat) 4 h
4-Methoxyphenol	1600 mg/kg (Rat)	LD50 > 2000 mg/kg (Rabbit)	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation May cause eye, skin, and respiratory tract irritation

Sensitization No information available

Carcinogenicity Limited evidence of a carcinogenic effect. The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Vinylidene chloride	75-35-4	Group 2B	Not listed	Not listed	X	Not listed
4-Methoxyphenol	150-76-5	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects Ames test: positive.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Vinylidene chloride	Not listed	LC50: 85 - 117 mg/L, 96h flow-through (Pimephales promelas) LC50: 161 - 179 mg/L, 96h static (Pimephales promelas) LC50: 57 - 91 mg/L, 96h static (Lepomis macrochirus)	EC50 > 2000 mg/L 17 h	LC50: 62 - 110 mg/L, 48h Static (Daphnia magna) LC50: 9.0 - 14.0 mg/L, 48h Static (Daphnia magna)
4-Methoxyphenol	Not listed	LC50: = 84.3 mg/L, 96h flow-through (Pimephales promelas) LC50: = 28.5 mg/L, 96h flow-through (Oncorhynchus mykiss)	EC50 = 3.66 mg/L 5 min EC50 = 4.30 mg/L 15 min EC50 = 4.61 mg/L 30 min	Not listed

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Vinylidene chloride	2.02
4-Methoxyphenol	1.3

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Vinylidene chloride - 75-35-4	U078	-

14. Transport information

DOT

UN-No UN1303

Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Packing Group I

TDG
UN-No UN1303
Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Packing Group I

IATA
UN-No UN1303
Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Packing Group I

IMDG/IMO
UN-No UN1303
Proper Shipping Name VINYLIDENE CHLORIDE, STABILIZED
Hazard Class 3
Subsidiary Hazard Class P
Packing Group I

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
Vinylidene chloride	75-35-4	X	ACTIVE	-
4-Methoxyphenol	150-76-5	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
Vinylidene chloride	75-35-4	X	-	200-864-0	X	X	X	X	KE-10122
4-Methoxyphenol	150-76-5	X	-	205-769-8	X	X	X	X	KE-23353

U.S. Federal Regulations

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Vinylidene chloride	75-35-4	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Vinylidene chloride	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Vinylidene chloride	X		-

OSHA - Occupational Safety and Health Administration: Not applicable

CERCLA: This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Vinylidene chloride	100 lb 1 lb	-

California Proposition 65: This product does not contain any Proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Vinylidene chloride	75-35-4	Carcinogen	0.88 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Vinylidene chloride	X	X	X	X	X
4-Methoxyphenol	X	X	X	-	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security: This product contains the following DHS chemicals:
Legend - STQs = Screening Threshold Quantities, APA = A placarded amount

Component	DHS Chemical Facility Anti-Terrorism Standard
Vinylidene chloride	Release STQs - 10000lb

Other International Regulations

Mexico - Grade: No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 22-Sep-2009
Revision Date 25-Apr-2019
Print Date 25-Apr-2019
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

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End of SDS

SAFETY DATA SHEET

Creation Date 04-Feb-2010 **Revision Date** 18-Jan-2018 **Revision Number** 6

1. Identification

Product Name 1,2-Dichloroethane

Cat No. : E175-4; E175-20; E175-500; E175RS-19; E175RS-50; E190-4

CAS-No 107-06-2
Synonyms Ethylene dichloride; Ethylene chloride (Certified ACS/Spectranalyzed)

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Vapors	Category 3
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system, Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if swallowed
Causes skin irritation
Causes serious eye irritation

Toxic if inhaled
May cause respiratory irritation
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear eye/face protection
Do not breathe dust/fume/gas/mist/vapors/spray
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Ethylene dichloride	107-06-2	>95

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms and effects Breathing difficulties. May cause cardiac arrhythmia. May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.

Unsuitable Extinguishing Media Water may be ineffective

Flash Point 13 °C / 55.4 °F

Method - No information available

Autoignition Temperature 440 °C / 824 °F

Explosion Limits

Upper 15.9 vol %

Lower 6.2 vol %

Sensitivity to Mechanical Impact No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Keep product and empty container away from heat and sources of ignition. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO_2) Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	3	0	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Ensure adequate ventilation. Remove all sources of ignition. Take precautionary measures against static discharges.

Environmental Precautions Should not be released into the environment. See Section 12 for additional ecological information.

Methods for Containment and Clean Up Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment.

7. Handling and storage

Handling Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Do not ingest. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded. Take precautionary measures against static discharges.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Ethylene dichloride	TWA: 10 ppm	(Vacated) TWA: 1 ppm (Vacated) TWA: 4 mg/m^3 Ceiling: 100 ppm (Vacated) STEL: 2 ppm (Vacated) STEL: 8 mg/m^3 TWA: 50 ppm	IDLH: 50 ppm TWA: 1 ppm TWA: 4 mg/m^3 STEL: 2 ppm STEL: 8 mg/m^3	TWA: 10 ppm TWA: 40 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. Tightly fitting safety goggles. Face-shield.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	sweet
Odor Threshold	400 ppm
pH	No information available
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	81 - 85 °C / 177.8 - 185 °F
Flash Point	13 °C / 55.4 °F
Evaporation Rate	6.5 (Butyl Acetate = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.9 vol %
Lower	6.2 vol %
Vapor Pressure	65 mmHg @ 29 °C
Vapor Density	3.4
Specific Gravity	1.250
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	440 °C / 824 °F
Decomposition Temperature	No information available
Viscosity	0.8 mPa s at 20 °C
Molecular Formula	C2 H4 Cl2
Molecular Weight	98.96

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents, Bases, Alkali metals

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ethylene dichloride	625 mg/kg (Rat) 413 mg/kg (Mouse)	2800 mg/kg (Rabbit)	28.79 mg/L (Rat) 1h 7.8 mg/l (Rat) 4h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Ethylene dichloride	107-06-2	Group 2B	Reasonably Anticipated	Not listed	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed May cause central nervous system depression: Symptoms may include tightness in the chest, flushing, headache, nausea, vomiting, respiratory depression, weakness, irregular heartbeat, abdominal pain, convulsions, and shock

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Ethylene dichloride	EC50: = 166 mg/L, 96h static (Desmodesmus subspicatus) EC50: > 433 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 110 - 123 mg/L, 96h flow-through (Pimephales promelas) LC50: 230 - 710 mg/L, 96h flow-through (Lepomis macrochirus) LC50: = 225 mg/L, 96h static (Oncorhynchus mykiss)	Not listed	EC50: 140 - 190 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Ethylene dichloride	1.45

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Ethylene dichloride - 107-06-2	U077	-

14. Transport information

DOT

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

TDG

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IATA

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

IMDG/IMO

UN-No	UN1184
Proper Shipping Name	ETHYLENE DICHLORIDE
Hazard Class	3
Subsidiary Hazard Class	6.1
Packing Group	II

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Ethylene dichloride	X	X	-	203-458-1	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Component	TSCA 12(b)
Ethylene dichloride	Section 4

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Ethylene dichloride	107-06-2	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Ethylene dichloride	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Ethylene dichloride	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Ethylene dichloride	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Ethylene dichloride	107-06-2	Carcinogen	10 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Ethylene dichloride	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 04-Feb-2010
Revision Date 18-Jan-2018
Print Date 18-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 24-Nov-2010 **Revision Date** 18-Jan-2018 **Revision Number** 3

1. Identification

Product Name **Carbon tetrachloride**

Cat No. : **AC148170000; AC148170010; AC148170025**

Synonyms Tetrachloromethane

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 3
Acute dermal toxicity	Category 3
Acute Inhalation Toxicity - Dusts and Mists	Category 3
Carcinogenicity	Category 2
Specific target organ toxicity - (repeated exposure)	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
Toxic if swallowed
Toxic in contact with skin
Toxic if inhaled
May cause cancer
Causes damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician
Skin
IF ON SKIN: Wash with plenty of soap and water
Call a POISON CENTER or doctor/physician if you feel unwell
Remove/Take off immediately all contaminated clothing
Wash contaminated clothing before reuse
Ingestion
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
Rinse mouth
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
Harms public health and the environment by destroying ozone in the upper atmosphere
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Carbon tetrachloride	56-23-5	>95

4. First-aid measures

Eye Contact Immediate medical attention is required. Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. If not breathing, give artificial respiration.

Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Drowsiness. Dizziness. Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	982 °C / 1799.6 °F
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Hydrogen chloride gas Carbon monoxide (CO) Carbon dioxide (CO_2) Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation. Avoid contact with the skin and the eyes. Keep people away from and upwind of spill/leak.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Ensure adequate ventilation. Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation.
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Carbon tetrachloride	TWA: 5 ppm STEL: 10 ppm Skin	(Vacated) TWA: 2 ppm (Vacated) TWA: 12.6 mg/m^3 Ceiling: 25 ppm TWA: 10 ppm	IDLH: 200 ppm STEL: 2 ppm STEL: 12.6 mg/m^3	TWA: 5 ppm TWA: 30 mg/m^3 STEL: 20 ppm STEL: 126 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	No information available
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-23 °C / -9.4 °F
Boiling Point/Range	76 °C / 168.8 °F
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	121 mbar @ 20 °C
Vapor Density	No information available
Specific Gravity	1.594
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	982 °C / 1799.6 °F
Decomposition Temperature	> 100°C
Viscosity	0.97 mPa.s at 20 °C
Molecular Formula	C Cl4
Molecular Weight	153.82

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products.

Incompatible Materials Strong oxidizing agents, Fluorine, Metals

Hazardous Decomposition Products Hydrogen chloride gas, Carbon monoxide (CO), Carbon dioxide (CO_2), Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Carbon tetrachloride	LD50 = 2350 mg/kg (Rat)	LD50 = 5070 mg/kg (Rat)	LC50 = 8000 ppm (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. Limited evidence of a carcinogenic effect.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Carbon tetrachloride	56-23-5	Group 2B	Reasonably Anticipated	A2	X	A2

Mutagenic Effects Not mutagenic in AMES Test

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

The product contains following substances which are hazardous for the environment. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Carbon tetrachloride	EC50: = 830 mg/L, 24h	LC50: 9.68 - 11.3 mg/L, 96h	EC50 = 34 mg/L 10 min	EC50: = 28 mg/L, 24h

	(Tetrahymena pyriformis)	static (Pimephales promelas) LC50: 23 - 33 mg/L, 96h static (Lepomis macrochirus) LC50: 36.3 - 47.3 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 5.6 mg/L 5 min	(Daphnia magna) EC50: = 29 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Carbon tetrachloride	2.75

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Carbon tetrachloride - 56-23-5	U211	-

14. Transport information

DOT
- **UN-No** 1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

TDG
- **UN-No** 1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

IATA
- **UN-No** UN1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

IMDG/IMO
- **UN-No** UN1846
- **Proper Shipping Name** CARBON TETRACHLORIDE
- **Hazard Class** 6.1
- **Packing Group** II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Carbon tetrachloride	X	X	-	200-262-8	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Carbon tetrachloride	56-23-5	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Carbon tetrachloride	X	10 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Carbon tetrachloride	X	X	-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Carbon tetrachloride	10 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Carbon tetrachloride	56-23-5	Carcinogen	5 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Carbon tetrachloride	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date	24-Nov-2010
Revision Date	18-Jan-2018
Print Date	18-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 28-May-2009 **Revision Date** 17-Jan-2018 **Revision Number** 3

1. Identification

Product Name **tert-Butyl methyl ether**

Cat No. : **E127-4; XXE127RS200; NC1240503; XXE127U200LI; NC1568440; E127RS1350ASME; NC1561779**

CAS-No 1634-04-4
Synonyms 2-Methyl-2-methoxy propane; MTBE; Methyl tert-butyl ether

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Skin Corrosion/irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Lungs.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Causes skin irritation
May cause respiratory irritation



Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Avoid breathing dust/fume/gas/mist/vapors/spray
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

Other hazards
Aspiration hazard if swallowed - can enter lungs and cause damage.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Methyl tert-butyl ether	1634-04-4	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Inhalation	Move to fresh air. Get medical attention immediately if symptoms occur. If not breathing, give artificial respiration.
Ingestion	Do not induce vomiting. Obtain medical attention.
Most important symptoms and effects	Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	-28 °C / -18.4 °F
Method -	No information available
Autoignition Temperature	224 °C / 435.2 °F
Explosion Limits	
Upper	15.1 vol %
Lower	1.6 vol %
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. Ensure adequate ventilation.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges. Use only under a chemical fume hood. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.
Storage	Flammables area. Keep away from heat and sources of ignition. Keep container tightly

closed in a dry and well-ventilated place. May form explosive peroxides on prolonged storage.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Methyl tert-butyl ether	TWA: 50 ppm			

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection No protective equipment is needed under normal use conditions.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Petroleum distillates
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-110 °C / -166 °F
Boiling Point/Range	54 - 56 °C / 129.2 - 132.8 °F
Flash Point	-28 °C / -18.4 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.1 vol %
Lower	1.6 vol %
Vapor Pressure	268 mbar @ 20 °C
Vapor Density	0.2
Specific Gravity	0.740
Solubility	Slightly soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	224 °C / 435.2 °F
Decomposition Temperature	No information available
Viscosity	0.36 mPa.s at 20 °C
Molecular Formula	C5 H12 O
Molecular Weight	88.15

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Methyl tert-butyl ether	LD50 = 2963 mg/kg (Rat)	LD50 = 10000 mg/kg (Rabbit)	LC50 = 85 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. Limited evidence of a carcinogenic effect.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Methyl tert-butyl ether	1634-04-4	Not listed	Not listed	A3	Not listed	Not listed

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in experimental animals.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Lungs

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Methyl tert-butyl ether	Group III Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Do not empty into drains. .

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Methyl tert-butyl ether	800 mg/L EC50 > 72 h 184 mg/L EC50 = 96 h	887 mg/L LC50 96 h 100 mg/L LC50 96 h 929 mg/L LC50 96 h 672 mg/L LC50 96 h	EC50 = 11.4 mg/L 30 min EC50 = 8.23 mg/L 5 min EC50 = 9.67 mg/L 15 min	EC50: = 542 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Methyl tert-butyl ether	1.06

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

TDG

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

IATA

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

IMDG/IMO

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Methyl tert-butyl ether	X	X	-	216-653-1	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Methyl tert-butyl ether	1634-04-4	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Methyl tert-butyl ether	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Methyl tert-butyl ether	1000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methyl tert-butyl ether	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 28-May-2009
Revision Date 17-Jan-2018

Print Date	17-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 10-Dec-2009 **Revision Date** 23-Jan-2018 **Revision Number** 5

1. Identification

Product Name **Tetrachloroethylene**

Cat No. : **AC445690000; ACR445690010; AC445690025; AC445691000**

CAS-No 127-18-4
Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products
Chlorine Hydrogen chloride gas Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m^3 Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 100 ppm TWA: 670 mg/m^3 TWA: 200 ppm TWA: 1250 mg/m^3 STEL: 200 ppm STEL: 1340 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C2 Cl4
Molecular Weight	165.83

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Exposure to moist air or water.

Incompatible Materials Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium

Hazardous Decomposition Products Chlorine, Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)
Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.53 - 2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1897

Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IMDG/IMO
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Subsidiary Hazard Class P
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Tetrachloroethylene	X	X	-	204-825-9	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 10-Dec-2009
Revision Date 23-Jan-2018
Print Date 23-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 03-Feb-2010 **Revision Date** 14-Jul-2016 **Revision Number** 2

1. Identification

Product Name **Trichloroethylene**

Cat No. : **T340-4; T341-4; T341-20; T341-500; T403-4**

Synonyms Trichloroethene (Stabilized/Technical/Electronic/Certified ACS)

Recommended Use Laboratory chemicals.
Uses advised against

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, spleen, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Trichloroethylene	79-01-6	100

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a

	pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms/effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	410 °C / 770 °F
Explosion Limits	
Upper	10.5 vol %
Lower	8 vol %
Oxidizing Properties	Not oxidising
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Hydrogen chloride gas Chlorine Phosgene Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Trichloroethylene	TWA: 10 ppm STEL: 25 ppm	(Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m³ Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m³ TWA: 100 ppm	IDLH: 1000 ppm	TWA: 100 ppm TWA: 535 mg/m³ STEL: 200 ppm STEL: 1080 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-85 °C / -121 °F
Boiling Point/Range	87 °C / 188.6 °F
Flash Point	No information available
Evaporation Rate	0.69 (Carbon Tetrachloride = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	10.5 vol %
Lower	8 vol %
Vapor Pressure	77.3 mbar @ 20 °C
Vapor Density	4.5 (Air = 1.0)
Specific Gravity	1.460
Solubility	Slightly soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	410 °C / 770 °F
Decomposition Temperature	> 120°C
Viscosity	0.55 mPa.s (25°C)

Molecular Formula C2 H Cl3
Molecular Weight 131.39

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals,

Hazardous Decomposition Products Hydrogen chloride gas, Chlorine, Phosgene, Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Trichloroethylene	LD50 = 4290 mg/kg (Rat) LD50 = 4920 mg/kg (Rat)	LD50 > 20 g/kg (Rabbit) LD50 = 29000 mg/kg (Rabbit)	LC50 = 26 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Trichloroethylene	79-01-6	Group 1	Reasonably Anticipated	A2	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart spleen Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is:. Harmful to aquatic organisms. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Trichloroethylene	EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus)	LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus) LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min	EC50: = 2.2 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Trichloroethylene	2.4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Trichloroethylene - 79-01-6	U228	-

14. Transport information

DOT

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE

Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Trichloroethylene	X	X	-	201-167-4	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

Component	TSCA 12(b)
Trichloroethylene	Section 5

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Trichloroethylene	79-01-6	100	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard Yes
Chronic Health Hazard Yes
Fire Hazard No
Sudden Release of Pressure Hazard No
Reactive Hazard No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Trichloroethylene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Trichloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Trichloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Trichloroethylene	79-01-6	Carcinogen Developmental Male Reproductive	14 µg/day 50 µg/day	Developmental Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-Feb-2010
Revision Date 14-Jul-2016
Print Date 14-Jul-2016
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

M9192 - ANSI - EN

Oxy Vinyls, LP
A subsidiary of Occidental Petroleum Corporation

VINYL CHLORIDE (MONOMER)

SDS No.: M9192 **SDS Revision Date:** 06-Apr-2015

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Company Identification:	Oxy Vinyls, LP 5005 LBJ Freeway Suite 2200 Dallas, Texas 75244-6119
24 Hour Emergency Telephone Number:	1-800-733-3665 or 1-972-404-3228 (USA); CHEMTREC (within USA and Canada): 1-800-424-9300; CHEMTREC (outside USA and Canada): +1 703-527-3887; CHEMTREC Contract No: CCN16186
To Request an SDS:	MSDS@oxy.com or 1-972-404-3245
Customer Service:	1-800-752-5151 or 1-972-404-3700
Product Identifier:	**VINYL CHLORIDE (MONOMER)**
Synonyms:	VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer
Product Use:	PVC Manufacturing
Uses Advised Against:	Aerosol propellant.

2. HAZARDS IDENTIFICATION

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

VINYL CHLORIDE (MONOMER)

SDS No.: M9192 **SDS Revision Date:** 06-Apr-2015

****

EMERGENCY OVERVIEW:

Color: Colorless
Physical state Compressed, liquefied gas
Odor: Sweet

Signal Word: **DANGER**

MAJOR HEALTH HAZARDS: CONTAINS VINYL CHLORIDE, A KNOWN HUMAN CANCER AGENT. MAY CAUSE CANCER. CONTACT WITH LIQUID MAY CAUSE FROSTBITE TO EXPOSED TISSUE. MAY PRODUCE SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION INCLUDING HEADACHE, DIZZINESS, NAUSEA, LOSS OF BALANCE AND DROWSINESS. CAUSES SKIN IRRITATION. CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY IRRITATION. CAUSES DAMAGE TO LIVER, BLOOD, NERVOUS SYSTEM, LYMPHATIC SYSTEM, AND MUSCULOSKELETAL SYSTEM THROUGH PROLONGED OR REPEATED EXPOSURE. CAUSES DAMAGE TO LUNGS THROUGH PROLONGED OR REPEATED EXPOSURE BY INHALATION. SUSPECTED OF CAUSING GENETIC DEFECTS. SUSPECTED REPRODUCTIVE HAZARD.

PHYSICAL HAZARDS: Extremely flammable gas under pressure.

PRECAUTIONARY STATEMENTS: Keep away from heat, sparks and flame. Wash thoroughly after handling. Avoid contact with eyes, skin and clothing. Do not breathe vapors or spray mist. Do not eat, drink or smoke in areas where this material is used. Use only outdoors or in a well-ventilated area. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Store in well-ventilated place. Keep container tightly closed.

****

GHS CLASSIFICATION:

GHS: PHYSICAL HAZARDS:	Flammable Gas - Cat. 1 Extremely Flammable Gas Under Pressure - Liquefied
GHS: CONTACT HAZARD - SKIN:	Category 2 - Causes skin irritation.
GHS: CONTACT HAZARD - EYE:	Category 2B - Causes eye irritation
GHS: TARGET ORGAN TOXICITY (SINGLE EXPOSURE):	Category 3 - May cause respiratory tract irritation Category 3 - May cause drowsiness or dizziness
GHS: TARGET ORGAN TOXICITY (REPEATED EXPOSURE):	Category 1 - Causes damage to liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system through prolonged or repeated exposure
GHS: CARCINOGENICITY:	Category 1A - May cause cancer.
GHS: GERM CELL MUTAGENICITY:	Category 2 - Suspected of causing genetic defects
GHS: REPRODUCTION TOXIN:	Category 2 - Suspected of damaging fertility or the unborn child
GHS - OSHA Hazard(s)	Simple Asphyxiant: May displace oxygen and cause rapid suffocation

Unknown Acute Dermal Toxicity:
100% of this product consists of ingredient(s) of unknown acute dermal toxicity.

