REMEDIAL INVESTIGATION REPORT

Former NuHart
Plastic Manufacturing Site

280 Franklin Street
Brooklyn, New York

NYSDEC Hazardous Waste Site: 224136

July 30, 2015

ESI File: SB09110

Prepared By:

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I Paul H. Ciminello certify that I am currently a Qualified Environmental Professional as defined in 6 NYCRR Part 375 and that this Remedial Investigation Report was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10) and that all activities were performed in full accordance with the DER-approved Work Plan and any DER-approved modifications.

Paul H. Ciminello
President

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1.0 INTRODUCTION

1.1 Purpose

This Remedial Investigation Report (RIR) summarizes environmental investigation services performed by Ecosystems Strategies, Inc. (ESI) at the Former NuHart Plastic Manufacturing Site, located at 280 Franklin Street, Brooklyn, New York (the "Site").

The investigative work was performed to document the extent of known contamination resulting from former manufacturing and industrial uses of the property. All investigations were conducted consistent with the NYSDEC approved Remedial Investigation Work Plan (RIWP, November 2011), directives from NYSDEC to conduct additional groundwater investigation, Supplemental Remedial Investigation Work Plan (SRIWP, July 2013), NYSDEC-approved Scope of Work for installation of monitoring wells at the adjoining Greenpoint Playground to the west (June 2014) and TCE Delineation Work Plan (TCEWP, September 2014), collectively referenced in this report as the "Work Plan". Any variations from the approved Work Plan are described in Section 3.1.8. This RIR summarizes data from previous environmental investigations performed by ESI and other environmental investigators (see Section 2.3), details fieldwork methodologies and sample collection procedures employed during implementation of the Work Plan (remedial investigation [RI]), documents laboratory analysis of samples collected in all media (soil, vapor and groundwater), and provides conclusions and recommendations based on the fieldwork and analytical data.

1.2 Limitations

This written analysis is an assessment of the Former NuHart Plastic Manufacturing Site located at 280 Franklin Street in Brooklyn, New York and is not relevant to any other property. It is a representation of those portions of the property analyzed as of the respective dates of the fieldwork.

Services summarized in this RIR were performed in accordance with the approved Work Plan and in general conformance with NYSDEC Division of Environmental Remediation Technical Guidance for Site Investigation and Remediation (DER-10), dated May 2010. Unless specifically noted, the findings and conclusions contained herein must be considered not as scientific certainties, but as probabilities based on professional judgment.

1.3 Objectives

ESI conducted an environmental investigation at the Site in order to:

- Characterize on-site and off-site soil and groundwater quality. Soil and groundwater samples directly related to the Site were analyzed for target compound list (TCL) volatile organic compounds (VOCs) plus tentatively identified compounds (TICS), semi-volatile organic compounds (SVOCs) plus TICS and Target Analyte List (TAL) metals in accordance with the Work Plan.
- Determine the impacts from historical site uses and the nature and extent of contamination in soil, groundwater and soil vapor.
- Obtain information sufficient to determine an appropriate remedial action.

2.0 SITE DESCRIPTION

2.1 Site Location and Description

The approximately 1-acre Site is identified on the city tax map as Block No. 2487, Lots No. 1, 10, 12, 72 and 78 (the dimensions of the Site are approximately 240 feet by 200 feet). The Site is comprised of the western portion of a vacant industrial building complex (the former NuHart Plastic Manufacturing facility) located in the Greenpoint section of Brooklyn, Kings County, New York. A Site Location Map, indicating the IHWDS boundary, is provided as Figure 1, Appendix A.

The Site is entirely covered by a complex of industrial buildings of various heights and dimensions. Historic maps indicate that the buildings were constructed at different times and agglomerated into the current "complex". As a result, many interior walls have footings and subgrade utility networks, representing constraints to current investigative efforts and, likely, future remedial work.

The Site is bordered immediately to the north by commercial/industrial buildings across Clay Street, to the east by remaining portions of the NuHart building, to the south by multi-family residential structures across Dupont Street and to the west by a New York City Park (Newtown Barge Playground) across Franklin Street. Residential buildings are located immediately east of the NuHart facility. Figure 2 (Appendix A) illustrates area-wide land uses in the vicinity of the Site.