Unknown Acute Inhalation Toxicity:
100% of this product consists of ingredient(s) of unknown acute inhalation toxicity.

GHS SYMBOL:
Flame, Gas cylinder, Exclamation mark, Health hazards



GHS SIGNAL WORD: **DANGER**

GHS HAZARD STATEMENTS:

GHS - Physical Hazard Statement(s)
Extremely flammable gas
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation

GHS - Health Hazard Statement(s)
Causes eye irritation
Causes skin irritation
May cause drowsiness or dizziness
May cause respiratory irritation
Causes damage to organs through prolonged or repeated exposure: (liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system)
May cause cancer
Suspected of causing genetic defects
Suspected of damaging fertility or the unborn child

GHS - OSHA Hazard(s)
Simple Asphyxiant: May displace oxygen and cause rapid suffocation

GHS - Precautionary Statement(s) - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. — No smoking
Do not breathe dust/fume/gas/mist/vapors/spray
Use personal protective equipment as required
Wear protective gloves/protective clothing/eye protection/face protection
Wash thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area

GHS - Precautionary Statement(s) - Response
Leaking gas fire: Do not extinguish, unless leak can be stopped safely
Eliminate all ignition sources if safe to do so
IF INHALED: Remove person to fresh air and keep comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
IF ON SKIN: Wash with plenty of water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash it before reuse
Specific treatment (see First Aid information on product label and/or Section 4 of the SDS)
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Specific treatment (see Section 4 of the safety data sheet and/or the First Aid information on the product label)
Get medical advice/attention if you feel unwell
IF exposed or concerned: call a POISON CENTER or doctor/physician

GHS - Precautionary Statement(s) - Storage
Store in a well-ventilated place. Keep container tightly closed
Protect from sunlight
Store locked up

GHS - Precautionary Statement(s) - Disposal
Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations.

Hazards Not Otherwise Classified (HNOC)
Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.)
Polymerization can occur

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer

Component	Percent [%]	CAS Number
Vinyl chloride	99 - 100	75-01-4

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: If frostbite or freezing occur, immediately flush with plenty of lukewarm water (100-105 °F, 38-41 °C). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure in occupational environment.

Most Important Symptoms/Effects (Acute and Delayed) :.

Acute Symptoms/Effects: Listed below. Prolonged, high concentration exposures may cause unconsciousness or death.
Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
Ingestion (Swallowing): Ingestion is not a likely route of exposure.
Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Delayed Symptoms/Effects:
- Carcinogen: Long term significant occupational overexposure to VCM has been associated with a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer
- Suspected mutagen and suspected of causing reproductive damage
- Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hand (Raynaud's Syndrome)
- Scleroderma is characterized by a hardening and tightening of patches of skin
- Raynaud's syndrome is characterized by an exaggerated response to cold temperatures or emotional distress, which can cause numbness, pain or color changes in the fingers or toes

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

Medical Conditions Aggravated by Exposure: Alcoholic Liver Disease. Infectious Hepatitis. Cirrhosis.

Protection of First-Aiders: Protect yourself by avoiding contact with this material. Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.). Use personal protective equipment. Refer to Section 8 for specific personal protective equipment recommendations. At minimum, treating personnel should utilize PPE sufficient for prevention of bloodborne pathogen transmission.

Notes to Physician: There is no specific antidote. Treat symptoms with supportive care. Cardiac stimulants such as epinephrine should be avoided in persons overexposed to chlorinated hydrocarbons.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Severe fire hazard. Vapor/air mixtures are explosive. Vapors or gases may ignite at distant sources and flash back. Containers may rupture or explode if exposed to heat.

Extinguishing Media: Stop flow of gas before extinguishing fire. Use carbon dioxide, regular dry chemical, foam or water. Use water spray to keep containers cool.

Fire Fighting: Move container from fire area if it can be done without risk. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this can't be done, then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode.

Hazardous Combustion Products:	Oxides of carbon, Hydrogen chloride, Phosgene
Sensitivity to Mechanical Impact:	Not sensitive.
Sensitivity to Static Discharge:	Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Flash point:	-108 °F (-78 °C)
Auto-ignition Temperature:	882 °F (472 °C)

GHS: PHYSICAL HAZARDS:
- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:
Isolate hazard area and deny entry. Keep unnecessary and unprotected persons away. Eliminate all sources of heat and ignition. Ventilate closed spaces before entering. Wear appropriate personal protective equipment recommended in Section 8, Exposure Controls / Personal Protection, of the SDS. Refer to Section 7, Handling and Storage, for additional precautionary measures.

Methods and Materials for Containment and Cleaning Up:
Remove sources of ignition. Ventilate closed spaces before entering. Stop leak if possible without personal risk. Vapors or gases may ignite at distant ignition sources and flash back. See Section 13, Disposal considerations, for additional information.

Environmental Precautions:
Keep out of water supplies and sewers. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Precautions for Safe Handling:
Avoid breathing vapor or mist. Avoid contact with skin, eyes and clothing. Keep away from heat, sparks and flame. Ground any equipment used in handling. Use non-sparking tools and equipment. All energized electrical equipment must be designed in accordance with the electrical classification of the area.

Safe Storage Conditions:
Store and handle in accordance with all current regulations and standards. Keep container tightly closed and properly labeled. Store in a cool, dry area. Store in a well-ventilated area. Do not enter confined spaces unless adequately ventilated. Avoid heat, flames, sparks and other sources of ignition. May be subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet).

Incompatibilities/ Materials to Avoid:
oxidizing agents, oxides of nitrogen, metals, aluminum, aluminum alloys, copper, metal alkyl complexes and alkali metals such as sodium, potassium and their alloys

GHS: PHYSICAL HAZARDS:
- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Regulatory Exposure Limit(s): As listed below.

Component	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PELCeiling
Vinyl chloride 75-01-4	1 ppm	5 ppm	-----

OEL: Occupational Exposure Limit; OSHA: United States Occupational Safety and Health Administration; PEL: Permissible Exposure Limit; TWA: Time Weighted Average; STEL: Short Term Exposure Limit

NON-REGULATORY EXPOSURE LIMIT(S): As listed below.

Component	CAS Number	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	OSHA TWA (Vacated)	OSHA STEL (Vacated)	OSHA Ceiling (Vacated)

Vinyl chloride	75-01-4	1 ppm	-----	-----	-----	-----	-----

- The Non-Regulatory United States Occupational Safety and Health Administration (OSHA) limits, if shown, are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

- The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professional industrial hygiene personnel in government or educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.

ENGINEERING CONTROLS: Use closed systems when possible. Provide local exhaust ventilation where vapor may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear safety glasses with side-shields. If eye contact is likely, wear chemical resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear appropriate chemical resistant clothing.

Hand Protection: Wear appropriate chemical resistant gloves. Consult a glove supplier for assistance in selecting an appropriate chemical resistant glove.

Protective Material Types: Butyl rubber, Nitrile, Silver Shield®, Viton®

Respiratory Protection: Refer to 29 CFR 1910.1017 for selection of respirators for vinyl chloride. A respiratory protection program that meets applicable regulatory requirements must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	Compressed, liquefied gas
Color:	Colorless
Odor:	Sweet
Odor Threshold [ppm]:	Not reliable to prevent excessive exposure.
Molecular Weight:	62.5
Molecular Formula:	C2ClH3
Decomposition Temperature:	Not applicable
Boiling Point/Range:	7 °F (-14 °C)
Freezing Point/Range:	No data available.
Melting Point/Range:	Not applicable
Vapor Pressure:	2660 mmHg @ 25 °C
Vapor Density (air=1):	2.15
Relative Density/Specific Gravity (water=1):	0.91 @ 25/25 °C
Water Solubility:	2.7 g/L

pH:	Not applicable
VOC Content (%):	100%
Volatility:	100%
Evaporation Rate (ether=1):	>15
Partition Coefficient (n-octanol/water):	Log Kow = 1.36
Flash point:	-108 °F (-78 °C)
Flammability (solid, gas):	No data available
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Auto-ignition Temperature:	882 °F (472 °C)
Viscosity:	Not applicable

10. STABILITY AND REACTIVITY

Reactivity: Not reactive under normal temperatures and pressures.

Chemical Stability: Stable at normal temperatures and pressures.

Possibility of Hazardous Reactions:
Avoid air and sunlight. Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

Conditions to Avoid:
(e.g., static discharge, shock, or vibration) -. Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].

Incompatibilities/ Materials to Avoid:
oxidizing agents. oxides of nitrogen. metals. aluminum. aluminum alloys. copper. metal alkyl complexes and alkali metals such as sodium, potassium and their alloys.

Hazardous Decomposition Products: oxides of carbon, chlorine, hydrogen chloride, phosgene

Hazardous Polymerization: Polymerization can occur. Avoid elevated temperatures, oxidizing agents, oxides of nitrogen, oxygen, peroxides, other polymerization catalysts/initiators, air and sunlight.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

PRODUCT TOXICITY DATA: VINYL CHLORIDE (MONOMER)

LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
> 4,000 mg/kg oral-rat LD50	-----	-----

COMPONENT TOXICITY DATA:

Note: The component toxicity data is populated by the LOLI database and may differ from the product toxicity data given.

Component	LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
Vinyl chloride 75-01-4	-----	-----	18 pph (15 minr-Rat)

****

POTENTIAL HEALTH EFFECTS:

Eye contact: Causes eye irritation. Rapid evaporation of the material may cause frostbite.

Skin contact: Causes skin irritation. Rapid evaporation of the material may cause frostbite.

Inhalation: May cause respiratory tract irritation. Several minutes of exposure to high, but attainable concentrations (over 1000 ppm) may cause difficulty breathing, central nervous system depression and symptoms such as: ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual and or hearing disturbances, nausea, memory loss. Prolonged, high concentration exposures may cause unconsciousness or death. Cardiac: Acute intoxication may cause irregular heartbeats.

Ingestion: Not a likely route of exposure in occupational settings.

Chronic Effects: Chronic exposure to vinyl chloride monomer (VCM) may cause damage to the nervous system, respiratory system, musculoskeletal system, and lymphatic system. Occupational overexposure has produced a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer. Repeated prolonged exposure may damage: skin (scleroderma), bones (acro-osteolysis), blood vessels in the hands (Raynaud's Syndrome). Suspected of causing genetic defects. Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

SIGNS AND SYMPTOMS OF EXPOSURE:

Listed below.

Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
Ingestion (Swallowing): Ingestion is not a likely route of exposure.

Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

****

GHS HEALTH HAZARDS:

Skin Absorbent / Dermal Route? No.

GHS: CONTACT HAZARD - SKIN: Category 2 - Causes skin irritation

GHS: CONTACT HAZARD - EYE: Category 2B - Causes eye irritation

GHS: CARCINOGENICITY:
Category 1A - May cause cancer.

Component	NTP:	IARC (GROUP 1):	IARC (GROUP 2):	OSHA:
Vinyl chloride	Listed	Group 1	Not listed	Listed

SPECIFIC TARGET ORGAN TOXICITY (Single Exposure):
Category 3 - Respiratory Tract Irritation
Category 3 - Narcotic Effects

SPECIFIC TARGET ORGAN TOXICITY (Repeated or Prolonged Exposure):
Category 1 - Liver, Blood, Nervous System, Lymphatic System, Musculoskeletal System, Respiratory System

MUTAGENIC DATA:
Category 2 - Suspected of causing genetic defects. Mutagenic in bacteria studies. Genetic studies in animals were negative in some cases and positive in others.

REPRODUCTIVE TOXICITY:
Category 2 - Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

Aquatic Toxicity:
This material is believed to be practically non-toxic to fish on an acute basis (LC50>100 mg/L).

FATE AND TRANSPORT:

BIODEGRADATION: Vinyl chloride may degrade under anaerobic conditions.

PERSISTENCE: Tropospheric half-life is estimated to be 23 hours. If released to air, this material will remain in the gas phase. If released to soil, volatilization will occur, but material that does not volatilize may be highly mobile. If released to water, evaporation will occur.

BIOCONCENTRATION: Bioconcentration potential is low (BCF <100 or log Kow <3).

13. DISPOSAL CONSIDERATIONS

Waste from material:
Reuse or reprocess, if possible. May be subject to disposal regulations. Dispose in accordance with all applicable regulations.

Container Management:
Refer to manufacturer/supplier for information on recovery/recycling. Dispose of container in accordance with applicable local, regional, national, and/or international regulations. Container rinsate must be disposed of in compliance with applicable regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT

U.S. DOT 49 CFR 172.101:

UN NUMBER: UN1086
PROPER SHIPPING NAME: Vinyl chloride, stabilized
HAZARD CLASS/ DIVISION: 2.1
LABELING REQUIREMENTS: 2.1
RQ (lbs): RQ 1 Lbs. (Vinyl chloride)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

UN NUMBER: UN1086
SHIPPING NAME: Vinyl chloride, stabilized
CLASS OR DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

MARITIME TRANSPORT (IMO / IMDG) Regulated

UN NUMBER: UN1086
PROPER SHIPPING NAME: Vinyl chloride, stabilized

HAZARD CLASS / DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 426-2675.

Component	CERCLA Reportable Quantities:
Vinyl chloride	1 lb (final RQ)

SARA EHS Chemical (40 CFR 355.30)
Not regulated

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.10):
Fire Hazard, Reactive Hazard, Sudden Release of Pressure, Acute Health Hazard, Chronic Health Hazard

EPCRA SECTION 313 (40 CFR 372.65):
The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Component	Status:
Vinyl chloride	0.1 %

OSHA SPECIFICALLY REGULATED SUBSTANCES:
OSHA 29 CFR 1910.1017 (Vinyl chloride); The U.S. Department of Labor, Occupational Safety and Health Administration specifically regulates manufacturing, handling and processing of vinyl chloride. Such regulations have been published at 29 CFR 1910.1017.

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):
The PSM standard may apply to processes which involve a flammable liquid or gas in a quantity of 10,000 pounds (4535.9 kg) or more.

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA): All components are listed or exempt.

TSCA 12(b): This product is not subject to export notification.

Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

STATE REGULATIONS

Component	California Proposition 65 Cancer WARNING:	California Proposition 65 CRT List - Male reproductive toxin:	California Proposition 65 CRT List - Female reproductive toxin:	Massachusetts Right to Know Hazardous Substance List	New Jersey Right to Know Hazardous Substance List	New Jersey Special Health Hazards Substance List
Vinyl chloride 75-01-4	Listed	Not Listed	Not Listed	Listed	2001	carcinogen; flammable - fourth degree; mutagen

Component	New Jersey - Environmental Hazardous Substance List	Pennsylvania Right to Know Hazardous Substance List	Pennsylvania Right to Know Special Hazardous Substances	Pennsylvania Right to Know Environmental Hazard List	Rhode Island Right to Know Hazardous Substance List
Vinyl chloride 75-01-4	Listed	Listed	Present	Present	Not Listed

CANADIAN REGULATIONS

• This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations

WHMIS - Classifications of Substances:

• A - Compressed Gas
• B1 - Flammable Gas
• D2A - Poisonous and Infectious Material; Materials causing other toxic effects - Very toxic material
• D2B - Poisonous and Infectious Material; Materials causing other toxic effects - Toxic material
• F - Dangerously reactive material

16. OTHER INFORMATION

Prepared by: OxyChem Corporate HESS - Product Stewardship

Rev. Date: 06-Apr-2015

HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association HMIS: Rating Instructions, 2nd Edition)

Health Rating: 2* **Flammability Rating:** 4 **Reactivity Rating:** 1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health Rating: 2 **Flammability:** 4 **Reactivity Rating:** 2

VINYL CHLORIDE (MONOMER)

Reason for Revision:
• Revised Major Health Hazards: SEE SECTION 2
• Revised GHS Information: SEE SECTION 2
• Updated First Aid Measures: SEE SECTION 4
• PPE recommendations have been modified: SEE SECTION 8
• Toxicological Information has been revised: SEE SECTION 11
• Updated Disposal Considerations. SEE SECTION 13
• Updated Transportation Information: SEE SECTION 14

IMPORTANT:
The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESSED OR IMPLIED, IS MADE REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, storage, disposal and other factors that may involve other or additional legal, environmental, safety or performance considerations, and OxyChem assumes no liability whatsoever for the use of or reliance upon this information. While our technical personnel will be happy to respond to questions, safe handling and use of the product remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, local or foreign laws

OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Safety Data Sheet available to your employees

End of Safety Data Sheet

SAFETY DATA SHEET

Creation Date 28-May-2009 **Revision Date** 17-Jan-2018 **Revision Number** 3

1. Identification

Product Name **tert-Butyl methyl ether**

Cat No. : **E127-4; XXE127RS200; NC1240503; XXE127U200LI; NC1568440; E127RS1350ASME; NC1561779**

CAS-No 1634-04-4
Synonyms 2-Methyl-2-methoxy propane; MTBE; Methyl tert-butyl ether

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Skin Corrosion/irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Lungs.	

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Causes skin irritation
May cause respiratory irritation



Precautionary Statements
Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear protective gloves/protective clothing/eye protection/face protection
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting/equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Keep cool
Avoid breathing dust/fume/gas/mist/vapors/spray
Response
Get medical attention/advice if you feel unwell
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
If skin irritation occurs: Get medical advice/attention
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Wash contaminated clothing before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)

Other hazards
Aspiration hazard if swallowed - can enter lungs and cause damage.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Methyl tert-butyl ether	1634-04-4	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.

Inhalation	Move to fresh air. Get medical attention immediately if symptoms occur. If not breathing, give artificial respiration.
Ingestion	Do not induce vomiting. Obtain medical attention.
Most important symptoms and effects	Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Cool closed containers exposed to fire with water spray.
Unsuitable Extinguishing Media	No information available
Flash Point	-28 °C / -18.4 °F
Method -	No information available
Autoignition Temperature	224 °C / 435.2 °F
Explosion Limits	
Upper	15.1 vol %
Lower	1.6 vol %
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Remove all sources of ignition. Take precautionary measures against static discharges. Ensure adequate ventilation.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Keep away from open flames, hot surfaces and sources of ignition. Use only non-sparking tools. Use explosion-proof equipment. Take precautionary measures against static discharges. Use only under a chemical fume hood. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.
Storage	Flammables area. Keep away from heat and sources of ignition. Keep container tightly

closed in a dry and well-ventilated place. May form explosive peroxides on prolonged storage.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Methyl tert-butyl ether	TWA: 50 ppm			

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location. Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection No protective equipment is needed under normal use conditions.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Petroleum distillates
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-110 °C / -166 °F
Boiling Point/Range	54 - 56 °C / 129.2 - 132.8 °F
Flash Point	-28 °C / -18.4 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	15.1 vol %
Lower	1.6 vol %
Vapor Pressure	268 mbar @ 20 °C
Vapor Density	0.2
Specific Gravity	0.740
Solubility	Slightly soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	224 °C / 435.2 °F
Decomposition Temperature	No information available
Viscosity	0.36 mPa.s at 20 °C
Molecular Formula	C5 H12 O
Molecular Weight	88.15

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Keep away from open flames, hot surfaces and sources of ignition.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Methyl tert-butyl ether	LD50 = 2963 mg/kg (Rat)	LD50 = 10000 mg/kg (Rabbit)	LC50 = 85 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. Limited evidence of a carcinogenic effect.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Methyl tert-butyl ether	1634-04-4	Not listed	Not listed	A3	Not listed	Not listed

ACGIH: (American Conference of Governmental Industrial Hygienists)

A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in experimental animals.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Lungs

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Methyl tert-butyl ether	Group III Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Do not empty into drains. .

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Methyl tert-butyl ether	800 mg/L EC50 > 72 h 184 mg/L EC50 = 96 h	887 mg/L LC50 96 h 100 mg/L LC50 96 h 929 mg/L LC50 96 h 672 mg/L LC50 96 h	EC50 = 11.4 mg/L 30 min EC50 = 8.23 mg/L 5 min EC50 = 9.67 mg/L 15 min	EC50: = 542 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Methyl tert-butyl ether	1.06

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

TDG

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

IATA

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

IMDG/IMO

UN-No UN2398
Proper Shipping Name METHYL tert-BUTYL ETHER
Hazard Class 3
Packing Group II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Methyl tert-butyl ether	X	X	-	216-653-1	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Methyl tert-butyl ether	1634-04-4	>95	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Methyl tert-butyl ether	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Methyl tert-butyl ether	1000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methyl tert-butyl ether	X	X	X	X	-

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade Serious risk, Grade 3

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 28-May-2009
Revision Date 17-Jan-2018

Print Date	17-Jan-2018
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 10-Dec-2009 **Revision Date** 23-Jan-2018 **Revision Number** 5

1. Identification

Product Name **Tetrachloroethylene**

Cat No. : **AC445690000; ACR445690010; AC445690025; AC445691000**

CAS-No 127-18-4
Synonyms Perchloroethylene

Recommended Use Laboratory chemicals.
Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
May cause cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Toxic to aquatic life with long lasting effects
WARNING. Cancer - https://www.p65warnings.ca.gov/.

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Tetrachloroethylene	127-18-4	>95

4. First-aid measures

General Advice If symptoms persist, call a physician.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Get medical attention if symptoms occur.

Ingestion Clean mouth with water and drink afterwards plenty of water.

Most important symptoms and effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated.

Hazardous Combustion Products
Chlorine Hydrogen chloride gas Phosgene
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation.
Environmental Precautions	Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Ensure adequate ventilation. Avoid ingestion and inhalation.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from sunlight.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Tetrachloroethylene	TWA: 25 ppm STEL: 100 ppm	(Vacated) TWA: 25 ppm (Vacated) TWA: 170 mg/m^3 Ceiling: 200 ppm TWA: 100 ppm	IDLH: 150 ppm	TWA: 100 ppm TWA: 670 mg/m^3 TWA: 200 ppm TWA: 1250 mg/m^3 STEL: 200 ppm STEL: 1340 mg/m^3

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic, sweet
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-22 °C / -7.6 °F
Boiling Point/Range	120 - 122 °C / 248 - 251.6 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	6.0 (Ether = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	18 mbar @ 20 °C
Vapor Density	No information available
Density	1.619
Specific Gravity	1.625
Solubility	0.15 g/L water (20°C)
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	> 150°C
Viscosity	0.89 mPa s at 20 °C
Molecular Formula	C2 Cl4
Molecular Weight	165.83

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions.

Conditions to Avoid Incompatible products. Excess heat. Exposure to moist air or water.

Incompatible Materials Strong acids, Strong oxidizing agents, Strong bases, Metals, Zinc, Amines, Aluminium

Hazardous Decomposition Products Chlorine, Hydrogen chloride gas, Phosgene

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Tetrachloroethylene	LD50 = 2629 mg/kg (Rat)	LD50 > 10000 mg/kg (Rat)	LC50 = 27.8 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Tetrachloroethylene	127-18-4	Group 2A	Reasonably Anticipated	A3	X	A3

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

Mexico - Occupational Exposure Limits - Carcinogens

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)
Mexico - Occupational Exposure Limits - Carcinogens
A1 - Confirmed Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Confirmed Animal Carcinogen
A4 - Not Classifiable as a Human Carcinogen
A5 - Not Suspected as a Human Carcinogen

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)

STOT - repeated exposure Kidney Liver Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Tetrachloroethylene	Group II Chemical	Not applicable	Not applicable

Other Adverse Effects Tumorigenic effects have been reported in experimental animals.

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Tetrachloroethylene	EC50: > 500 mg/L, 96h (Pseudokirchneriella subcapitata)	LC50: 4.73 - 5.27 mg/L, 96h flow-through (Oncorhynchus mykiss) LC50: 11.0 - 15.0 mg/L, 96h static (Lepomis macrochirus) LC50: 8.6 - 13.5 mg/L, 96h static (Pimephales promelas) LC50: 12.4 - 14.4 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 100 mg/L 24 h EC50 = 112 mg/L 24 h EC50 = 120.0 mg/L 30 min	EC50: 6.1 - 9.0 mg/L, 48h Static (Daphnia magna)

Persistence and Degradability Insoluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility . Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its volatility.

Component	log Pow
Tetrachloroethylene	2.53 - 2.88

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Tetrachloroethylene - 127-18-4	U210	-

14. Transport information

DOT

UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1897

Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IMDG/IMO
UN-No UN1897
Proper Shipping Name TETRACHLOROETHYLENE
Hazard Class 6.1
Subsidiary Hazard Class P
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Tetrachloroethylene	X	X	-	204-825-9	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Tetrachloroethylene	127-18-4	>95	0.1

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Tetrachloroethylene	-	-	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Tetrachloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Tetrachloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Tetrachloroethylene	127-18-4	Carcinogen	14 µg/day	Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Tetrachloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant Y
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 10-Dec-2009
Revision Date 23-Jan-2018
Print Date 23-Jan-2018
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Creation Date 03-Feb-2010 **Revision Date** 14-Jul-2016 **Revision Number** 2

1. Identification

Product Name **Trichloroethylene**

Cat No. : **T340-4; T341-4; T341-20; T341-500; T403-4**

Synonyms Trichloroethene (Stabilized/Technical/Electronic/Certified ACS)

Recommended Use Laboratory chemicals.
Uses advised against

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number
CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Skin Sensitization	Category 1
Germ Cell Mutagenicity	Category 2
Carcinogenicity	Category 1A
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS).	
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Kidney, Liver, Heart, spleen, Blood.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause an allergic skin reaction
May cause drowsiness or dizziness
Suspected of causing genetic defects
May cause cancer
May cause damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Do not breathe dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
Take off contaminated clothing and wash before reuse
If skin irritation or rash occurs: Get medical advice/attention
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Harmful to aquatic life with long lasting effects
WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Trichloroethylene	79-01-6	100

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If not breathing, give artificial respiration. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a

	pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms/effects	None reasonably foreseeable. May cause allergic skin reaction. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	410 °C / 770 °F
Explosion Limits	
Upper	10.5 vol %
Lower	8 vol %
Oxidizing Properties	Not oxidising
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Containers may explode when heated. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Hydrogen chloride gas Chlorine Phosgene Carbon monoxide (CO) Carbon dioxide (CO_2)
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas.
Environmental Precautions	Should not be released into the environment. Do not flush into surface water or sanitary sewer system.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Use only under a chemical fume hood. Do not breathe vapors or spray mist. Do not ingest.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from light. Do not store in aluminum containers.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Trichloroethylene	TWA: 10 ppm STEL: 25 ppm	(Vacated) TWA: 50 ppm (Vacated) TWA: 270 mg/m³ Ceiling: 200 ppm (Vacated) STEL: 200 ppm (Vacated) STEL: 1080 mg/m³ TWA: 100 ppm	IDLH: 1000 ppm	TWA: 100 ppm TWA: 535 mg/m³ STEL: 200 ppm STEL: 1080 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Use only under a chemical fume hood. Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Long sleeved clothing.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Characteristic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-85 °C / -121 °F
Boiling Point/Range	87 °C / 188.6 °F
Flash Point	No information available
Evaporation Rate	0.69 (Carbon Tetrachloride = 1.0)
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	10.5 vol %
Lower	8 vol %
Vapor Pressure	77.3 mbar @ 20 °C
Vapor Density	4.5 (Air = 1.0)
Specific Gravity	1.460
Solubility	Slightly soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	410 °C / 770 °F
Decomposition Temperature	> 120°C
Viscosity	0.55 mPa.s (25°C)

Molecular Formula C2 H Cl3
Molecular Weight 131.39

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive.

Conditions to Avoid Incompatible products. Excess heat. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Strong bases, Amines, Alkali metals, Metals,

Hazardous Decomposition Products Hydrogen chloride gas, Chlorine, Phosgene, Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Trichloroethylene	LD50 = 4290 mg/kg (Rat) LD50 = 4920 mg/kg (Rat)	LD50 > 20 g/kg (Rabbit) LD50 = 29000 mg/kg (Rabbit)	LC50 = 26 mg/L (Rat) 4 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Trichloroethylene	79-01-6	Group 1	Reasonably Anticipated	A2	X	Not listed

IARC: (International Agency for Research on Cancer)

NTP: (National Toxicity Program)

ACGIH: (American Conference of Governmental Industrial Hygienists)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
NTP: (National Toxicity Program)
Known - Known Carcinogen
Reasonably Anticipated - Reasonably Anticipated to be a Human Carcinogen
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects Mutagenic effects have occurred in humans.

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Central nervous system (CNS)
STOT - repeated exposure Kidney Liver Heart spleen Blood

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting: Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. The product contains following substances which are hazardous for the environment. Contains a substance which is:. Harmful to aquatic organisms. Toxic to aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Trichloroethylene	EC50: = 175 mg/L, 96h (Pseudokirchneriella subcapitata) EC50: = 450 mg/L, 96h (Desmodesmus subspicatus)	LC50: 39 - 54 mg/L, 96h static (Lepomis macrochirus) LC50: 31.4 - 71.8 mg/L, 96h flow-through (Pimephales promelas)	EC50 = 0.81 mg/L 24 h EC50 = 115 mg/L 10 min EC50 = 190 mg/L 15 min EC50 = 235 mg/L 24 h EC50 = 410 mg/L 24 h EC50 = 975 mg/L 5 min	EC50: = 2.2 mg/L, 48h (Daphnia magna)

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its volatility.

Component	log Pow
Trichloroethylene	2.4

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Trichloroethylene - 79-01-6	U228	-

14. Transport information

DOT

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

TDG

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

IATA

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE

Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN1710
Proper Shipping Name TRICHLOROETHYLENE
Hazard Class 6.1
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Trichloroethylene	X	X	-	201-167-4	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

Component	TSCA 12(b)
Trichloroethylene	Section 5

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Trichloroethylene	79-01-6	100	0.1

SARA 311/312 Hazard Categories

Acute Health Hazard Yes
Chronic Health Hazard Yes
Fire Hazard No
Sudden Release of Pressure Hazard No
Reactive Hazard No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Trichloroethylene	X	100 lb	X	X

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Trichloroethylene	X		-

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Trichloroethylene	100 lb 1 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Trichloroethylene	79-01-6	Carcinogen Developmental Male Reproductive	14 µg/day 50 µg/day	Developmental Carcinogen

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichloroethylene	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 03-Feb-2010
Revision Date 14-Jul-2016
Print Date 14-Jul-2016
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
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End of SDS

SAFETY DATA SHEET

M9192 - ANSI - EN

Oxy Vinyls, LP
A subsidiary of Occidental Petroleum Corporation

VINYL CHLORIDE (MONOMER)

SDS No.: M9192 **SDS Revision Date:** 06-Apr-2015

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Company Identification:	Oxy Vinyls, LP 5005 LBJ Freeway Suite 2200 Dallas, Texas 75244-6119
24 Hour Emergency Telephone Number:	1-800-733-3665 or 1-972-404-3228 (USA); CHEMTREC (within USA and Canada): 1-800-424-9300; CHEMTREC (outside USA and Canada): +1 703-527-3887; CHEMTREC Contract No: CCN16186
To Request an SDS:	MSDS@oxy.com or 1-972-404-3245
Customer Service:	1-800-752-5151 or 1-972-404-3700
Product Identifier:	**VINYL CHLORIDE (MONOMER)**
Synonyms:	VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer
Product Use:	PVC Manufacturing
Uses Advised Against:	Aerosol propellant.

2. HAZARDS IDENTIFICATION

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

VINYL CHLORIDE (MONOMER)

SDS No.: M9192 **SDS Revision Date:** 06-Apr-2015

****

EMERGENCY OVERVIEW:

Color: Colorless
Physical state Compressed, liquefied gas
Odor: Sweet

Signal Word: **DANGER**

MAJOR HEALTH HAZARDS: CONTAINS VINYL CHLORIDE, A KNOWN HUMAN CANCER AGENT. MAY CAUSE CANCER. CONTACT WITH LIQUID MAY CAUSE FROSTBITE TO EXPOSED TISSUE. MAY PRODUCE SYMPTOMS OF CENTRAL NERVOUS SYSTEM DEPRESSION INCLUDING HEADACHE, DIZZINESS, NAUSEA, LOSS OF BALANCE AND DROWSINESS. CAUSES SKIN IRRITATION. CAUSES EYE IRRITATION. MAY CAUSE RESPIRATORY IRRITATION. CAUSES DAMAGE TO LIVER, BLOOD, NERVOUS SYSTEM, LYMPHATIC SYSTEM, AND MUSCULOSKELETAL SYSTEM THROUGH PROLONGED OR REPEATED EXPOSURE. CAUSES DAMAGE TO LUNGS THROUGH PROLONGED OR REPEATED EXPOSURE BY INHALATION. SUSPECTED OF CAUSING GENETIC DEFECTS. SUSPECTED REPRODUCTIVE HAZARD.

PHYSICAL HAZARDS: Extremely flammable gas under pressure.

PRECAUTIONARY STATEMENTS: Keep away from heat, sparks and flame. Wash thoroughly after handling. Avoid contact with eyes, skin and clothing. Do not breathe vapors or spray mist. Do not eat, drink or smoke in areas where this material is used. Use only outdoors or in a well-ventilated area. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Store in well-ventilated place. Keep container tightly closed.

****

GHS CLASSIFICATION:

GHS: PHYSICAL HAZARDS:	Flammable Gas - Cat. 1 Extremely Flammable Gas Under Pressure - Liquefied
GHS: CONTACT HAZARD - SKIN:	Category 2 - Causes skin irritation.
GHS: CONTACT HAZARD - EYE:	Category 2B - Causes eye irritation
GHS: TARGET ORGAN TOXICITY (SINGLE EXPOSURE):	Category 3 - May cause respiratory tract irritation Category 3 - May cause drowsiness or dizziness
GHS: TARGET ORGAN TOXICITY (REPEATED EXPOSURE):	Category 1 - Causes damage to liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system through prolonged or repeated exposure
GHS: CARCINOGENICITY:	Category 1A - May cause cancer.
GHS: GERM CELL MUTAGENICITY:	Category 2 - Suspected of causing genetic defects
GHS: REPRODUCTION TOXIN:	Category 2 - Suspected of damaging fertility or the unborn child
GHS - OSHA Hazard(s)	Simple Asphyxiant: May displace oxygen and cause rapid suffocation

Unknown Acute Dermal Toxicity:
100% of this product consists of ingredient(s) of unknown acute dermal toxicity.

Unknown Acute Inhalation Toxicity:
100% of this product consists of ingredient(s) of unknown acute inhalation toxicity.

GHS SYMBOL:
Flame, Gas cylinder, Exclamation mark, Health hazards



GHS SIGNAL WORD: **DANGER**

GHS HAZARD STATEMENTS:

GHS - Physical Hazard Statement(s)
Extremely flammable gas
Contains gas under pressure; may explode if heated
May displace oxygen and cause rapid suffocation

GHS - Health Hazard Statement(s)
Causes eye irritation
Causes skin irritation
May cause drowsiness or dizziness
May cause respiratory irritation
Causes damage to organs through prolonged or repeated exposure: (liver, blood, nervous system, lymphatic system, musculoskeletal system, respiratory system)
May cause cancer
Suspected of causing genetic defects
Suspected of damaging fertility or the unborn child

GHS - OSHA Hazard(s)
Simple Asphyxiant: May displace oxygen and cause rapid suffocation

GHS - Precautionary Statement(s) - Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Keep away from heat/sparks/open flames/hot surfaces. — No smoking
Do not breathe dust/fume/gas/mist/vapors/spray
Use personal protective equipment as required
Wear protective gloves/protective clothing/eye protection/face protection
Wash thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area

GHS - Precautionary Statement(s) - Response
Leaking gas fire: Do not extinguish, unless leak can be stopped safely
Eliminate all ignition sources if safe to do so
IF INHALED: Remove person to fresh air and keep comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
IF ON SKIN: Wash with plenty of water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash it before reuse
Specific treatment (see First Aid information on product label and/or Section 4 of the SDS)
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Specific treatment (see Section 4 of the safety data sheet and/or the First Aid information on the product label)
Get medical advice/attention if you feel unwell
IF exposed or concerned: call a POISON CENTER or doctor/physician

GHS - Precautionary Statement(s) - Storage
Store in a well-ventilated place. Keep container tightly closed
Protect from sunlight
Store locked up

GHS - Precautionary Statement(s) - Disposal
Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations.

Hazards Not Otherwise Classified (HNOC)
Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.)
Polymerization can occur

See Section 11: TOXICOLOGICAL INFORMATION

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms: VCM, Monochloroethylene, Chloroethene, Ethylene, chloro-, Vinyl chloride monomer

Component	Percent [%]	CAS Number
Vinyl chloride	99 - 100	75-01-4

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. If respiration or pulse has stopped, have a trained person administer basic life support (Cardio-Pulmonary Resuscitation and/or Automatic External Defibrillator) and CALL FOR EMERGENCY SERVICES IMMEDIATELY.

SKIN CONTACT: If frostbite or freezing occur, immediately flush with plenty of lukewarm water (100-105 °F, 38-41 °C). GET MEDICAL ATTENTION IMMEDIATELY.

EYE CONTACT: Immediately flush eyes with a directed stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissues. Washing eyes within several seconds is essential to achieve maximum effectiveness. GET MEDICAL ATTENTION IMMEDIATELY.

INGESTION: Not a likely route of exposure in occupational environment.

Most Important Symptoms/Effects (Acute and Delayed) :.

Acute Symptoms/Effects: Listed below. Prolonged, high concentration exposures may cause unconsciousness or death.
Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
Ingestion (Swallowing): Ingestion is not a likely route of exposure.
Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Delayed Symptoms/Effects:
- Carcinogen: Long term significant occupational overexposure to VCM has been associated with a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer
- Suspected mutagen and suspected of causing reproductive damage
- Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hand (Raynaud's Syndrome)
- Scleroderma is characterized by a hardening and tightening of patches of skin
- Raynaud's syndrome is characterized by an exaggerated response to cold temperatures or emotional distress, which can cause numbness, pain or color changes in the fingers or toes

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

Medical Conditions Aggravated by Exposure: Alcoholic Liver Disease. Infectious Hepatitis. Cirrhosis.

Protection of First-Aiders: Protect yourself by avoiding contact with this material. Direct contact with liquid may cause frostbite to exposed tissue (eyes, skin, etc.). Use personal protective equipment. Refer to Section 8 for specific personal protective equipment recommendations. At minimum, treating personnel should utilize PPE sufficient for prevention of bloodborne pathogen transmission.

Notes to Physician: There is no specific antidote. Treat symptoms with supportive care. Cardiac stimulants such as epinephrine should be avoided in persons overexposed to chlorinated hydrocarbons.

5. FIRE-FIGHTING MEASURES

Fire Hazard: Severe fire hazard. Vapor/air mixtures are explosive. Vapors or gases may ignite at distant sources and flash back. Containers may rupture or explode if exposed to heat.

Extinguishing Media: Stop flow of gas before extinguishing fire. Use carbon dioxide, regular dry chemical, foam or water. Use water spray to keep containers cool.

Fire Fighting: Move container from fire area if it can be done without risk. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this can't be done, then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode.

Hazardous Combustion Products:	Oxides of carbon, Hydrogen chloride, Phosgene
Sensitivity to Mechanical Impact:	Not sensitive.
Sensitivity to Static Discharge:	Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Flash point:	-108 °F (-78 °C)
Auto-ignition Temperature:	882 °F (472 °C)

GHS: PHYSICAL HAZARDS:
- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions:
Isolate hazard area and deny entry. Keep unnecessary and unprotected persons away. Eliminate all sources of heat and ignition. Ventilate closed spaces before entering. Wear appropriate personal protective equipment recommended in Section 8, Exposure Controls / Personal Protection, of the SDS. Refer to Section 7, Handling and Storage, for additional precautionary measures.

Methods and Materials for Containment and Cleaning Up:
Remove sources of ignition. Ventilate closed spaces before entering. Stop leak if possible without personal risk. Vapors or gases may ignite at distant ignition sources and flash back. See Section 13, Disposal considerations, for additional information.

Environmental Precautions:
Keep out of water supplies and sewers. Releases should be reported, if required, to appropriate agencies.

7. HANDLING AND STORAGE

Precautions for Safe Handling:
Avoid breathing vapor or mist. Avoid contact with skin, eyes and clothing. Keep away from heat, sparks and flame. Ground any equipment used in handling. Use non-sparking tools and equipment. All energized electrical equipment must be designed in accordance with the electrical classification of the area.

Safe Storage Conditions:
Store and handle in accordance with all current regulations and standards. Keep container tightly closed and properly labeled. Store in a cool, dry area. Store in a well-ventilated area. Do not enter confined spaces unless adequately ventilated. Avoid heat, flames, sparks and other sources of ignition. May be subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet).

Incompatibilities/ Materials to Avoid:
oxidizing agents, oxides of nitrogen, metals, aluminum, aluminum alloys, copper, metal alkyl complexes and alkali metals such as sodium, potassium and their alloys

GHS: PHYSICAL HAZARDS:
- Flammable Gas - Cat. 1 Extremely Flammable
- Gas Under Pressure - Liquefied

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Regulatory Exposure Limit(s): As listed below.

Component	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PELCeiling
Vinyl chloride 75-01-4	1 ppm	5 ppm	-----

OEL: Occupational Exposure Limit; OSHA: United States Occupational Safety and Health Administration; PEL: Permissible Exposure Limit; TWA: Time Weighted Average; STEL: Short Term Exposure Limit

NON-REGULATORY EXPOSURE LIMIT(S): As listed below.

Component	CAS Number	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	OSHA TWA (Vacated)	OSHA STEL (Vacated)	OSHA Ceiling (Vacated)

Vinyl chloride	75-01-4	1 ppm	-----	-----	-----	-----	-----

- The Non-Regulatory United States Occupational Safety and Health Administration (OSHA) limits, if shown, are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

- The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professional industrial hygiene personnel in government or educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices.

ENGINEERING CONTROLS: Use closed systems when possible. Provide local exhaust ventilation where vapor may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear safety glasses with side-shields. If eye contact is likely, wear chemical resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear appropriate chemical resistant clothing.

Hand Protection: Wear appropriate chemical resistant gloves. Consult a glove supplier for assistance in selecting an appropriate chemical resistant glove.