Former industrial operations at the Site have impacted on-site and off-site soil and groundwater through releases of phthalates and lubricating oil from holding tanks and piping networks. Phthalates and a phthalate/oil mixture are present as widespread light non-aqueous phase liquid (LNAPL) impacting soil and floating on the groundwater. Dissolved groundwater contamination is generally limited to phthalates and localized impacts from a former release of chlorinated solvents.

The Site entered the New York State Inactive Hazardous Waste Disposal Site (IHWDS) Remedial Program (also known as the State Superfund Program) in July 2010 and is identified as Site No. 224136.

A NYSDEC spill event (file No. 0601852) has been reported for the NuHart property based on a release of petroleum from former underground storage tanks (USTs); the spill area, however, is located east of the Site at the northeastern portion of the building and is the subject of a separate remedial action. Data generated during the spill investigation has been incorporated into this RIR as appropriate, in order to document environmental conditions outside the Site boundaries.

2.2 Physical Setting

2.2.1 Site Topography

Information on the subject property's topography was obtained from the review of the United States Geological Survey (USGS) Topographic Map of the Brooklyn, New York Quadrangle and from observations made during the RI. The property is located in a relatively level urban area, which generally has surface elevations ranging from 10 to 15 feet above mean sea level (msl), with overall gentle downward slopes to the west-northwest, toward the confluence of the nearby East River and Newtown Creek. The Site is located within an industrial building, with a concrete floor at an elevation

generally matching grade level along Dupont and Clay Streets (eastern portion of building) and above grade level at Franklin Street (western portion of building).

2.2.2 Site Geology

U.S. Geological Survey reports describe the subsurface sequence in the general vicinity of the Site as unconsolidated fill overlying salt-marsh deposits and alluvium, typically underlain by till and ground moraine of the Upper Glacial Aquifer.

Subsurface soils exposed in mechanical borings extended during the RI to approximately 20 feet below surface grade (bsg) were noted to generally consist of fine to coarse, brown and gray sands, with variable proportions of gravel, silt and clay. Likely fill materials were noted beneath the building slab throughout the Site. Sandy silt, sandy and silty clay, and clay were noted in deeper saturated intervals at several locations. A single boring (3SB-6) extended to document soil conditions from 20 to 30 feet bsg contained a dense, continuous layer of gray to red silty clay. No bedrock was encountered in any boring.

Geotechnical borings were extended on- and off-site by Soil Mechanics Drilling Corp. in November and December 2014 (outside the scope of the Work Plan), in support of future development activities. Borings documented a general subsurface sequence of sandy fill located beneath the building slab, poorly-graded sands and silty sands extending into the saturated zone, and underlying layers of low-plasticity clays and silts (the clay layers were not observed at the western edge of the Site). Hard crystalline bedrock (gneiss) was encountered at depths of approximately 50 to 60 feet bsg.

A geological cross-section of the Site is presented on Figure 4, Appendix A. Soil boring methodology and observations are described in Section 3.3, soil boring logs from the RI and a copy of the geotechnical Boring Plan are presented in Appendix C, and driller's monitoring well construction logs are provided in Appendix D.

2.2.3 Site Subsurface Hydrogeology

Monthly well gauging data from September 2012 through March 2015 indicate that groundwater depth ranges from approximately 7 to 12 feet below grade (in the immediate vicinity of the well), with minimum groundwater depths generally recorded during the winter. Saturated soils observed during the extension of borings and the installation of monitoring wells generally consist of poorly-graded, variable texture sands with some silt and gravel.

Groundwater flow at the Site (as measured at 7 of 35 wells in March 2014) is in an overall westerly direction, towards the East River (located approximately 450 feet west of the property), and is somewhat tidally influenced west of the Site. Groundwater flow and tidal influences are discussed in Section 3.4.3.

2.3 History of Site and Previous Environmental Investigations

ESI has reviewed previous environmental reports issued by Advanced Site Restoration, LLC (ASR), including an Underground Tank Closure Report dated July 2006 (ASR TCR), a Phase II Site Assessment dated March 2007 (ASR Phase II) and several groundwater gauging and sampling reports (November and December 2007, August 2008 and March 2009 (ASR Groundwater Reports). Copies of these reports are provided in Appendix E.