Protective Material Types: Butyl rubber, Nitrile, Silver Shield®, Viton®

Respiratory Protection: Refer to 29 CFR 1910.1017 for selection of respirators for vinyl chloride. A respiratory protection program that meets applicable regulatory requirements must be followed whenever workplace conditions warrant use of a respirator.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical state	Compressed, liquefied gas
Color:	Colorless
Odor:	Sweet
Odor Threshold [ppm]:	Not reliable to prevent excessive exposure.
Molecular Weight:	62.5
Molecular Formula:	C2ClH3
Decomposition Temperature:	Not applicable
Boiling Point/Range:	7 °F (-14 °C)
Freezing Point/Range:	No data available.
Melting Point/Range:	Not applicable
Vapor Pressure:	2660 mmHg @ 25 °C
Vapor Density (air=1):	2.15
Relative Density/Specific Gravity (water=1):	0.91 @ 25/25 °C
Water Solubility:	2.7 g/L

pH:	Not applicable
VOC Content (%):	100%
Volatility:	100%
Evaporation Rate (ether=1):	>15
Partition Coefficient (n-octanol/water):	Log Kow = 1.36
Flash point:	-108 °F (-78 °C)
Flammability (solid, gas):	No data available
Lower Flammability Level (air):	3.6%
Upper Flammability Level (air):	33.0%
Auto-ignition Temperature:	882 °F (472 °C)
Viscosity:	Not applicable

10. STABILITY AND REACTIVITY

Reactivity: Not reactive under normal temperatures and pressures.

Chemical Stability: Stable at normal temperatures and pressures.

Possibility of Hazardous Reactions:
Avoid air and sunlight. Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

Conditions to Avoid:
(e.g., static discharge, shock, or vibration) -. Electrostatic charges may build up during handling and may form ignitable vapor-air mixtures in storage containers. Ground equipment in accordance with industry standards and best practices such as NFPA 77 [Recommended Practices on Static Electricity (2007)] and American Petroleum Institute (API) RP Recommended Practice 2003 [Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2008)].

Incompatibilities/ Materials to Avoid:
oxidizing agents. oxides of nitrogen. metals. aluminum. aluminum alloys. copper. metal alkyl complexes and alkali metals such as sodium, potassium and their alloys.

Hazardous Decomposition Products: oxides of carbon, chlorine, hydrogen chloride, phosgene

Hazardous Polymerization: Polymerization can occur. Avoid elevated temperatures, oxidizing agents, oxides of nitrogen, oxygen, peroxides, other polymerization catalysts/initiators, air and sunlight.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA:

PRODUCT TOXICITY DATA: VINYL CHLORIDE (MONOMER)

LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
> 4,000 mg/kg oral-rat LD50	-----	-----

COMPONENT TOXICITY DATA:

Note: The component toxicity data is populated by the LOLI database and may differ from the product toxicity data given.

Component	LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
Vinyl chloride 75-01-4	-----	-----	18 pph (15 minr-Rat)

****

POTENTIAL HEALTH EFFECTS:

Eye contact: Causes eye irritation. Rapid evaporation of the material may cause frostbite.

Skin contact: Causes skin irritation. Rapid evaporation of the material may cause frostbite.

Inhalation: May cause respiratory tract irritation. Several minutes of exposure to high, but attainable concentrations (over 1000 ppm) may cause difficulty breathing, central nervous system depression and symptoms such as: ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual and or hearing disturbances, nausea, memory loss. Prolonged, high concentration exposures may cause unconsciousness or death. Cardiac: Acute intoxication may cause irregular heartbeats.

Ingestion: Not a likely route of exposure in occupational settings.

Chronic Effects: Chronic exposure to vinyl chloride monomer (VCM) may cause damage to the nervous system, respiratory system, musculoskeletal system, and lymphatic system. Occupational overexposure has produced a specific cancer (angiosarcoma of the liver) and is associated with hepatocellular cancer. Repeated prolonged exposure may damage: skin (scleroderma), bones (acro-osteolysis), blood vessels in the hands (Raynaud's Syndrome). Suspected of causing genetic defects. Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

SIGNS AND SYMPTOMS OF EXPOSURE:

Listed below.

Inhalation (Breathing): Respiratory Tract Irritation: rhinitis, scratchy throat, cough, sore throat, runny nose, wheezing, difficulty breathing (dyspnea). Inhalation of this material may cause central nervous system depression (narcotic effects).
Skin: Skin Irritation. If spilled on skin, rapid evaporation can cause local frostbite with redness, blistering, and scaling.
Eye: Eye Irritation. Rapid evaporation can cause local frostbite with corneal and conjunctival irritation or burns. High concentrations of vapor can cause eye irritation.
Ingestion (Swallowing): Ingestion is not a likely route of exposure.

Other Health Effects: Narcotic Effects (Central Nervous System Depression): Ataxia or dizziness, drowsiness or fatigue, loss of consciousness, headache, euphoria and irritability, visual or hearing disturbances, nausea, memory loss.

Interaction with Other Chemicals Which Enhance Toxicity: Alcohol may enhance toxic effects.

****

GHS HEALTH HAZARDS:

Skin Absorbent / Dermal Route? No.

GHS: CONTACT HAZARD - SKIN: Category 2 - Causes skin irritation

GHS: CONTACT HAZARD - EYE: Category 2B - Causes eye irritation

GHS: CARCINOGENICITY:
Category 1A - May cause cancer.

Component	NTP:	IARC (GROUP 1):	IARC (GROUP 2):	OSHA:
Vinyl chloride	Listed	Group 1	Not listed	Listed

SPECIFIC TARGET ORGAN TOXICITY (Single Exposure):
Category 3 - Respiratory Tract Irritation
Category 3 - Narcotic Effects

SPECIFIC TARGET ORGAN TOXICITY (Repeated or Prolonged Exposure):
Category 1 - Liver, Blood, Nervous System, Lymphatic System, Musculoskeletal System, Respiratory System

MUTAGENIC DATA:
Category 2 - Suspected of causing genetic defects. Mutagenic in bacteria studies. Genetic studies in animals were negative in some cases and positive in others.

REPRODUCTIVE TOXICITY:
Category 2 - Suspected of damaging fertility or the unborn child. Reproductive effects and testes damage occurred in rats exposed to vinyl chloride. These endpoints, however, were generally noted at concentrations greater than those necessary to cause liver damage.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:

Aquatic Toxicity:
This material is believed to be practically non-toxic to fish on an acute basis (LC50>100 mg/L).

FATE AND TRANSPORT:

BIODEGRADATION: Vinyl chloride may degrade under anaerobic conditions.

PERSISTENCE: Tropospheric half-life is estimated to be 23 hours. If released to air, this material will remain in the gas phase. If released to soil, volatilization will occur, but material that does not volatilize may be highly mobile. If released to water, evaporation will occur.

BIOCONCENTRATION: Bioconcentration potential is low (BCF <100 or log Kow <3).

13. DISPOSAL CONSIDERATIONS

Waste from material:
Reuse or reprocess, if possible. May be subject to disposal regulations. Dispose in accordance with all applicable regulations.

Container Management:
Refer to manufacturer/supplier for information on recovery/recycling. Dispose of container in accordance with applicable local, regional, national, and/or international regulations. Container rinsate must be disposed of in compliance with applicable regulations.

14. TRANSPORT INFORMATION

LAND TRANSPORT

U.S. DOT 49 CFR 172.101:

UN NUMBER: UN1086
PROPER SHIPPING NAME: Vinyl chloride, stabilized
HAZARD CLASS/ DIVISION: 2.1
LABELING REQUIREMENTS: 2.1
RQ (lbs): RQ 1 Lbs. (Vinyl chloride)

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

UN NUMBER: UN1086
SHIPPING NAME: Vinyl chloride, stabilized
CLASS OR DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

MARITIME TRANSPORT (IMO / IMDG) Regulated

UN NUMBER: UN1086
PROPER SHIPPING NAME: Vinyl chloride, stabilized

HAZARD CLASS / DIVISION: 2.1
LABELING REQUIREMENTS: 2.1

15. REGULATORY INFORMATION

U.S. REGULATIONS

OSHA REGULATORY STATUS:
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 426-2675.

Component	CERCLA Reportable Quantities:
Vinyl chloride	1 lb (final RQ)

SARA EHS Chemical (40 CFR 355.30)
Not regulated

EPCRA SECTIONS 311/312 HAZARD CATEGORIES (40 CFR 370.10):
Fire Hazard, Reactive Hazard, Sudden Release of Pressure, Acute Health Hazard, Chronic Health Hazard

EPCRA SECTION 313 (40 CFR 372.65):
The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Component	Status:
Vinyl chloride	0.1 %

OSHA SPECIFICALLY REGULATED SUBSTANCES:
OSHA 29 CFR 1910.1017 (Vinyl chloride); The U.S. Department of Labor, Occupational Safety and Health Administration specifically regulates manufacturing, handling and processing of vinyl chloride. Such regulations have been published at 29 CFR 1910.1017.

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):
The PSM standard may apply to processes which involve a flammable liquid or gas in a quantity of 10,000 pounds (4535.9 kg) or more.

NATIONAL INVENTORY STATUS

U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA): All components are listed or exempt.

TSCA 12(b): This product is not subject to export notification.

Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

STATE REGULATIONS

Component	California Proposition 65 Cancer WARNING:	California Proposition 65 CRT List - Male reproductive toxin:	California Proposition 65 CRT List - Female reproductive toxin:	Massachusetts Right to Know Hazardous Substance List	New Jersey Right to Know Hazardous Substance List	New Jersey Special Health Hazards Substance List
Vinyl chloride 75-01-4	Listed	Not Listed	Not Listed	Listed	2001	carcinogen; flammable - fourth degree; mutagen

Component	New Jersey - Environmental Hazardous Substance List	Pennsylvania Right to Know Hazardous Substance List	Pennsylvania Right to Know Special Hazardous Substances	Pennsylvania Right to Know Environmental Hazard List	Rhode Island Right to Know Hazardous Substance List
Vinyl chloride 75-01-4	Listed	Listed	Present	Present	Not Listed

CANADIAN REGULATIONS

• This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations

WHMIS - Classifications of Substances:

• A - Compressed Gas
• B1 - Flammable Gas
• D2A - Poisonous and Infectious Material; Materials causing other toxic effects - Very toxic material
• D2B - Poisonous and Infectious Material; Materials causing other toxic effects - Toxic material
• F - Dangerously reactive material

16. OTHER INFORMATION

Prepared by: OxyChem Corporate HESS - Product Stewardship

Rev. Date: 06-Apr-2015

HMIS: (SCALE 0-4) (Rated using National Paint & Coatings Association HMIS: Rating Instructions, 2nd Edition)

Health Rating: 2* **Flammability Rating:** 4 **Reactivity Rating:** 1

NFPA 704 - Hazard Identification Ratings (SCALE 0-4)

Health Rating: 2 **Flammability:** 4 **Reactivity Rating:** 2

VINYL CHLORIDE (MONOMER)

Reason for Revision:
• Revised Major Health Hazards: SEE SECTION 2
• Revised GHS Information: SEE SECTION 2
• Updated First Aid Measures: SEE SECTION 4
• PPE recommendations have been modified: SEE SECTION 8
• Toxicological Information has been revised: SEE SECTION 11
• Updated Disposal Considerations. SEE SECTION 13
• Updated Transportation Information: SEE SECTION 14

IMPORTANT:
The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESSED OR IMPLIED, IS MADE REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, storage, disposal and other factors that may involve other or additional legal, environmental, safety or performance considerations, and OxyChem assumes no liability whatsoever for the use of or reliance upon this information. While our technical personnel will be happy to respond to questions, safe handling and use of the product remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, local or foreign laws

OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Safety Data Sheet available to your employees

End of Safety Data Sheet

APPENDIX D
EMPLOYEE SAFETY TRAINING CHECKLIST

Employee Safety Training Checklist

Employee Name: _____ Hire Date: _____

Position: _____ Trainer: _____

I acknowledge that I have been trained in the SAFETY AND HEALTH areas checked below, and agree to follow all TRC Environmental Corporation Safety and Health Rules, Policies and Procedures.

_____ Safety and Health Program

- My right to ask questions, or report any safety hazards, either directly or anonymously without any fear of reprisal.
- The location of TRC Environmental Corporation safety bulletins and required safety postings (i.e., summary of occupational injuries and illnesses, and Safety and Health Protection Poster).
- Disciplinary procedures that may be used to ensure compliance with safe work practices.
- Reporting safety concerns.
- Accessing the department safety committee.

_____ Incident Reporting and Reporting Occupational Injuries and Illnesses.

_____ Hazard Communication

- The potential occupational hazards in the work area associated with my job assignment.
- The safe work practices and personal protective equipment required for my job title.
- The location and availability of MSDSs.
- The hazards of any chemicals to which I may be exposed, and my right to the information contained on Material Safety Data Sheets (MSDS's) for those Chemicals.

_____ Hazardous Material Spill Response

_____ Bloodborne Pathogen Response

_____ Personal Protective Equipment

_____ Employee Safety Manual

_____ Machinery Tag Out Program

_____ Emergency Procedures

_____ HAZWOPER

_____ Drug and Alcohol Policy

_____ Other: _____

I understand the above items and agree to comply with safe work practices in my work area.

_____ _____

Employee Signature Date

I have trained the above employee in the categories indicated on this form.

_____ _____

Trainers Signature Date

APPENDIX E

EMPLOYEE MEDICAL DATA SHEET/MEDICAL EVALUATION STATEMENT/

FIRST AID ACCIDENT REPORT

Employee Medical Data Sheet

In case of injury, this form is to accompany personnel to the hospital. It is designed to provide needed medical information in times of emergency.

This form is to be kept on-site under the care of the SHSO or his designee.

Employee Name:_____

Address:_____

Home Telephone:_____

Occupation:_____

Age:_____Height:_____ Weight:_____ Blood Type:_____

Name and Number of Emergency Contact:

1.) _____

2.) _____

Allergies and Sensitivities (*please list allergies to drugs or other materials*):

Medications (*please list any medications, prescription or non-prescription that you are presently using or expect to use*):

Medical Restrictions (*please list any current or past medical restrictions or significant illnesses experienced in the past):*

Your Doctor’s name, address and phone number:

First Aid Accident Report

Complete this form for all accidents involving only first aid treatment, and which are non-reportable as defined by OSHA 29 CFR 1910.4.

_____ _____

Name of employee receiving treatment: Date of treatment

_____ _____

Occupation of employee receiving treatment Employer

_____

Employee's home telephone number

_____

Name of First Aid Provider

_____ _____

Time of accident Date of accident

_____

Location of accident

Describe how the accident occurred (be specific; indicate the cause such as: debris, oil spill, ladder in poor condition or not tied-off)

_____

_____

Describe the injury:

_____

_____

Indicate First Aid measures taken:

_____

_____

What can be done to prevent future accidents of this kind:

_____

_____

APPENDIX E

MEDICAL EVALUATION FORM

Employee Name: _____ Employee Number: _____

Office: _____ Date of Exam: _____

_____ Initial _____ Annual _____ Exit Protocol

I have reviewed the results of the medical health history, physical examination, and laboratory tests prescribed by _____: and certify that: the record is complete, and the following were not performed:

_____

_____

_____

Based upon my examination, I certify that this employee:

_____ Have no medical contraindications to the use of supplied air or self-contained breathing apparatus (SCBA) and air-purifying respirators.

_____ Has a medical restriction in the use of respiratory equipment (describe below):

_____

_____

_____

Based upon by examination, I certify that this employee:

_____ Have no medical contraindications to full participation in hazardous waste site work, when conducted under the conditions of adequate training and a health and safety plan.

_____ Have medical limitations that restrict full participation in hazardous waste site work. Describe work functions limitations (i.e., lifting, temporary limitation, pending medical follow-up work, etc.).

Comments: _____

_____

Appendix E

MEDICAL EVALUATION FORM (Continued)

_____ Is medically restricted from any direct work with hazardous waste or hazardous waste sites, but **may** continue to perform office work.

Comments: _____

_____

_____

I have communicated the examination results to the employees and have informed the employee about medical conditions discovered during my examination that require further examination or treatment.

_____

Name of Physician Signature of Examining Physician

Address: _____ Date: _____

_____ _____

_____ _____

APPENDIX F

OCCUPATIONAL INJURIES AND ILLNESS FORM

(OSHA 101)

OSHA's Form 300

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related death and about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR Part 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an Injury and Illness Incident Report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name ______________________

City ______________ *State* __________

Identify the person | **Describe the case** | **Classify the case**

Using these four categories, check ONLY the most serious result for each case: | *Enter the number of days the injured or ill worker was:* | *Check the "Injury" column or choose one type of illness:* (M)

(A) Case no.	(B) Employee's name	(C) Job title (e.g., *Welder*)	(D) Date of injury or onset of illness	(E) Where the event occurred (*e.g., Loading dock north end*)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (*e.g., Second degree burns on right forearm from acetylene torch*)	(G) Death	(H) Days away from work	(I) Remained at work: Job transfer or restriction	(J) Remained at work: Other record-able cases	(K) On job transfer or restriction	(L) Away from work	(1) Injury	(2) Skin disorder	(3) Respiratory condition	(4) Poisoning	(5) All other illnesses
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
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___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
___	___	___	___/___ month/day	___	___	☐	☐	☐	☐	___ days	___ days	☐	☐	☐	☐	☐
					Page totals ➤	___	___	___	___	___	___	Injury (1)	Skin disorder (2)	Respiratory condition (3)	Poisoning (4)	All other illnesses (5)

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A

Summary of Work-Related Injuries and Illnesses

Year 20__ __

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no work-related injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete and accurate before completing this summary.

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the Log. If you had no cases, write "0."

Employees, former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR Part 1904.35, in OSHA's recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
_____	_____	_____	_____
(G)	(H)	(I)	(J)

Number of Days

Total number of days of job transfer or restriction	Total number of days away from work
_____	_____
(K)	(L)

Injury and Illness Types

Total number of . . .

	(M)		
(1) Injuries	_____	(4) Poisonings	_____
		(5) All other illnesses	_____
(2) Skin disorders	_____		
(3) Respiratory conditions	_____		

Establishment information

Your establishment name _____

Street _____

City _____ State _____ ZIP _____

Industry description (*e.g., Manufacture of motor truck trailers*)

_____

Standard Industrial Classification (SIC), if known (*e.g., SIC 3715*)

___ ___ ___ ___

Employment information *(If you don't have these figures, see the Worksheet on the back of this page to estimate.)*

Annual average number of employees _____

Total hours worked by all employees last year _____

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

_____ _____
Company executive Title

( ) - / /
Phone Date

Post this Summary page from February 1 to April 30 of the year following the year covered by the form.

Public reporting burden for this collection of information is estimated to average 50 minutes per response, including time to review the instructions, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any other aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Avenue, NW, Washington, DC 20210. Do not send the completed forms to this office.

APPENDIX G

EMPLOYEE ACKNOWLEDGEMENT OF THE HASP

APPENDIX H

COVID-19 GUIDELINES FOR FIELD ACTIVITIES

TRC Pandemic Program
Coronavirus Disease (COVID-19) Response Efforts

The safety and health of our employees and families, clients, subcontractors, and the public is of paramount importance to TRC. As the COVID-19 Pandemic evolves, TRC continues to monitor workplace safety guidelines and requirements issued by health officials, government agencies and clients. These guidelines and requirements have been used to develop TRC's Revised COVID-19 Protocols listed in this document.

I. FACE COVERINGS

Based on the recent upward trend in COVID-19 cases and CDC's guidance, TRC is requiring **face coverings for all employees and visitors while inside offices, field locations (trailers) and while riding in vehicles with other people, regardless of vaccination status.**

II. VACCINATIONS

According to the CDC, a growing body of evidence suggests that fully vaccinated people are less likely to have symptomatic infection or transmit the virus to others. If you are searching for an opportunity to get vaccinated, you can visit www.vaccines.gov.

Our clients are increasingly asking us to provide the vaccination status for those employees working at their sites. Because of this, **all employees are required to complete the Certificate of Vaccination Status Form**, however it is voluntary whether you choose to disclose your vaccination status. Employees will not be subject to any retaliation as a result of their vaccination status and the Company will not tolerate any harassment concerning an employee's decision not to receive the vaccination.

III. SYMPTOMS AND SCREENING

Employees should NOT enter the workplace if any of the following are present:

- COVID-19 Symptoms
- Undergoing evaluation for SARS-CoV-2 infection (such as pending viral test)
- Diagnosis of SARS-CoV-2 infection in the prior 10 days
- Under current instructions to self-quarantine
- Close contact to someone with SARS-CoV-2 infection during the prior 14 days, unless fully vaccinated and asymptomatic

Both vaccinated and unvaccinated employees and visitors shall complete the Pre-Entry Questionnaire, which has been revised to reflect current screening criteria in a single acknowledgement format. If an employee doesn't have access to an electronic device, a paper questionnaire can be used and is included in Attachment A.

Employee Pre-Entry Questionnaire Visitor Questionnaire

IV. REPORTING

Employees are expected to notify their supervisor and a member of the Corporate Safety Department if they experience COVID-19 symptoms or have recently been in close contact to someone with SARS-CoV-2 infection during the prior 14 days.

V. TRC OFFICE OCCUPANCY AND TRAVEL

TRC will allow up to 75% office occupancy capacity if needed to meet business demands, however employees are currently being asked to **Work From Home (WFH) if possible**. Meetings in offices should be avoided and conducted remotely when possible.

Note: Local municipalities and client locations may have more stringent requirements which would be implemented under that circumstance.

Please coordinate your return to the office or ongoing Work From Home (WFH) with your supervisor and Office Practice Leader (OPL) to ensure an orderly transition back to office work. Additionally, you should discuss any concerns that you may have with respect to working in the office with your HR representative.

Travel is currently limited to client meetings and needed business development opportunities.

VI. Communications

TRC has provided regular communications on COVID-19 to our employees, inclusive of the information provided in this document. Our Executive Leadership Team and Crisis Management Committee meet daily to develop strategies to best support our employees and communicate these strategies through various sources of media and have launched an internal COVID-19 focused intranet SharePoint site. This site will be a central repository for all communications, health and safety tips, preparedness plans, links to important resources such as the CDC, WHO, etc.

VII. Monitoring

As this pandemic has progressed, TRC has recommended that our employees keep current on the ever-changing landscape of COVID-19 by visiting the following websites.

- CDC COVID-19 Guidance: CDC COVID-19 Situation Summary
- Travel
  - Travel health notices from the Centers for Disease Control and Prevention (CDC).
  - Travel Advisories from the U.S. Department of State
- Overview of Global Cases: GIS Map by Johns Hopkins
- CDC COVID-19 Symptoms: COVID-19 Symptoms

TRC will continue to monitor the situation and work with our employees, clients, and subcontractors to be proactive in planning efforts. Should you have any questions or concerns, please feel free to reach out to me and I will be happy to discuss our strategy with you.

Best Regards,

Mike Glenn
Senior Vice President, Director of EHS and Quality

Attachment: CP052 Pandemic Program

1. PURPOSE

The purpose of this Pandemic Program (Program) is to protect our employees' health, improve preparedness and response, and minimize the negative impact on TRC's ability to service clients during a pandemic disease event. This Program will be managed in conjunction with TRC's Business Continuity Plan (BCP) and Crisis Management Committee program.

2. SCOPE

This procedure applies to TRC employees.

3. DEFINITIONS

Pandemic: Refers to an epidemic that has spread over several countries or continents, usually impacting a large number of people. A pandemic includes:

- Healthcare services not being available (they are already full at present with the usual ailments).
- Schools, churches and other public places not being open.
- Borders are partially or fully closed, especially airports, leaving people (our families, employees, business partners, customers and suppliers) "stranded".
- Essential materials and supplies may be limited due to distribution chains that are affected by the travel restrictions or absentee workers supporting those transportation means.
- Essential services around utilities, food distribution/access and banking systems may not be at "normal levels"; access to cash flow could be tight.
- People may not be willing to or able to come to work.

Avian influenza: A virus that infects birds especially poultry and variations have been known to be transmitted to humans. One strain, H5N1 is highly pathogenic to humans and limited vaccine is available.

COVID-19: A highly infectious disease that is spread most commonly through respiratory droplets and particles produced when an infected person exhales, talks, vocalizes, sneezes, or coughs. COVID-19 is highly transmissible and can be spread by people who have no symptoms.

Influenza pandemic: Occurs when a new influenza virus emerges and spreads around the world as most people do not have immunity.

H1N1: Commonly referred to as the "swine flu" because it has been found in farm animals and can be transmitted to humans.

Seasonal influenza: Regional common influenza that is routine and vaccines are readily available.

Vaccine: Pre-emptive treatment in the form of a shot or nasal mist specific to a viral strain that increases a person's immunity and ability to resist infection.

US Department of State Travel Advisory Levels: Levels and definitions issued in 2018 by the US Department of State include the following:

- **Level 1 – Exercise Normal Precautions:** This is the lowest advisory level for safety and security risk. There is some risk in any international travel. Conditions in other countries may differ from those in the United States and may change at any time.
- **Level 2 – Exercise Increased Caution:** Be aware of heightened risks to safety and security. The Department of State provides additional advice for travelers in these areas in the Travel Advisory. Conditions in any country may change at any time.
- **Level 3 – Reconsider Travel:** Avoid travel due to serious risks to safety and security. The Department of State provides additional advice for travelers in these areas in the Travel Advisory. Conditions in any country may change at any time.
- **Level 4 – Do Not Travel:** This is the highest advisory level due to greater likelihood of life-threatening risks. During an emergency, the U.S. government may have very limited ability to provide assistance. The Department of State advises that U.S. citizens not travel to the country or leave as soon as it is safe to do so. The Department of State provides additional advice for travelers in these areas in the Travel Advisory. Conditions in any country may change at any time.

4. RESPONSIBILITIES

4.1 The SVP, Director of Corporate EHS and the Director of Corporate EHS and Compliance are responsible for the following:

- Implement this Program throughout TRC.
- Define roles and responsibilities necessary to effectively implement this Program.
- Facilitate communications to employees and management during pandemic events.
- Periodically review the effectiveness of this Program and modify as necessary to ensure it remains current and effective.

4.2 Corporate EHS Team are responsible for the following:

- Assist the SVP, Director of Corporate EHS and the Director of Corporate EHS and Compliance of the implementation of this Program throughout TRC.
- Facilitate communication to Human Resources Department (HR) and Project Managers/Supervisors regarding employees impacted by pandemic.

4.3 Office Safety Coordinators are responsible for the following:

- Communicate the requirements of this Program to office personnel.
- Promote other risk mitigation methods (e.g., social distancing, minimize room occupancies, etc.).

4.4 Project Managers and Supervisors are responsible for the following:

- Consult with the SVP, Director of Corporate EHS and Director of Corporate EHS and Compliance, and monitor travel advisories for the geographic areas where employees are either working at or will be traveling to.
- Assist with implementing the health and travel precautions recommended by the respective authorities and TRC.
- Notify clients of project delays due to travel restrictions or positive test results.
- Communicate and support mitigation strategies to employees.
- Assist with identifying State and local travel restrictions and requirements to conduct work (e.g., wear face coverings, vaccinations, etc.).

4.5 Employees are responsible for the following:

- Notify supervision or the Corporate EHS Team of symptoms associated with the pandemic.
- Follow health and travel precautions in accordance with this Program and guidance provided by TRC leadership.
- Review health and travel advisories issued by the government and health organizations prior to travelling outside the United States or to locations within the United States that may be considered at risk.
- Provide feedback on the effectiveness of this Program to Project Managers/Supervisors and Office Safety Coordinators to improve the effectiveness of this Program.

5. PROCEDURES

5.1 Work Site Risk Assessment

- A pandemic disease presents a serious health risk and could prevent TRC from serving clients. The risk to employee health and the business will vary based on the geographic area of the pandemic and the potential severity of the disease.

- The SVP, Director of Corporate EHS and/or the Director of Corporate EHS and Compliance will develop and facilitate the risk assessment process in consultation with members of the executive team and the Crisis Management Committee to assess the potential impact of a pandemic on domestic and international business and associated travel (e.g. quarantines, border closures, etc.).

- The risk assessment process will follow guidelines provided by current governmental agencies, including the Center for Disease Control (CDC), World Health Organization (WHO), and the US Department of State. Community public health, emergency management, and other sources will also be monitored.

- Employees who develop symptoms associated with the pandemic shall immediately notify their supervisor or a member of the Corporate EHS Team regarding the development of symptoms and their recent history of close contact with other employees and clients.
- Based on the risk assessment process, employees will be placed into one of the following categories:

    - **Low Risk:** Exposure risk (caution) jobs are those that do not require contact with people known to be, or suspected of being, infected with a disease nor frequent close contact with the general public. Workers in this category have minimal occupational contact with the public and other coworkers.

    - **Medium Risk:** Exposure risk jobs include those that require frequent and/or close contact with people who may be infected with a disease, but who are not known or suspected patients. In areas without ongoing community transmission, workers in this risk group may have frequent contact with travelers who may return from international locations with widespread transmission of a disease. In areas where there is ongoing community transmission, workers in this category may have contact be with the general public (e.g., in schools, high-population-density work environments, and some high-volume retail settings).

    - **High Risk:** Exposure risk jobs are those with high potential for exposure to known or suspected sources of a disease. Workers in this category include healthcare delivery and support staff (e.g., doctors, nurses, and other hospital staff who must enter patients' rooms) exposed to known or suspected patients.
    - **Very High**: Exposure risk jobs are those with high potential for exposure to known or suspected sources of a disease during specific medical, postmortem, or laboratory procedures. Workers in this category include healthcare workers and healthcare or laboratory personnel collecting or handling specimens from known or suspected patients.

- Employees who are classified as medium or high risk will be required to self-isolate and refrain from returning to work in accordance with section 5.3 of this program.
- Additionally, the risk assessment will consider the essential/critical components of TRC's business operation that need to be conducted during the pandemic.

5.2 Health Risk Assessment and Quarantine

- The SVP, Director of Corporate EHS with support from the Corporate EHS Team will facilitate a self-quarantine and return to work process for employees that have been impacted by the pandemic. Employees will be placed into one of three categories based on their exposure to the pandemic.
    - **Category 1:** Employee reporting symptoms and/or receives negative test result for a disease.
    - **Category 2:** Employee suspects exposure to a disease but does not develop symptoms.
    - **Category 3:** Employee receives a positive test for a disease.
- No matter the category, all employees shall notify the SVP, Director of Corporate EHS and/or the Director of Corporate EHS and Compliance regarding the development of symptoms, suspected exposure or positive test. Upon notification to the Corporate EHS Team will notify HR and work the employees and Supervisor/Project Manager to make appropriate client notifications.
- Employees of each category will be required to quarantine for the appropriate amount of time based on the medical opinion of the employee's third-party medical provider and the best available guidance from government agencies such the CDC.
- Employees can continue working from home during self-quarantine if approved by their supervisor. Employees who are not able to work at home will coordinate benefits with TRC's HR.

5.3 Clearance to Return to Work After Illness

- Prior to returning to work after a quarantine has been issued to an employee, the employee shall receive a medical clearance from a third-party medical provider and provide a copy the Corporate EHS Team. Examples for each category are listed here:
    - **Category 1**: Employee must receive clearance to return to work from third party medical provider (WorkCare is an option for employees).
    - **Category 2**: Employee can return work following quarantine period provided they remain symptom free. Telephonic healthcare provider such as WorkCare may be optional.

- **Category 3**: Recovered employee provides Safety and HR clearance from third party medical provider prior to returning to work.

Please reference section 5.7 for COVID-19 and Appendix A CP052.1 COVID-19 Protocols for specific guidance.

5.4 Communication

- TRC will provide periodic updates through internal & external communications when a pandemic is imminent and ongoing includes, but is not limited to:
  - Notification to employees of operational changes.
  - Provide frequent updates about the pandemic status.
  - Provide advisories and alerts as conditions change.
  - Monitor local, state, and federal pandemic updates.
- Internal Communication
  - Internal communication will be provided to employees to educate them about pandemic diseases and current mitigation methods.
  - Health and travel information will be closely monitored by the Crisis Management Committee. Necessary mitigation strategies and pandemic status will be routinely provided to employees through regular business communications which may include e-mail, Safety Alerts, electronic mass communication systems (i.e., Honeywell/Everbridge), telephone, etc.
- External Communication
  - Project Managers will keep clients informed of project schedules and potential delays due to travel advisories and impacts to supply chains.

5.5 Pandemic Response by Pandemic Phase

- Currently the World Health Organization (WHO) has created various phases for a pandemic.
  - **Phase 1:** No viruses circulating among animals have been reported to cause infections in humans.
  - **Phase 2:** An animal influenza virus circulating among domesticated or wild animals is known to have caused infection in humans and is therefore considered a potential pandemic threat.

- **Phase 3:** An animal or human-animal influenza reassortment virus has caused sporadic cases or small clusters of disease in people but has not resulted in human-to-human transmission sufficient to sustain community-level outbreaks. Limited human-to-human transmission may occur under some circumstances, for example, when there is close contact between an infected person and an unprotected caregiver. However, limited transmission under such restricted circumstances does not indicate that the virus has gained the level of transmissibility among humans necessary to cause a pandemic.
- **Phase 4:** Characterized by verified human-to-human transmission of an animal or human-animal influenza reassortment virus able to cause "community-level outbreaks." The ability to cause sustained disease outbreaks in a community marks a significant upwards shift in the risk for a pandemic. Any country that suspects or has verified such an event should urgently consult with WHO so that the situation can be jointly assessed, and a decision made by the affected country if implementation of a rapid pandemic containment operation is warranted. Phase 4 indicates a significant increase in risk of a pandemic but does not necessarily mean that a pandemic is a forgone conclusion.
- **Phase 5:** Characterized by human-to-human spread of the virus into at least two countries in one WHO region. While most countries will not be affected at this stage, the declaration of Phase 5 is a strong signal that a pandemic is imminent and that the time to finalize the organization, communication, and implementation of the planned mitigation measures is short.
- **Phase 6:** This pandemic phase, is characterized by community level outbreaks in at least one other country in a different WHO region in addition to the criteria defined in Phase 5. Designation of this phase will indicate that a global pandemic is under way.
- During the post-peak period, pandemic disease levels in most countries with adequate surveillance will have dropped below peak observed levels. The post-peak period signifies that pandemic activity appears to be decreasing; however, it is uncertain if additional waves will occur and countries will need to be prepared for a second wave.
- In the post-pandemic period, influenza disease activity will have returned to levels normally seen for seasonal influenza. It is expected that the pandemic virus will behave as a seasonal influenza virus. At this stage, it is important to maintain surveillance and update pandemic preparedness and response plans accordingly. An intensive phase of recovery and evaluation may be required.

5.6 Mitigation Strategies

TRC will follow health and travel precautions issued by the respective authorities. One or more of the following precautions may be implemented based on business condition and guidance from authorities.

5.6.1 Telecommute:

- Many TRC employees have the ability to telecommute. Employees are encouraged to stay at home when ill, when having to care for ill family members, or when caring for children due to school closure. TRC also offers Personal Time Off (PTO) as an option for employees.
- Employees should stay at home when sick or otherwise experience symptoms that are consistent with the pandemic disease.

5.6.2 Infection Control Measures:

Infection control is an essential component of pandemic management and a component of public health measures. Essential measures include:

- Practice frequent hand washing. According to the CDC, washing hands with soap and water is the best way to get rid of germs in most situations. If soap and water are not readily available, you can use an alcohol-based hand sanitizer that contains at least 60% alcohol. You can tell if the sanitizer contains at least 60% alcohol by looking at the product label.
- Obtain immunizations recommended by healthcare providers to help avoid disease.
- Practice social distancing to increase the space between employee work areas and decreasing the possibility of contact by limiting large or close contact gatherings and avoid shaking hands.
- Frequently disinfect all areas that are likely to have frequent hand contact (like doorknobs, faucets, handrails).

5.7 Travel

Prior to traveling outside the United States, employees and project managers should review the current travel advisory levels that are posted on the United States Department of State. These advisories provide safety and security information intended for US travelers who are intending to travel outside the United Sates. The travel advisory system includes the following levels:

- **Level 1 – Exercise Normal Precautions**
- **Level 2 – Exercise Increased Caution**
- **Level 3 – Reconsider Travel**
- **Level 4 – Do Not Travel**

TRC's Crisis Management Committee will periodically monitor travel advisory levels and will provide company guidance on business travel to areas with active travel advisories.

5.8 COVID-19

Following TRC's Health and Safety Management System, field activities related to COVID-19 were assessed based on four risk levels, best practices were developed based on tasks, self-quarantine and return to work process, and symptoms and precautions were identified (**Appendix A COVID-19 Protocols**). Additionally, a COVID-19 Questionnaire (**Appendix B**) should be used to determine the health of TRC and subcontractors' employees at a project.

6. TRAINING

TRC has a Pandemic: Slowing the Spread course available to employees through the TRC Academy. Employees may complete this course if they want further information on illness prevention and avoiding the spread of disease. This course discusses disease containment strategies and disease prevention.

7. EVALUATION

The plan and emergency communication strategies will be periodically reviewed to ensure it remains current and effective. Performance of this plan during actual events will be considered for continual improvement.

8. REFERENCES/RELATED DOCUMENTATION

CP048 TRC Business Continuity Plan

CP053 Crisis Management Committee Program

CP054 COVID-19 Back to Work Program

9. APPENDICIES

A. CP052.1 COVID-19 Protocols

B. CP052.2 COVID-19 Questionnaire for Onsite Workers

C. CP052.3 COVID-19 Pre-Screeing

10. REVISION HISTORY

Revision Number	Revision Date	Summary of Revision	Modified by
0	5/3/10	New Document	Gary Ritter
1	6/23/15	Minor Revisions to previous program	Mike Glenn
2	3/3/20	Updated to reflect COVID-19 and included as part of the HSMS	Mike Glenn and Todd Woletz
3	3/17/20	Added COVID-19 Field Guidelines	Tim Johnson
4	3/24/20	Added COVID-19 Questionnaire for Onsite Workers	Tim Johnson
5	3/27/20	Revised COVID-19 Field Guidelines and add COVID-19 information to program	Tim Johnson
6	4/1/20	Revised COVID-19 Questionnaire for Onsite Workers	Tim Johnson
7	4/22/20	Added Self-Quarantine, Return to Work Guidance, and Office Reopening Guidance	Andy Boehm, Tim Johnson, Todd Woletz, and Mike Caro
8	5/6/20	Minor Revisions to Training Section and Appendix A	Tim Johnson
9	5/12/20	Revisions to COVID-19 Symptoms	Tim Johnson
10	6/19/20	Revisions to COVID-19 Symptoms	Tim Johnson
11	11/2/20	Revised COVID-19 Field Guidelines and Questionnaire	Todd Woletz
12	4/27/21	Included CDC guidelines for vaccinated people	Todd Woletz
13	8/6/21	Revisions to program and replacement of Field Guidelines to COVID-19 Protocols and Questionnaire	Tim Johnson
14	11/12/21	Revisions to COVID-19 Protocols and addition of COVID-19 Pre-Screening Information	Tim Johnson

Attachment A
CP052.1 COVID-19 Protocols

As the COVID-19 Pandemic evolves, TRC continues to monitor workplace safety guidelines and requirements issued by health officials, government agencies and clients. These guidelines and requirements have been used to develop TRC's Revised COVID-19 Protocols listed in this document.

I. FACE COVERINGS

Based on the recent upward trend in COVID-19 cases and CDC's guidance, TRC is requiring **face coverings for all employees and visitors while inside offices, field locations (trailers) and while riding in vehicles with other people, regardless of vaccination status.**

II. VACCINATIONS

According to the CDC, a growing body of evidence suggests that fully vaccinated people are less likely to have symptomatic infection or transmit the virus to others. If you are searching for an opportunity to get vaccinated, you can visit www.vaccines.gov.

Our clients are increasingly asking us to provide the vaccination status for those employees working at their sites. Because of this, **all employees are required to complete the Certificate of Vaccination Status Form**, however it is voluntary whether you choose to disclose your vaccination status. Employees will not be subject to any retaliation as a result of their vaccination status and the Company will not tolerate any harassment concerning an employee's decision not to receive the vaccination.

III. SYMPTOMS AND SCREENING

Employees should NOT enter the workplace if any of the following are present:

- COVID-19 Symptoms
- Undergoing evaluation for SARS-CoV-2 infection (such as pending viral test)
- Diagnosis of SARS-CoV-2 infection in the prior 10 days
- Under current instructions to self-quarantine
- Close contact to someone with SARS-CoV-2 infection during the prior 14 days, unless fully vaccinated and asymptomatic

Both vaccinated and unvaccinated employees and visitors shall complete the Pre-Entry Questionnaire, which has been revised to reflect current screening criteria in a single acknowledgement format. If an employee doesn't have access to an electronic device, a paper questionnaire can be used and is included in Attachment A.

Employee Pre-Entry Questionnaire Visitor Questionnaire

IV. REPORTING

Employees are expected to notify their supervisor and a member of the Corporate Safety Department if they experience COVID-19 symptoms or have recently been in close contact to someone with SARS-CoV-2 infection during the prior 14 days.

V. TRC OFFICE OCCUPANCY AND TRAVEL

TRC will allow up to 75% office occupancy capacity if needed to meet business demands, however employees are currently being asked to **Work From Home (WFH) if possible**. Meetings in offices should be avoided and conducted remotely when possible.

Note: Local municipalities and client locations may have more stringent requirements which would be implemented under that circumstance.

Please coordinate your return to the office or ongoing Work From Home (WFH) with your supervisor and Office Practice Leader (OPL) to ensure an orderly transition back to office work. Additionally, you should discuss any concerns that you may have with respect to working in the office with your HR representative.

Travel is currently limited to client meetings and needed business development opportunities.

Attachment B
CP052.2 COVID-19 Questionnaire for Onsite Workers

Name: _____

Date: _____

Office / Project Location: _____

1. *I acknowledge that I understand and will follow TRC guidelines as it relates to the use of face coverings and compliance with proper social distancing requirements regardless of my vaccination status. TRC's current guidelines may be found on TRCNet.*

   Initial if you agree _____

2. *I further acknowledge that I am currently not exhibiting any signs or symptoms associated with COVID-19 now or in the past 72 hours. Signs and symptoms include fever or measured temperature greater than 100.4°F, cough, congestion, fatigue, nausea, diarrhea, new loss of taste or smell, sore throat, muscle or body aches, headache, or difficulty breathing/shortness of breath. Unvaccinated individuals also acknowledge no close contact with an individual diagnosed with COVID-19 and that neither they nor anyone else inside their residence have been exposed to someone who is currently being quarantined by a doctor or local public health official.*

   Initial if you agree _____

Please forward completed forms to the Office Manager or the Field Project Manger

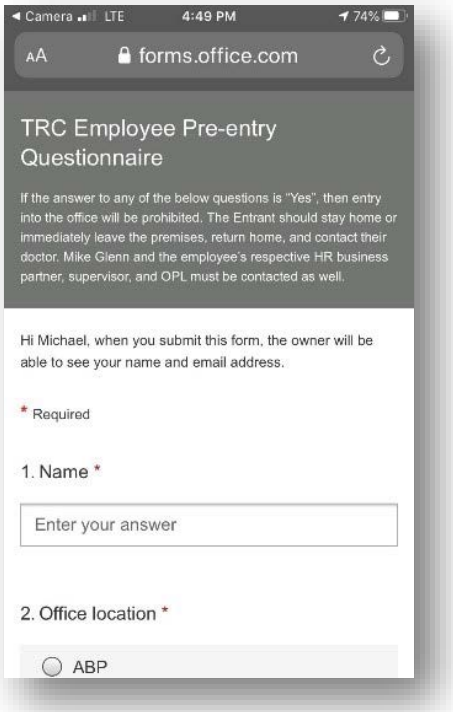
Attachment C
CP052.3 COVID-19 Pre-Screening

To reduce the risk of spreading COVID-19, all employees and visitors are required to complete TRC's Pre-Entry Questionnaire or a paper sign-in sheet. The Questionnaire can be accessed using either the QR Code or by the hyperlink found below.

TRC Employees

Open the camera on your smart phone or tablet (iPhone or Android). Scan the QR code and the questionnaire will appear as shown below. Employees can also access the questionnaire using the following link: Employee Pre-Entry Questionnaire

Touch the banner and you will be taken to a sign-in page for your TRC Microsoft access. Sign-in with your normal password. Note: you will likely have to use the @trc**solutions.**com email address rather than the @trc**companies**.com email address. After you're signed in, you will see the pre-entry questionnaire.



Guests / Visitors

Open the camera on your smart phone or tablet (iPhone or Android). Scan the QR code and the questionnaire will appear as shown below. Visitors will go directly to the acknowledgment without signing in to TRC by using the following QR Code or hyperlink. Guest Pre-Entry Questionnaire

Please contact Todd Woletz twoletz@trccompanies.com or Marty Cowie mcowie@trccompanies.com in the Corporate Safety Department with questions.

The following QR Codes can be printed and posted at entrances.

TRC Employee QR Code

Guest / Visitor QR Code

APPENDIX F

MTA LONG ISLAND RAIL ROAD
ARCH STREET YARD
LONG ISLAND CITY, NEW YORK

QUALITY ASSURANCE PROJECT PLAN
FOR
REMEDIAL ACTION WORK PLAN

Prepared for:

METROPOLITAN TRANSPORTATION AUTHORITY
LONG ISLAND RAIL ROAD

Prepared by:

TRC ENGINEERS, INC.
NEW YORK, NEW YORK

MARCH 2022

MTA LIRR – ARCH STREET YARD
QUALITY ASSURANCE PROJECT PLAN FOR
REMEDIAL ACTION WORK PLAN

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1.0 QUALITY ASSURANCE PROJECT PLAN

1.1 Objective and Scope

The Long Island Railroad (LIRR) entered into a Voluntary Cleanup Agreement (NYSDEC Index Nos. W1-0993-04-04 and W2-0994-04-04) with the New York State Department of Environmental Conservation (NYSDEC) and Metropolitan Transportation Authority (MTA) in order to investigate and remediate the LIRR Arch Street Yard (the Yard). The Yard is currently owned by the LIRR and is approximately eight acres in size. The area of the Yard that is subject to the Order on Consent and Administrative Settlement and this Remedial Action Work Plan (RAWP), is an approximate 0.3-acre portion of the Yard designated as New York Department of Environmental Conservation (NYSDEC) Site No. 241222 (herein referred to as "the Site").

A Remedial Action Work Plan (RAWP) dated March 2022 was developed for the Site to address a residual area of "hot-spot" of chlorinated VOC contaminated subsurface soil and groundwater in a discrete area of the Yard to the south of the tracks. As discussed in detail in the March 2022 RAWP, remedial activities to be completed at the Site will include the injection of amendments to stimulate chemical and biological reduction of chlorinated VOCs, as well as the implementation of institutional controls.

A pre-design investigation will be performed prior to implementation of the remedy to further delineate the horizontal and vertical extents of contamination and refine the targeted treatment volumes, if necessary. The pre-design investigation will include the installation and associated sampling of soil borings and if necessary, the installation and/or sampling of groundwater probes and existing monitoring wells, for delineation. However, details associated with the pre-design investigation will be developed as part of a separate Pre-Design Investigation Work Plan.

Upon the completion of remedial excavation activities at the Site, post-remediation groundwater sampling will be conducted at the Site. It should be noted that the implementation of additional rounds of amendment injections may be necessary.

The purpose of this Quality Assurance Project Plan (QAPP) is to develop and describe the detailed sample collection and analytical procedures that will ensure high quality data for the environmental sampling that will be completed by TRC Engineers, Inc. (TRC) throughout implementation of the remedy, including during the pre-design investigation, as well as during post-remediation groundwater sampling. It should be noted, TRC has prepared this QAPP based on a prior submission to NYSDEC by D&B Architects & Engineers, P.C. (D&B) in September 2018.

1.2 Data Usage

The data generated from the sampling covered by this QAPP will be utilized for various purposes depending on the type of sampling performed. The summary below provides a brief description of the sampling activities that may be undertaken in support of the remedial activities to be completed at the Site. Additional details on the remedial activities to be completed at the Site are provided in the March 2022 RAWP.

Pre-Design Investigation

A pre-design investigation is recommended to be completed prior to implementation of remedial activities at the Site. The data generated from sampling during the pre-design investigation will primarily be used to identify and delineate any areas containing residual chlorinated VOC soil contamination and refine the extents of treatment. A scope of work detailing the sampling activities to be completed as part of the pre-design investigation will be developed as part of a separate Pre-Design Investigation Work Plan (PDIWP). This QAPP will be revised accordingly prior to implementing the PDIWP.

Post-Remediation Groundwater Sampling

Post-remediation groundwater sampling will be conducted upon completion of remedial excavation activities in order to evaluate changes in groundwater contaminant concentrations and to ascertain the level of any natural attenuation which may occur. Data generated from the post-remediation groundwater sampling will be used to evaluate if additional groundwater treatment or

remediation is warranted at the Site. Details regarding post-remediation groundwater sampling requirements will be included in the Site Management Plan (SMP) that will be prepared for the Site upon completion of the remedy. This QAPP will be revised accordingly prior to implementing post-remediation groundwater sampling.

1.3 Sampling Program Design and Rationale

The following presents a general discussion of the sampling that may be conducted in support of remedial activities to be conducted at the Site.

- Subsurface Soil – Subsurface soil samples will be collected on-site from borings as part of the pre-design investigation to: determine the extent of impacted subsurface soil, and to obtain confirmation endpoint/sidewall soil samples, if necessary. In addition, subsurface endpoint and sidewall soil samples will be collected from the excavation utilizing the bucket of the excavation equipment.

- Groundwater – Groundwater samples will be collected from existing monitoring wells for emerging contaminants prior to implementation of the remedy. If deemed necessary, groundwater samples may be collected from groundwater probes installed during the pre-design investigation, or existing monitoring wells at the Site, to further characterize groundwater quality. In addition, groundwater samples will be collected from existing groundwater monitoring wells as part of post-remediation groundwater sampling in order to assess groundwater quality and evaluate the effectiveness of the remedy.

1.4 Analytical Parameters

Soil samples collected from the Site will be analyzed for volatile organic compounds (VOCs) utilizing United States Environmental Protection Agency (USEPA) Methods 5035 and 8260 (using the En Core sampling method). Groundwater samples collected from the Site will be analyzed for VOCs utilizing USEPA Method 8260.

Table 1-1 presents a summary of the parameters/sample fractions to be analyzed with the typical sample location, type of sample, sample matrix, type of sample container, method of preservation, holding time and analytical method.

1.5 Data Quality Requirements

Data quality requirements and assessment are provided in the 7/05 NYSDEC ASP, which includes the detection limit for each parameter and sample matrix. Note that quantification limits, estimated accuracy, accuracy protocol, estimated precision and precision protocol are determined by the laboratory and will be in conformance with the requirements of the 2005 NYSDEC ASP, where applicable. Table 1-2 presents a summary of the data quality requirements.

Table 1-1

SUMMARY OF MONITORING PARAMETERS/SAMPLE FRACTIONS

Sample Location	Sample Type	Sample Matrix	Sample Fraction	Container Type/Size/No.	Sample Preservation	Maximum Holding Time	Analytical Method
Subsurface Soil Samples	Grab	Soil	TCL VOCs	En Core Sampler/3 or equivalent	Cool to 4°C	2 days after VTSR for prep/10 days for analysis	7/05 NYSDEC ASP, USEPA Methods 5035 and 8260
Groundwater Monitoring Wells/Groundwater Probes	Grab	Groundwater	TCL VOCs	Glass/clear/40 ml/3 ICHEM 300 series or equivalent	Cool to 4°C	7 days after VTSR for analysis	7/05 NYSDEC ASP, USEPA Method 8260

VTSR - Verified time of sample receipt at the laboratory.
Most recent versions of the analytical methods will be utilized.
QA/QC samples will be collected based upon the frequency of sampling and the final number and schedule of samples collected. Details regarding sampling frequency for the pre-design investigation will be defined in a Pre-Design Work Plan to be prepared prior to implementation of the pre-design investigation. Confirmation subsurface soil samples will be collected in accordance with DER-10 and will be dependent upon the size of the completed excavation area. Post-remediation groundwater sampling frequency will be defined in a Site Management Plan to be prepared for the Site.

Table 1-2

DATA QUALITY REQUIREMENTS
OBJECTIVES FOR PRECISION AND ACCURACY

Parameter	Sample Matrix	CRDL*	Estimated Accuracy	Accuracy Protocol**	Estimated Precision	Precision Protocol**
Volatile Organics	Liquid Solid	5-10 ug/l 5-10 ug/kg	0.87 – 2.48 ug/l	Vol. IB, Chapter 4, Method 8260, Table 7	0.11 – 4.00 ug/l	Vol. IB, Chapter 4, Method 8260, Table 7

*Contract Required Detection Limits.
**Reference: NYSDEC 7/05 ASP and EPA/600/R-08/092

Table 1-2 (continued)

DATA QUALITY REQUIREMENTS
OBJECTIVES FOR PRECISION AND ACCURACY

Matrix/Parameter	Precision %	Accuracy %
Groundwater		
VOCs[(a)]	See Table 1-2a	See Table 1-2a
Soil		
VOCs[(a)]	See Table 1-2a	See Table 1-2a

Notes:

(a) Accuracy will be determined as percent recovery of surrogate spike compounds and matrix spike compounds. Surrogate and matrix spike compounds for VOCs are listed in Table 1-2a. Precision will be estimated as the relative standard deviation of the percent recoveries per matrix.

Source: NYSDEC ASP

Table 1-2a

DATA QUALITY REQUIREMENTS
ACCURACY AND PRECISION REQUIREMENTS FOR VOCs

	Water		Low/Medium Soil	
	Spike Recovery Limits (%)	Precision %	Spike Recovery Limits (%)	Precision %
Surrogate Compound				
Toluene-d8	88 – 110	--	84 – 138	--
4-Bromofluorobenzene	86 – 115	--	59 – 113	--
1,2-Dichloroethane-d4	76 – 114	--	70 – 121	--
Matrix Spike Compound				
1,1-Dichloroethene	61 – 145	≤ 14	59 – 172	≤ 22
Trichloroethane	71 – 120	≤ 14	62 – 137	≤ 24
Chlorobenzene	75 – 130	≤ 13	60 – 133	≤ 21
Toluene	76 – 125	≤ 13	59 – 139	≤ 21
Benzene	76 – 127	≤ 11	66 – 142	≤ 21

Source: NYSDEC ASP

The methods of analysis will be in accordance with SW-846 and 7/05 NYSDEC ASP. Specific analytical procedures and laboratory QA/QC descriptions are not included in this QAPP, but will be available upon request from the laboratory selected to perform the analyses. The laboratory will be New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified for organic and inorganic analyses.

1.5.1 Data Representativeness

Representative samples will be collected as follows:

- Subsurface Soil (Boring) – Samples will be collected using a decontaminated macrocore sampler and disposable acetate liner.
- Groundwater (Probe) – Samples will be collected immediately upon installation of the probe using dedicated tubing equipped with a bottom check valve.

1.5.2 Data Comparability

All data will be presented in the units designated by the methods specified by a NYSDOH ELAP certified laboratory and the 7/05 NYSDEC ASP. In addition, sample locations, collection procedures and analytical methods from earlier studies will be evaluated for comparability with current procedures/methods.

1.5.3 Data Completeness

The acceptability of 100% of the data is desired as a goal for this project. The acceptability of less than 100% complete data, meeting all laboratory Quality Assurance/Quality Control (QA/QC) protocols/standards, will be evaluated on a case-by-case basis.

The laboratory utilized to perform the analyses on the soil and groundwater samples will provide NYSDEC ASP Category B Deliverables. All data will be provided in the NYSDEC EQuIS format.

1.6 Detailed Sampling Procedures

Environmental samples will be collected from different locations throughout the Site as part of activities completed in support of the remedy. These may include subsurface soil and groundwater samples. Sample locations may consist of soil borings, subsurface grab samples, groundwater probes and groundwater monitoring wells.

General sampling approaches and equipment are described in this section. A summary of the sampling program for the Pre-Design Investigation will be detailed in a PDIWP that will be prepared prior to implementation of the Pre-Design Investigation. A summary of the sampling program for post-remediation groundwater sampling will be detailed in a Site Management Plan to be prepared for the Site as part of the remedy.

When collecting the samples, care will be taken to maintain sample integrity by preserving its physical form and chemical composition to as great an extent as possible. An appropriate sampling device (i.e., decontaminated or dedicated equipment) will be utilized to transfer the sample into the sample container. Every effort will be made to ensure that the sample is a proper representation of the matrix from which it was collected. The sample will be transferred into the sample container as quickly as possible. Soil samples to be analyzed for VOCs will be collected using the En Core sampling method in accordance with USEPA Method 5035.

The materials involved in groundwater sampling are critical to the collection of high quality monitoring information, particularly where the analyses of volatile, pH sensitive or reduced chemical constituents are of interest. Bailers and pump parts will be constructed of PTFE (e.g., Teflon), stainless steel and/or polyethylene.

Several steps will be taken after the transfer of the soil or water sample into the sample container that are necessary to properly complete collection activities. Once the sample is transferred into the appropriate container, the container will be capped and, if necessary, the outside of the container will be wiped with a clean paper towel to remove excess sample material.

The container will not be submerged in water in an effort to clean it. Rather, if necessary, a clean paper towel moistened with distilled/deionized water will be used.

The sample container will be properly labeled. Information such as the sample identification number, location, collection time and sample description will be recorded in the field log book. Associated paper work (e.g., Chain of Custody forms) will then be completed and will stay with the sample. The samples will be packaged in a manner that will allow the appropriate storage temperature to be maintained during transportation to the laboratory. Samples will be delivered to the laboratory within 48 hours of collection.

Proper personal protective equipment and monitoring equipment (if determined to be necessary) will be used at all times during sample collection to further maintain sample integrity and protection of worker health and safety.

1.6.1 Sample Identification

All samples collected will be labeled with a sample identification code. The code will identify the sample type (sample matrix), sample location, sample depth and collection date, as appropriate. Samples will be labeled according to the following system:

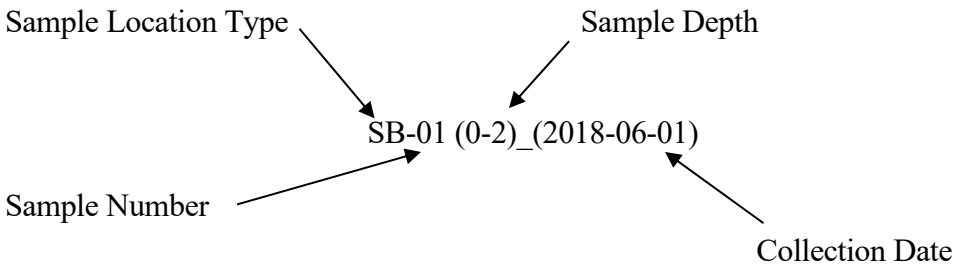
Sample Location Type:
- Soil Boring "SB"
- Groundwater Probe "GP"

Sample Number:
- Each sample location will be designated with a number. For soil samples, a depth will be provided which will correspond to the depth in feet at which the sample was collected below grade (e.g., 0-2). This number will likely be recorded in parentheses.

Collection Date:
- The date of collection will be included in the sample identification as an eight-digit number as follows (year-month-day).

Quality Assurance/ Quality Control (QA/QC): – A "MS" for Matrix Spike, "MSD" for Matrix Spike Duplicate, "FB" for Field Blank or "TB" for Trip Blank, as appropriate, will be attached to the end of the sample identification name

Based on the above sample identification procedures, an example of a sample label may be:



1.6.2 Sample Handling, Packaging and Shipping

All analytical samples will be placed in the appropriate sample containers as specified in 7/05 NYSEC ASP. The holding time criteria identified in the ASP will be followed, as specified in Table 1-1.

Prior to packaging any samples for transportation to the laboratory, the sample containers will be checked for proper identification and compared to the field log book for accuracy. The samples will then be wrapped with a cushioning material and placed in a cooler (or laboratory shuttle) with a sufficient quantity of bagged ice to maintain the samples at 4°C until arrival at the laboratory.

All necessary documentation required to accompany the samples during transportation will be placed in a sealed plastic bag and taped to the underside of the cooler lid. The cooler will then be sealed with fiber (duct) tape or clear packing tape, and custody seals will be placed in such a manner that any opening of the cooler prior to arrival at the laboratory can be detected.

All samples will be shipped to ensure receipt at the laboratory within 48 hours of sample collection in accordance with ASP requirements. The laboratory will be notified prior to the shipment of the samples.

1.6.3 Soil (Boring)

The following procedure will be utilized for the collection of soil samples from soil borings:

- Be certain that the sample location is noted on Location Sketch.
- Remove laboratory-supplied precleaned sample container from sample cooler, label container with an indelible marker and fill out Chain of Custody Form.
- Drive the probe to the desired sampling depth.
- Retrieve the soil core and immediately after opening it, obtain an organic vapor measurement with a PID.
- Samples for VOC analysis will be collected immediately using the En Core sampling method in accordance with USEPA Method 5035. If warranted, for any remaining analyses, remove a sample aliquot from the soil probe using a disposable scoop or sterile wooden tongue depressor, place into the open sample container and replace the container cover.
- Return the sample container to the cooler.
- If reusable, decontaminate the sampling equipment according to the procedures described in Section 1.7.
- Place all disposable personal protective equipment and disposable sampling equipment into a 55-gallon drum or other approved container for disposal.

1.6.4 Groundwater (Probe)

The following procedure will be utilized for the collection of groundwater samples from groundwater probes:

- Be certain sample location is noted on Location Sketch.

- Remove the laboratory-supplied precleaned sample container from sample cooler, label container with an indelible marker and fill out Chain of Custody Form.

- Obtain a sample by using dedicated polyethylene tubing equipped with a bottom check valve.

- Gently pour the sample into the sample container taking care not to spill on the outside of the container or overfill container and replace cover on the sample container. Samples for volatile organic analyses will have no air space in the sample vial prior to sealing. This is done by filling the vial such that there is a meniscus on top. Carefully slide the septum, Teflon side down, onto the top of the vial and cap the vial. Check for bubbles by turning the vial upside down and tapping it lightly. If bubbles appear, reopen the vial, remove the septum and add more sample (or resample). Replace the septum, recap and check for bubbles. Continue until vial is bubble-free.

- After sample collection, obtain field measurements including pH, conductivity, temperature and turbidity.

- Return sample containers to sample cooler.

- If reusable, decontaminate the sampling equipment according to the procedures described in Section 1.7.

- Place all disposable personal protective equipment and disposable sampling equipment into a 55-gallon drum or other approved container for disposal.

1.7 Decontamination Procedures

Whenever possible, all field sampling equipment should be sterile/disposable and dedicated to a particular sampling location. In instances where this is not possible, a field cleaning/decontamination procedure will be used in order to mitigate cross-contamination between sample locations. A decontamination station/pad will be established for all field activities if field decontamination is necessary. This will be an area located at some distance from the sampling locations so as not to adversely impact the decontamination procedure while still allowing the sampling teams to keep equipment handling to a minimum after decontamination.

1.7.1 Field Decontamination Procedures

All non-disposable equipment will be decontaminated at appropriate intervals (e.g., prior to initial use, prior to moving to a new sampling interval or location, and prior to leaving the site). Different decontamination procedures are used for the various types of equipment utilized to collect the samples. When designing a field decontamination program, it is advisable to initiate environmental sampling in the area of the site with the lowest contaminant probability and proceed through to the areas of highest suspected contamination.

1.7.2 Decontamination Procedure for Drilling/Probing Equipment

All equipment such as drill rigs and other mobile equipment will receive an initial cleaning prior to use at the Site. The frequency of subsequent cleanings while on-site will depend on how the equipment is actually used in relation to collecting environmental samples. All wash/rinse solutions will be collected and contained on-site in DOT-approved 55-gallon drums for proper off-site disposal.

1.7.3 Decontamination Procedure for Sampling Equipment

All Teflon, polyethylene and stainless steel sampling equipment will be decontaminated utilizing the following procedure:

- Wash thoroughly with non-residual detergent (e.g., Alconox) and clean potable tap water using a brush to remove particulate matter or surface film.
- Steam clean (if necessary).
- Rinse thoroughly with tap water.
- Rinse thoroughly utilizing distilled or deionized water and air dry.

The first step, a soap and water wash, is designed to remove all visible particulate matter and residual oils and grease. Pressure washing will be utilized followed by a steam cleaning, if

necessary. This step will be followed by a tap water rinse and a distilled/deionized water rinse to remove detergent.

1.8 Laboratory Sample Custody Procedures

A NYSDOH ELAP certified laboratory meeting the requirements for sample custody procedures, including cleaning and handling sample containers and analytical equipment, will be used. The Standard Operating Procedures of the laboratory selected to undertake the analysis of environmental samples for this program will be available upon request.

1.9 Field Management Documentation

Proper management and documentation of the field activities is essential to ensure that all necessary work is conducted in accordance with this QAPP in an efficient and high quality manner. Field management procedures will include maintaining a daily Field Log Book, following proper chain of custody procedures to track a sample from collection through analysis, noting when and how samples are split (if required), preparing a location sketch for sampling points in the field log, recording sample information in the field log and completing Daily Equipment Calibration Logs. Boring and well construction logs, if necessary, will be completed in the office. Proper completion of these forms and the field log book are necessary to support the consequent actions that may result from the sample analysis. This documentation will support that the samples were collected and handled properly.

1.9.1 Location Sketch

For each sampling point, a location sketch will be completed in the field log using permanent references and distances to the sampling point noted, if possible. Photographs may also be utilized.

1.9.2 Sample Information

At each sampling location, sample information will be recorded in the field log including, but not limited to, the following information:

- Sample location identification;
- Field sample identification number;
- Date and time of sample collection;
- Sample matrix;
- Method of sample collection and any factor that may affect its quality adversely;
- Well information (groundwater only);
- Field test results; and
- Analysis to be performed.

1.9.3 Chain of Custody

A Chain of Custody (COC) form will be completed and is initiated at the laboratory with container preparation and transportation to the Site. The COC remains with the samples at all times and bears the name of the person assuming responsibility for the samples. This person is tasked with ensuring secure and proper handling of the containers and samples. When the form is complete, it should indicate that there were no lapses in sample accountability.

A sample is considered to be in an individual's custody if any of the following conditions are met:

- It is in the individual's physical possession; or
- It is in the individual's view after being in his or her physical possession; or
- It is secured by the individual so that no one can tamper with it; or

- The individual puts it in a designated and identified secure area.

In general, COC forms are provided by the laboratory contracted to perform the analytical services. At a minimum, the following information shall be provided on these forms:

- Project name and address
- Project number
- Sample identification number
- Sample collection date
- Sample collection time
- Sample location
- Sample type/matrix
- Analysis requested
- Number of containers and volume collected
- Remarks (e.g., preservation, special handling, etc.)
- Sampler(s) name(s) and signature(s)
- Spaces for relinquished by/received by signature and date/time.

For this particular project, COC forms provided by the laboratory will be utilized.

The COC form is completed and signed by the person performing the sampling activities. The original form travels with the samples and will be signed and dated each time the samples are relinquished to another party, until it reaches the laboratory or analysis is completed. The field sampler maintains a copy of the COC form and a copy is retained for the project file. Each sample container will also be labeled with an indelible marker with a minimum of the following information:

- Sample number

- Analysis to be performed
- Date and time of collection
- Sampler's initials

A copy of the completed COC form is returned by the laboratory with the analytical results.

1.9.4 Field Log Book

Field log books will be bound and should have consecutively numbered, water resistant pages. All pertinent information regarding the Site and sampling procedures will be documented. Notations will be made in log book fashion, noting the time and date of all entries. Information recorded in the log book should include, but is not limited to, the following:

The first page of the log book will contain the following information:

- Project name and address
- Name, address and phone number of field contact
- Waste generator and address, if different from above
- Type of process (if known) generating waste
- Name, address and phone number of subcontractors and contact persons

Daily entries are made for the following information:

- Weather conditions
- Purpose of sampling
- Location of sampling points
- Number(s) and volume(s) of sample(s) collected
- Description of sample location and sampling methodology

- Date and time of sample collection and personnel arrival and departure
- Geologic description of each sample interval, if applicable
- Collector's sample identification number(s)
- Sample distribution and method of storage and transportation
- References, such as sketches of the sample location or photographs of sample collection with dimensions
- Field observations, including results of field analyses (e.g., pH, temperature, specific conductance, etc.), water levels, drilling logs, and organic vapor and dust readings
- Signature of personnel responsible for completing log entries.

1.9.5 Field Changes and Corrective Actions

Whenever there is a required or recommended sampling change or correction, it will be noted in the field log by the Field Operations Manager, with approval by the D&B Project Manager.

1.10 Calibration Procedures and Preventive Maintenance

The following information regarding equipment will be maintained at the Site:

- Equipment calibration and operating procedures which will include provisions for documentation of frequency, conditions, standards and records reflecting the calibration procedures, methods of usage and repair history of the measurement system. Calibration of field equipment will be completed daily at the sampling site so that any background contamination can be taken into consideration and the instrument calibrated accordingly.
- A schedule of preventive maintenance tasks, consistent with the instrument manufacturer's specific operation manuals that will be carried out to minimize down time of the equipment.
- Critical spare parts, necessary tools and manuals will be on hand to facilitate equipment maintenance and repair.

Calibration procedures and preventative maintenance, in accordance with the NYSDEC 7/05 ASP, for laboratory equipment, will be contained in the laboratory's standard operating procedures (SOP) which will be made available upon request.

1.11 Performance of Field Audits

During field activities, if determined to be necessary, the QA/QC Officer may accompany sampling personnel into the field, verify that the Site sampling program is being properly implemented and detect and define problems so that resolutions can be determined and implemented. All findings will be documented and provided to the Field Operations Manager.

1.12 Control and Disposal of Contaminated Material

During sampling activities, contaminated waste, soil and water may be generated from drill cuttings, drilling fluids, decontamination water and purge water. In addition, contaminated materials may include spent protective clothing, spent disposable sampling equipment and wastes generated as a result of equipment decontamination.

Any contaminated materials generated as a result of the field program will be contained in U.S. Department of Transportation (DOT) 55-gallon drums, or an approved equivalent container, and staged in a designated area for subsequent waste characterization. Each drum will be identified by the type of material contained.

DOT-approved 55-gallon drums will be available for disposal of spent protective clothing and disposable sampling equipment, if any. These drums will be marked and labeled as containing personnel protective and sampling equipment. These drums will not be sampled. All drums will be sealed and staged on-site to await proper off-site disposal.

1.13 Documentation, Data Reduction and Reporting

A NYSDOH ELAP-certified laboratory meeting the New York State requirements for documentation, data reduction and reporting will be used for all laboratory analysis. All data will be cataloged according to sampling locations and sample identification nomenclature that is described in this QAPP. The laboratory analysis will be reported in the NYSDEC ASP Category B deliverables format, as well as Electronic Data Deliverables (EDDs in EQuIS format). The EDDs will be submitted to the NYSDEC.

NYSDEC "Sample Identification and Analytical Requirement Summary" and "Sample Preparation and Analysis Summary" forms (for organic and inorganic analysis, if deemed necessary) will be completed and included with each data package. The sample tracking forms are required and supplied by the 7/05 NYSDEC ASP.

1.14 Data Validation

Summary documentation regarding data validation will be completed by the laboratory using NYSDEC forms contained in the 7/05 NYSDEC ASP and submitted with the data package.

A Data Usability Summary Report (DUSR) will be prepared in lieu of a full data validation. The analytical and usability processes will be conducted in conformance with the NYSDEC ASP dated July 2005 and NYSDEC DER-10, as well as USEPA National Functional Guidelines for Data Validation and USEPA Region 2 Data Validation SOPs.

The DUSR will be prepared by reviewing and evaluating the analytical data. The parameters to be evaluated in reference to compliance with analytical method protocols include all chain of custody forms, holding times, raw data (instrument print out data and chromatograms), calibrations, blanks, spikes, controls, surrogate recoveries, duplicates and sample data. If available, field sampling notes will also be reviewed, and any quality control problems will be evaluated as to their effect on the usability of the sample data.

The DUSR will describe the samples and analytical parameters reviewed. Data deficiencies, analytical protocol deviations and quality control problems will be described and their effect on the data discussed. Resampling and reanalysis recommendations will be made, if necessary.

The DUSR shall be prepared by a data validator who meets the NYSDEC personnel requirements in DER-10.

The following is a description of the two-phased approach to data validation which will be used for evaluation of the data. The first phase is called checklisting and the second phase is the analytical quality review, with the former being a subset of the latter.

- Checklisting - The data package will be checked for correct submission of the contract required deliverables, correct transcription from the raw data to the required deliverable summary forms and proper calculation of a number of parameters.
- Analytical Quality Review - The data package will be closely examined to recreate the analytical process and verify that proper and acceptable analytical techniques have been performed. Additionally, overall data quality and laboratory performance will be evaluated by applying the appropriate data quality criteria to the data to reflect conformance with the specified, accepted QA/QC standards and contractual requirements.

At the completion of the data validation, a Data Usability Summary Report section will be prepared by the data validator and included in the final report submitted to the NYSDEC.

1.15 Performance and System Audits

A NYSDOH ELAP certified laboratory, which has satisfactorily completed performance audits and performance evaluation samples, shall be used to perform sample analyses on this project.

1.16 Corrective Action

A NYSDOH ELAP certified laboratory shall meet the requirements for corrective action protocols, including sample "cleanup" to attempt to eliminate/mitigate "matrix interference." Sample "cleanup" is not required for samples to be analyzed for volatile organic compounds.

1.17 Trip Blanks

The primary purpose of a trip blank is to detect other sources of contamination that might potentially influence contaminant values reported in actual samples, both quantitatively and qualitatively. The following have been identified as potential sources of contamination:

- Laboratory reagent water;
- Sample containers;
- Cross contamination in shipment;
- Ambient air or contact with analytical instrumentation during preparation and analysis at the laboratory; and
- Laboratory reagents used in analytical procedures.

A trip blank will consist of a set of 40 milliliter (ml) sample vials filled at the laboratory with laboratory demonstrated analyte free water. Trip blanks will be handled, transported and analyzed in the same manner as the samples acquired that day, except that the sample containers themselves are not opened in the field. Rather, these sample containers only travel with the sample cooler. The temperature of the trip blanks will be maintained at 4°C while on-site and during shipment. Trip blanks will return to the laboratory with the same set of bottles they accompanied in the field.

The purpose of a trip blank is to control sample bottle preparation and blank water quality as well as sample handling. Thus, the trip blank will travel to the Site with the empty sample bottles and back from the Site with the collected samples in an effort to simulate sample handling

conditions. Contaminated trip blanks may indicate inadequate bottle cleaning or blank water of questionable quality. Trip blanks will be implemented only when collecting water samples, including field blanks, and analyzed for volatile organic compounds only.

1.18 Method Blanks/Holding Blanks

A method blank is an aliquot of laboratory water or soil which is spiked with the same internal and surrogate compounds as the samples. The purpose of the method blank is to define and determine the level of laboratory background contamination. Frequency, procedure and maximum laboratory containment concentration limits are specified in the 7/05 NYSDEC ASP. A holding blank is an aliquot of analyte-free water that is stored with the environmental samples in order to demonstrate that the samples have not been contaminated during laboratory storage. This blank will be analyzed using the same analytical procedure as the samples.

1.19 Matrix Spikes/Matrix Spike Duplicates and Field Duplicates

Matrix spike samples are quality control procedures, consistent with 7/05 NYSDEC ASP specifications, used by the laboratory as part of its internal Quality Assurance/Quality Control program. The matrix spikes (MS) and matrix spike duplicates (MSD) will be aliquots of a designated sample (water or soil) which are spiked with known quantities of specified compounds. These QA/QC samples will be used to evaluate the matrix effect of the sample upon the analytical methodology, as well as to determine the precision of the analytical method used. A matrix spike blank will be an aliquot of analyte-free water, prepared in the laboratory, and spiked with the same solution used to spike the MS and MSD. The matrix spike blank (MSB) will be subjected to the same analytical procedure as the MS/MSD and used to indicate the appropriateness of the spiking solution by calculating the spike compound recoveries. The procedure and frequency regarding the MS, MSD and MSB samples are defined in the 7/05 NYSDEC ASP.

Field blind duplicate samples will be collected to demonstrate the accuracy of field screening and unvalidated laboratory data with limited analytical deliverables. One blind duplicate sample will be collected for every 20 soil and groundwater samples. The location to be sampled in

duplicate will be selected at random and the sample identification will be coded to show the sample as a blind duplicate.

1.20 Field Blank (Field Rinsate Blank)/Equipment Blank

If necessary, field blank samples may be collected. The field blank will consist of an aliquot of analyte-free water, supplied by the laboratory, which is opened in the field and is generally poured over or through a sample collection device after it has been decontaminated, collected in a sample container and returned to the laboratory as a sample for analysis. In this manner, it is a check on sampling procedures and cleanliness (decontamination) of sampling devices. Generally, a field blank will be collected for a "batch" of sample matrices collected in the same manner (such as water and soil/sediment) up to a maximum of 20 samples. Field blanks will be analyzed for the same suite of chemicals analyzed for in the environmental samples collected in that "batch." Field blanks will not be analyzed when using dedicated or disposable (one use only) sampling equipment unless directed otherwise.

APPENDIX G

Elizabeth Denly

Quality Control Officer

Areas of Expertise

- *Field and Laboratory Analyses*
- *Quality Assurance/Quality Control*
- *Data Validation/Data Management*
- *Field and Laboratory Analyses*
- *Emerging Contaminants*
- *Consultant for Regulatory Agencies*
- *Field and Laboratory Audits*

Professional Affiliations

- *American Chemical Society (ACS)*
- *American Society for Quality (ASQ)*

Ms. Denly serves as TRC's Quality Assurance & Chemistry Systems Manager, responsible for the creation and implementation of the Quality Management Plan and SOPs for field sampling and documentation protocols. Ms. Denly's experience includes 10 years in an analytical laboratory performing GC and GC/MS analyses and 24 years of chemistry consulting. Ms. Denly's responsibilities include defining data quality objectives, preparing QAPPs (including UFP format), conducting data validation, oversight of data management, and laboratory and field audits.

Ms. Denly also serves as a Quality Assurance Manager, responsible for development and communication of quality initiatives within the organization and leads Quality Coordinator networks, which are responsible for the development and communication of quality initiatives within the organization. The quality initiatives that have been implemented or created under Ms. Denly's leadership include the following:

- Procedures for Peer Review of Deliverables
- Tracking of Peer Review Documentation via Monthly Random Audits
- Project Planning Checklist Tool
- Analytical Data Review Checklist and Training
- Practice Self-Assessments with Follow-up Corrective Actions
- Biweekly Quality Messaging
- Publication of Quality Lessons Learned Reports
- Development of Standard Operating Procedures for Field Sampling Activities

As a project QA chemist at TRC, Ms. Denly is responsible for providing QA/QC oversight in support of a variety of environmental investigations, including risk-based soil cleanups, remediation programs, delineation, contaminant ambient air monitoring, and human health and ecological risk assessments. Ms. Denly has provided this oversight under different state and federal regulatory programs, including NYSDEC, NJDEP, and USEPA Regions 1, 2, 3, and 5.

CREDENTIALS

Education

- B.A., Chemistry, University of New Hampshire, 1987

Professional Certifications

- Certified Manager of Quality/Organizational Excellence, American Society of Quality, 2016

PROJECT EXPERIENCE

- **Data Usability/Data Validation**
  Ms. Denly routinely performs or provides oversight of data usability assessments, including NYSDEC DUSRs, or data validation for a variety of analytical parameters, including VOCs, SVOCs, pesticides, PCB aroclors, metals, wet chemistry, PCB homologues/congeners, PFAS, dioxins, and specialty analyses, including GC/MS/SIM and various air analyses.

- **Preparation of Project-specific QAPPs**
  Ms. Denly has prepared QAPPs for a wide body of regulatory programs, including NYSDEC, NYCDEP, and various USEPA Regions. This experience includes the more detailed format in the Uniform Federal Policy for QAPPs, currently required by many of the USEPA Regions. In addition, brownfields QAPPs are routinely prepared using *Quality Assurance Guidance for Conducting Brownfields Site Assessments*, September 1998, EPA 540-R-98-038.

- **Field Audits**
  Ms. Denly periodically performs field audits of TRC's projects, typically consisting of an evaluation of various procedures versus SOPs and regulatory requirements. In general, the procedures evaluated during a field audit include sampling of various media, decontamination, field screening, calibration, collection of QC samples, documentation, sample labeling, and chain-of-custody. Ms. Denly has developed internal field audit checklists for various procedures.

- **Selection of Appropriate Analytical Methodologies**
  In order to ensure the objectives of projects are met, Ms. Denly is responsible for working with project teams and laboratories to ensure the selected methodologies will achieve the desired regulatory standards. Ms. Denly has extensive experience requesting method modifications (i.e., decreasing final extract or digestate volumes) or specialized analyses (i.e., SIM, PCB homologue analyses) that can be performed to increase the sensitivity for various analytes.

- **Analytical Laboratory Audits**
  Ms. Denly typically performs a very detailed on-site laboratory audit before TRC contracts with laboratories. These audits allow TRC to ensure that the laboratory staff members are technically competent in the methods they perform, are following acceptable QA practices, and are in compliance with the various methods. Ms. Denly has developed internal audit checklists for an extensive list of preparation and analytical methods (including the most commonly used SW-846 methods and USEPA air methods), as well as general QA laboratory procedures.

Kirsten Myers, PE

Senior Project Manager

Areas of Expertise

- *Remedial Design*
- *Remedial Construction Inspection*
- *Remedial Construction Management*
- *Groundwater and Soil Remediation*
- *Environmental Site Assessment*
- *Remedial Investigation*

Ms. Myers is based in TRC's New York City office and has over fourteen years of environmental consulting experience.

CREDENTIALS

Education

- B.S., Civil Engineering, Cornell University, 2004

Professional Registrations/Certifications/Training

- Professional Engineer - New York (No. 089236)
- Professional Engineer - Massachusetts (No. 48184)
- OSHA 40-Hour Hazardous Waste Operations and Emergency Response Training
- OSHA 8-Hour Hazardous Waste Operations and Emergency Response Refresher Training
- Supervisory OSHA Health and Safety Training
- OSHA 30-Hour Construction Safety Training

PROJECT EXPERIENCE

- **National Grid, Engineering Services during Decommissioning, Glenwood and Far Rockaway Power Stations – Glenwood Landing and Far Rockaway, NY**
  Ms. Myers served as the project engineer for engineering during decommissioning of the Glenwood and Far Rockaway Power Stations. The Glenwood Power Station was a 210-megawatt natural gas-fired steam electric generating peaking facility and Far Rockaway Power Station was a 100-megawatt natural gas-fired steam electric generating peaking facility. Ms. Myers served as the project engineer for the following decommissioning services: pre-demolition assessment of structures, buildings, and cooling water intake and discharge structures; preparation of specifications and drawings for hazardous materials removal, structure demolition, and site restoration; preparation of engineer's cost estimate; and bid documents. Additionally, between October 2013 and June 2015, Ms. Myers served as the on-site environmental monitor/inspector, and was responsible for confirming compliance with all permits and regulatory agency requirements, review of construction submittals, oversight of spill closure contractor, investigation and closure of underground injection control wells, coordination with the utility company, and all required notifications and reporting related to deviations from approved construction documents and plans during the active decommissioning at both power stations.

- **New York City School Construction Authority (NYCSCA)**
  Under consecutive on-call environmental consulting hazardous materials services contract with the NYCSCA, Ms. Myers has been responsible for maintenance, monitoring, and reporting in connection with the oil removal system (a network of belt skimmers) in the basement boiler room at PS 192M in Manhattan. In addition, Ms. Myers implemented and prepared the Phase II ESI report for PS 70Q. Ms. Myers has also served as project engineer for review of construction contractor submittals for sub-slab depressurizations systems (piping plans and sub-slab pit details) and earthwork submittals (excavated materials disposal plans). Finally, Ms. Myers managed the surface soil PCB investigations at PS 79M and PS 128M.

- **Hudson Park III, Sub-Slab Ventilation System Design – Yonkers, NY**
  Ms. Myers served as project engineer for the design of a sub-slab ventilation system (SSVS) for a residential building in Yonkers, New York. Ms. Myers coordinated with the architect of record to locate SSVS pits, piping, and monitoring points.

- **City of Glen Cove Incinerator, Engineering Services during Demolition – Glen Cove, NY**
  Ms. Myers served as the project engineer for engineering during deconstruction of the City of Glen Cove's incinerator. The City of Glen Cove's incinerator was a municipal solid waste and sludge co-disposal and energy recovery facility. Ms. Myers served as the project engineer for the following services provided to the City of Glen Cove: preparation of specifications and drawings and bid documents.

- **Jetro/Restaurant Depot, Oak Point Properties – Bronx, NY**
  Ms. Myers served as the project engineer during construction of the 200,000 ft^2 high-bay wholesale warehouse located at the site of a former construction and demolition debris landfill in the Hunts Point neighborhood of the Bronx. Ms. Myers's responsibilities have included development of details for the gas vapor barrier, inspection of the installation of the sub-slab depressurization system and gas vapor barrier system, oversight of non-destructive testing of the gas vapor barrier system, and review of construction contractor submittals.

- **Golden Horseshoe Shopping Center – Scarsdale, NY**
  Ms. Myers conducted the annual inspection of a sub-slab depressurization system (SSDS) installed in a U.S. post office, which is part of a shopping center in Scarsdale, New York.

- **New York City Economic Development Corporation (NYCEDC), On-Call Environmental Services Contract – New York, NY**
  Under TRC's on-call environmental services contract with the NYCEDC, Ms. Myers has been responsible for the management of site investigations and modifications to existing remedial construction specifications associated with the emergency shoreline repairs at the Homeport Stapelton Facility and September 11, 2001, Memorial, St. George Station.

- **New York Power Authority, Engineering Services during Deconstruction, Charles Poletti Power Plant – Astoria, NY**
  Ms. Myers served as the project engineer for engineering during deconstruction of the Charles Poletti Power Plant. The Charles Poletti Power Plant was a steam-electric 825-megawatt facility capable of firing natural gas and fuel oil. Ms. Myers served as the project engineer for the following deconstruction services: pre-demolition hazardous materials assessment of buildings and cooling water intake and discharge structures, preparation of specifications and drawings, oversight of on-site subcontractors and asset recovery, preparation of engineer's cost estimate, and bid documents.

- **U.S. Army Corps of Engineers (USACE), Total Environmental Restoration Contract (TERC) – Massachusetts Military Reservation, Camp Edwards, MA**
  Ms. Myers served as the project engineer for the investigation and remediation of small arms ranges, gun positions, and the central impact area at the Massachusetts Military Reservation. Ms. Myers's responsibilities included preparation of investigation plans, remediation work plans, specifications, closeout reports, and

feasibility studies. Ms. Myers served as construction field engineer during the excavation and screening of approximately 4,000 cubic yards of lead-contaminated soil at inactive small arms ranges, and as field operations lead during investigation efforts, which included multi-incremental soil sampling, x-ray fluorescence screening, and installation of monitoring wells. During field activities, Ms. Myers was responsible for preparing construction quality reports, interfacing with the on-site client representatives and regulatory agencies, and coordinating activities with subcontractors and unexploded ordnance (UXO) investigation teams.

- **Engineering Field Activity Northeast (EFANE), Remedial Action Contract (RAC), Naval Air Station South Weymouth – South Weymouth, MA**
  Ms. Myers served as the project engineer for the investigation and remediation of several areas of concern at the Naval Air Station in South Weymouth. Ms. Myers was the task manager for the remediation of the former sewage treatment plant. The removal activities included the excavation of 3,500 cubic yards of petroleum-impacted soil and pesticide-contaminated sediment. Ms. Myers completed PetroFLAG® (petroleum) and EnviroGard® (pesticides) field screening to delineate the excavation boundaries. Ms. Myers' responsibilities included preparation of investigation plans, remediation work plans, specifications, and closeout reports. Ms. Myers served as the field engineer and health and safety officer for five remedial actions, including the demolition and removal of six 100-foot radio antennae. She also made two public presentations to the Restoration Advisory Board during removal actions to provide information regarding the remediation efforts.

- **Confidential Insurance Company**
  Ms. Myers served as project engineer to insurance underwriters in the completion of insurance quotes. Ms. Myers' responsibilities included reviewing environmental assessment, site investigation, and remediation reports, and other site information to identify potential environmental conditions at the sites or deviations/omissions from regulatory requirements. She also participated in conference calls with the client, developers, and attorneys.

- **U.S. Army Corps of Engineers (USACE), Total Environmental Restoration Contract (TERC), Silresim Superfund Site – Lowell, MA**
  Ms. Myers served as the project engineer for the design of a 4.5-acre soil cap at the Silresim Superfund Site. Ms. Myers was responsible for on-site health and safety oversight of the surveyor and reviewed as-built conditions plans. She designed with AutoCAD Civil 3D the cap and site grading to allow for the future reuse of the property. Ms. Myers was also responsible for completing calculations, design analysis, specifications, CQAP, and the Health and Safety Requirements Plan.

- **IMTT-Bayonne, Soil Permeability Study – Bayonne, NJ**
  Ms. Myers served as the project engineer/laboratory technician for the soil permeability study at the 600-tank IMTT-Bayonne facility. Ms. Myers ran an on-site geotechnical laboratory to determine the spill prevention capabilities of the existing earthen berms. Ms. Myers' responsibilities included creating sampling plans, following ASTM standards to test samples for a variety of parameters (permeability, grain size, maximum density, plasticity, and in-field density), performing the data analysis used to evaluate the spill capabilities, and coordinating the biweekly sampling between IMTT and a civil construction contractor.

Wes Lindemuth, CHMM, CSP

Sr. Project Manager

Areas of Expertise

- *Environmental Health and Safety*
- *Remedial Construction Inspection and Management*
- *Project Management*
- *Environmental Assessments, Investigations and Audits*
- *Hazardous Materials Building Inspections*

Wes Lindemuth serves as a Senior Project Manager based in TRC's New York City office and has over 13 years of environmental consulting experience. His experience includes project scoping, budgeting, management, implementing site assessments and investigations, reporting, health and safety management, and close out of large-scale environmental projects, as well as supervising and directing project staff.

CREDENTIALS

Education

- B.S., Environmental Science, Kutztown University, 2004

Professional Registrations/Certifications/Training

- Transportation Worker Identification Credential (TWIC)
- IHMM – Certified Hazardous Materials Manager (CHMM) (No. 15661)
- BCSP – Certified Safety Professional (CSP) (No. CSP-30429)
- NYSDEC – Erosion and Sediment Control Training (No. 45T-012014-31)
- Secure Worker Access Credential (SWAC)
- 4-Hour NYSDEC Erosion and Sediment Control Training, 2014
- 8-Hour OSHA HAZWOPER Supervisor, 2015
- 8-Hour OSHA HAZWOPER Refresher, 2016
- 10-Hour OSHA Construction Safety Training, 2015
- 30-Hour OSHA Construction Safety Training, 2010
- 40-Hour OSHA HAZWOPER, 2004

PROJECT EXPERIENCE

- **New York City Economic Development Corporation – New York, NY**
  Mr. Lindemuth served as an Assistant Project Manager in connection with seven Phase I ESAs, four Phase II ESIs, one hazardous material building inspection, an UST closure and two in-situ soil characterizations. His responsibilities included all aspects of preparation of Phase I ESA reports, all elements of Phase II ESI field investigations, confined space entry associated with the inspection of an underground storage tank vault, and preparation of two proposals for in-situ soil characterization. Additionally, he was responsible for the field inspection services in connection with the initial preparation of the Bush Terminal Landfill for development into a park. Mr. Lindemuth responsibilities included inspection of dynamic compaction activities on the landfill, storm water management, soil gas sampling, and installation of a groundwater monitoring well network.

- **The City of New York Department of Parks and Recreation – New York City**
  Mr. Lindemuth serves as a Senior Project Manager providing environmental consulting services in support of the construction and reconstruction of park buildings and facilities in New York City. Responsibilities include investigation, remediation and reconstruction of several ballfields under the direction of the USEPA located within the 57-acre Red Hook Recreation Area. Responsibilities include all aspects of scope of work and cost estimate preparation, client consultation, staff supervision, subcontractor supervision and work plan preparation and implementation, preparation of contract drawings and specifications, preparation of engineers estimates, and report writing including development of conclusions and recommendations.

- **NYC School Construction Authority – New York, NY**
  Serves as a Senior Project Manager and provides consulting services in connection with proposed new construction, alteration, and leased sites to assess the suitability

of the sites for use as public school facilities. Responsibilities include management of 25 Phase I ESAs, 15 Phase II ESIs, five vapor intrusion and indoor air quality investigations, four PCB remediation projects, three underground storage tank (UST) closures, four petroleum spill investigations, four product safety reviews, review of two excavated material disposal plans (EMDPs), preparation of state pollutant discharge elimination system (SPDES) permit applications, Long Island well permit applications, and a chemical bulk storage tank closure plan, and assisted with obtaining New York City (NYC) Department of Environmental Protection (DEP) sewer use permits. Responsibilities include all aspects of scope of work and cost estimate preparation, client consultation, staff supervision, subcontractor supervision and work plan implementation, emergency response, and report writing including development of conclusions and recommendations.

Additionally, Mr. Lindemuth served as in-house consultant staff for the IEH Division and provided technical oversight, performed quality control reviews, and assisted with coordination and management of the Local Law 12 (LL12) reporting program. He provided oversight and reviews of the reporting documentation provided by several prime environmental consulting firms which are contracted to provide environmental due diligence, remedial design and remedial construction phase services to NYCSCA. His responsibilities included review of LL12 reporting checklists, contextualized summaries and associated Phase I Environmental Site Assessments reports, Phase II Environmental Site Investigation reports, indoor air quality survey reports, remedial investigation reports, construction inspection reports, water disinfection reports, and evaluations of excavated material disposal plans for consistency with LL12 reporting checklists and contextualized summaries. Mr. Lindemuth responsibilities also included the submission of notifications of "exceedances" of applicable regulatory criteria to the New York City Department of Education.

- **Vornado Realty Trust – New York, NY**
  Mr. Lindemuth served as Project Manager responsible for the continuous performance of due diligence and environmental investigation services associated with acquisition, financial lending and redevelopment of over 25 properties located in NYC. He was responsible for managing property inspections, remediation cost estimates, Phase I ESAs, Phase II ESIs and coordination with NYC OER in connection with site redevelopment including Site Investigations, Remedial Action Work Plans, and Remedial Action Reports.

- **SL Green Realty Corporation – New York, NY**
  Mr. Lindemuth served as a Project Manager responsible for the performance of due diligence and environmental investigation services associated with acquisition, financial lending and redevelopment of over 25 properties located in NYC. Services provided by Mr. Lindemuth included property inspections, remediation cost estimates, Phase I ESAs, Phase II ESIs and technical and regulatory assistance with one property enrolled in the New York State Brownfield Cleanup Program.

- **AIMCO, West Harlem Portfolio – Manhattan, NY**
  Mr. Lindemuth served as a Senior Project Scientist responsible for performing pre-acquisition due diligence surveys for 95 apartment buildings located throughout the Harlem neighborhood in Manhattan, New York for AIMCO, a real estate investment trust company. His responsibilities included preparation of Phase I ESA reports for each property as well as radon sampling and implementing several Phase II ESIs. Mr.

Lindemuth performed construction oversight for remediation projects including oversight of the removal of an underground storage tank systems and oversight of in-situ chemical oxidation for groundwater remediation.

- **Spectra Energy – NY/NJ Expansion**
  Mr. Lindemuth served as an Associate Project Manager in connection with the construction of a natural gas pipeline from New Jersey to New York. The project consisted of the construction of approximately 20.3 miles of multi-diameter pipeline, associated pipeline support facilities, and six new metering and regulating stations. Mr. Lindemuth supervised a team of ten environmental inspectors performing oversight of construction activities including excavation and off-site disposal of non-hazardous and hazardous soil, treatment of groundwater prior to discharge to the ground surface or surface water body, spill reporting and cleanup, stormwater erosion and control inspection, worker health and safety oversight, and compliance with the approved work plans. Responsibilities included team supervision, team health and safety oversight, review and distribution of daily reports, soil disposal management and tracking, and responding to client requests associated with construction operations.

- **Queens West Development Corporation – Queens, NY**
  Mr. Lindemuth served as the Site Construction Manager in connection with the remediation of a nine acre designated Brownfield (NYSDEC BCP Site Nos. C241095 and C241096) site in Long Island City, Queens, NY. Supervised a team of four environmental professionals during the excavation of approximately 100,000 tons of soil under negative pressure enclosures (tents), removal of Light Non Aqueous Phase Liquid (LNAPL) via high vacuum extraction and implementation of an in-situ chemical oxidation pilot test using direct injection methods and a five foot diameter soil mixing/injection tool, post-excavation (end point) soil sampling, post-remediation groundwater well construction and sampling and soil vapor sampling. Supervised supplemental remediation activities including excavation of approximately 10,000 cubic yards of “grossly contaminated” soil below a lower permeability “peat” layer and the water table. Responsibilities included staff supervision and management of daily reporting to NYSDEC Region 2, oversight of excavation, dewatering, management of separate phase product, off-site transportation and disposal of excavated material, post-excavation sampling, procurement of clean soil backfill, backfilling of excavations and implementation of the site SWPPP, community air monitoring program, and health and safety oversight.

- **National Grid, Rockaway Park Former Manufactured Gas Plant (MGP) Site, – Queens, NY**
  Mr. Lindemuth periodically served as the Site Health and Safety Manager in connection with the remediation of the 9.8-acre National Grid Rockaway Park Former Manufactured Gas Plant (MGP) Site located in Queens, NY. The remedial activities performed included the excavation of over 150,000 tons of contaminated soil under negative pressure enclosures (tents) for off-site disposal. Responsible for providing daily health and safety briefings (tool box talks), performing real time air monitoring in the exclusion zone, implementing the necessary personal protective equipment (PPE) level, performing daily and weekly Health and Safety Inspections, and ensuring all site workers were in full compliance with the approved Site-Specific HASP.

APPENDIX H

Appendix H
MTA Long Island Rail Road
Arch Street Yard
Remedial Action Work Plan
Alternative 2 Cost Estimate
ISCR of Groundwater

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Pre-Design Investigation						
Delineation Sampling	1	l.s.	$ 25,000	$ 25,000	NA	$ 25,000
Treatability Study	1	l.s.	$ 20,000	$ 20,000	NA	$ 20,000
ISCR of Groundwater						
Direct Push Injection Event	1	l.s.	$ 85,000	$ 85,000	NA	$ 85,000
TOTAL DIRECT COSTS						$ 130,000
CAPITAL COST - INDIRECT						
Engineering and Design (20%)						$ 26,000
Construction Phase Engineering Services (20%)						$ 26,000
Permits and Plans (5%)						$ 6,500
TOTAL INDIRECT COSTS						$ 58,500
TOTAL CAPITAL COSTS						$ 188,500
FUTURE ACTIONS						
Quarterly Groundwater Sampling/Reporting (Years 1 and 2)	1	l.s. (per year)	$ 60,000	$ 60,000	2	$ 108,500
Annual Groundwater Sampling/Reporting (Years 3 through 9)	1	l.s. (per year)	$ 15,000	$ 15,000	7	$ 83,700
ISCR of Groundwater						
Direct Push Injection Event (Year 3)	1	l.s.	$ 76,500	$ 76,500	1	$ 62,400
Direct Push Injection Event (Year 5)	1	l.s.	$ 68,000	$ 68,000	1	$ 48,500
Direct Push Injection Event (Year 7)	1	l.s.	$ 59,500	$ 59,500	1	$ 37,100
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$ 340,200
CONTINGENCY (20%)						$ 105,740
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 2						$ 634,440

Notes

1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs are not included in cost estimate.

Appendix H
MTA Long Island Rail Road
Arch Street Yard
Remedial Action Work Plan
Alternative 3 Cost Estimate
ISCR and EISB of Groundwater

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Pre-Design Investigation						
Delineation Sampling	1	l.s.	$ 25,000	$ 25,000	NA	$ 25,000
Treatability Study	1	l.s.	$ 20,000	$ 20,000	NA	$ 20,000
ISCR and EISB of Groundwater						
Direct Push Injection Event	1	l.s.	$ 100,000	$ 100,000	NA	$ 100,000
TOTAL DIRECT COSTS						$ 145,000
CAPITAL COST - INDIRECT						
Engineering and Design (20%)						$ 29,000
Construction Phase Engineering Services (20%)						$ 29,000
Permits and Plans (5%)						$ 7,250
TOTAL INDIRECT COSTS						$ 65,250
TOTAL CAPITAL COSTS						$ 210,250
FUTURE ACTIONS						
Quarterly Groundwater Sampling/Reporting (Years 1 and 2)	1	l.s. (per year)	$ 60,000	$ 60,000	2	$ 108,500
Annual Groundwater Sampling/Reporting (Years 1 through 7)	1	l.s. (per year)	$ 15,000	$ 15,000	5	$ 51,600
ISCR and EISB of Groundwater						
Direct Push Injection Event (Year 3)	1	l.s.	$ 80,000	$ 80,000	1	$ 65,300
Direct Push Injection Event (Year 5)	1	l.s.	$ 60,000	$ 60,000	1	$ 42,800
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$ 268,200
CONTINGENCY (20%)						$ 95,690
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 3						$ 574,140

Notes
1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs are not included in cost estimate.

Appendix H
MTA Long Island Rail Road
Arch Street Yard
Remedial Action Work Plan
Alternative 4 Cost Estimate
Limited Soil Removal with ISCR and EISB of Groundwater

Item	Quantity	Units	Unit Cost	Extended Cost	# Yrs - Future Costs	Present Value
CAPITAL COST - DIRECT						
Pre-Design Investigation						
Delineation Sampling	1	l.s.	$ 35,000	$ 35,000	NA	$ 35,000
Treatability Study	1	l.s.	$ 20,000	$ 20,000	NA	$ 20,000
Soil Excavation and Backfill						
Mobilization	1	l.s.	$ 20,000	$ 20,000	NA	$ 20,000
Erosion and Sediment Control	1	l.s.	$ 5,000	$ 5,000	NA	$ 5,000
Excavation, Stockpiling, and Backfilling	4	week	$ 45,000	$ 180,000	NA	$ 180,000
Sheeting (Install, Remove, Salvage)	4,200	sq. ft.	$ 75	$ 315,000	NA	$ 315,000
Dewatering	4	week	$ 35,000	$ 140,000	NA	$ 140,000
Transportation and Disposal - RCRA non-Haz	900	ton	$ 56	$ 50,400	NA	$ 50,400
Transportation and Disposal - RCRA Haz	1,000	ton	$ 350	$ 350,000	NA	$ 350,000
Confirmatory Samples (Analysis)	8	ea.	$ 50	$ 400	NA	$ 400
Backfill Samples (Analysis)	1	ea.	$ 750	$ 750	NA	$ 750
Backfill Material	980	ton	$ 50	$ 49,000	NA	$ 49,000
Site Restoration (Gravel)	1,125	sq. ft.	$ 1.50	$ 1,688	NA	$ 1,688
ISCR and EISB of Groundwater						
Direct Push Injection Event	1	l.s.	$ 80,000	$ 80,000	NA	$ 80,000
TOTAL DIRECT COSTS						$ 1,247,238
CAPITAL COST - INDIRECT						
Engineering and Design (10%)						$ 124,724
Construction Phase Engineering Services (10%)						$ 124,724
Permits and Plans (5%)						$ 62,362
TOTAL INDIRECT COSTS						$ 311,809
TOTAL CAPITAL COSTS						$ 1,559,047
FUTURE ACTIONS						
Quarterly Groundwater Sampling/Reporting (Years 1 and 2)	1	l.s. (per year)	$ 60,000	$ 60,000	2	$ 108,480
Annual Groundwater Sampling/Reporting (Years 1 through 5)	1	l.s. (per year)	$ 15,000	$ 15,000	3	$ 39,360
TOTAL PRESENT VALUE OF FUTURE ACTIONS						$ 108,480
CONTINGENCY (20%)						$ 333,505
TOTAL PRESENT VALUE COST FOR ALTERNATIVE 5						$ 2,001,032

Notes
1. 7% discount rate used to calculate present value cost.
2. Cost estimate intended only for the purpose of determining relative cost in comparison to other alternatives.
3. Legal and administrative costs are not included in cost estimate.
4. Estimate based on approximately 10% of excavated soil requiring disposal as RCRA hazardous waste.

APPENDIX I

Remedial Action Work Plan
MTA Long Island Rail Road - Arch Street Yard
NYSDEC Site No. 241222
Remedial Action Schedule

Year	2023		2024						2025					
Month	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12
Task														
NYSDEC/NYSDOH Approval of RAWP	■													
Pre-Design Investigation and Treatability Study				■										
Submittal of Remedial Design					■									
NYSDEC/NYSDOH Approval of Remedial Design						■								
Permitting										■	■	■		
Initial Injection													■	
Post-Injection Groundwater Sampling													■	
Quarterly Groundwater Sampling (Year 1)														
Quarterly Groundwater Sampling (Year 2)														
Second Injection														
Annual Groundwater Sampling (Year 3)														
Annual Groundwater Sampling (Year 4)														
Annual Groundwater Sampling (Year 5)														
Third Injection														
Annual Groundwater Sampling (Year 6)														
Annual Groundwater Sampling (Year 7)														
Monitoring Well Abandonment and Closeout														

Year	2026						2027						2028					
Month	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12
Task																		
NYSDEC/NYSDOH Approval of RAWP																		
Pre-Design Investigation and Treatability Study																		
Submittal of Remedial Design																		
NYSDEC/NYSDOH Approval of Remedial Design																		
Permitting																		
Initial Injection																		
Post-Injection Groundwater Sampling																		
Quarterly Groundwater Sampling (Year 1)	■	■		■	■													
Quarterly Groundwater Sampling (Year 2)							■	■		■	■							
Second Injection															■			
Annual Groundwater Sampling (Year 3)																	■	
Annual Groundwater Sampling (Year 4)																		
Annual Groundwater Sampling (Year 5)																		
Third Injection																		
Annual Groundwater Sampling (Year 6)																		
Annual Groundwater Sampling (Year 7)																		
Monitoring Well Abandonment and Closeout																		

Year	2029						2030						2031						2032					
Month	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12	1/2	3/4	5/6	7/8	9/10	11/12
Task																								
NYSDEC/NYSDOH Approval of RAWP																								
Pre-Design Investigation and Treatability Study																								
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Second Injection																								
Annual Groundwater Sampling (Year 3)																								
Annual Groundwater Sampling (Year 4)					■																			
Annual Groundwater Sampling (Year 5)											■													
Third Injection															■									
Annual Groundwater Sampling (Year 6)																	■							
Annual Groundwater Sampling (Year 7)																							■	
Monitoring Well Abandonment and Closeout																							■	