The ASR Phase II summarizes the findings of previous environmental site assessment reports for the NuHart facility issued by RTP Environmental Associates Inc. (Preliminary Phase I Site Assessment) and FPM Group (Phase I Environmental Site Assessment). Commercial uses of the property prior to 1950 included manufacturing (metalworking, light fixtures, soap and water proofing materials); after 1950 the building complex was primarily used for the production, storage, and shipping of plastic and vinyl products by several tenants (the last tenant ceased operation in 2004). These reports identified the presence of USTs containing plasticizers, lubricating oil, chemicals and fuel oil.

The ASR TCR documented the in-place closure of seventeen USTs and associated sub-grade pipe trenches. A total of 8 tanks containing plasticizers (phthalates) and 4 tanks containing "Super Hecla" oil (a heavy-weight machine lubricant) were located at the Site, and 5 tanks (3 fuel oil tanks and 2 chemical tanks [methyl tert-butyl ketone and acetone]) were located east of the Site at the northeastern corner of the Building.

The ASR Phase II documents a soil and groundwater investigation beneath the NuHart building and at nearby public sidewalks. Petroleum contamination was found in the vicinity of former fuel oil tanks at the northeastern portion of the building (NYSDEC spill site) and phthalate impacts were found at the western portion of the building complex (the Site). Observations and laboratory findings presented in the report, which apply to the Site, are discussed below.

- Liquid phthalates were observed as LNAPL in groundwater wells, and elevated levels of phthalates were detected in soil and groundwater samples. LNAPL was found in monitoring and recovery wells throughout the Site and beneath adjoining sidewalk areas.
- A total of 46 soil samples from 37 Site sampling locations were submitted for laboratory analysis of semi-volatile organic compounds (SVOCs) and volatile organic compounds (VOCs). Total phthalate compounds were detected above 1,000 parts per million (ppm) in 6 samples (generally from deep soil near the groundwater interface), between 100 and 1,000 ppm in 4 samples, and below 100 ppm in 20 samples. Other semi-volatile organic compounds were detected in 11 samples, with 5 samples containing compounds slightly above NYSDEC Remedial Program Soil Cleanup Objectives (SCOs) for Restricted-Residential Use (RRUSCOs); these SVOC detections were generally limited to soils from 0 to 5 feet bsg. VOCs were detected below SCOs for Unrestricted Use in 8 samples.
- Additional analyses for TAL metals, PCBs and pesticides were completed for 4 Site soil samples. Low-level exceedances of RRUSCOs for metals (arsenic, barium, copper, lead and/or mercury) were detected in 3 samples. Re-analysis of the sample containing elevated mercury showed no contamination. PCBs were detected in only 1 sample at trace levels. No samples contained detectable levels of pesticides.
- Groundwater from 9 Site monitoring wells (within the building and in nearby sidewalks) was submitted for laboratory analysis of VOCs (petroleum related compounds, only) and SVOCs. Phthalates were detected above NYSDEC standards in 6 wells, with 4 wells located within the LNAPL plume exhibiting levels of total phthalate compounds above 100,000 parts per billion. Low-level exceedances of VOCs were detected in 2 wells.

ASR conducted an interim remedial measure (IRM) from 2006 through 2009, consisting of the removal of LNAPL from recovery wells located within the building, using both manual bailing and automated equipment (approximately 9,000 gallons were removed). LNAPL was historically detected in Site monitoring wells MW-4 through MW-7, MW-15 and MW-16, and recovery wells RW-2 through RW-12. Concurrent quarterly groundwater sampling for petroleum compounds and phthalates documented ongoing contamination by dissolved phthalates and an absence of any significant dissolved VOCs.

ESI began overseeing IRM activities at the Site in December 2009. Product recovery belt skimmers were installed at recovery wells RW-8 and RW-12 in October 2010 to enhance the product recovery system previously installed by ASR (pumping units at RW-3 and RW-10). Product recovery activities by ESI through January 2015 account for removal of approximately 12,400 gallons from the subsurface are documented in monthly reports submitted to NYSDEC. Historical LNAPL gauging data (September 2012 to March 2014) are presented in Table 15, Appendix B.

An Interim Investigation Report issued by ESI in April 2010 documents additional site investigation completed prior to the listing of the western portion of the NuHart property as an IHWDS. A copy of the Interim Investigation Report is provided in Appendix E and observations and laboratory findings presented in the report are discussed below.

- An analysis of the LNAPL present in RW-7, located at the northeastern portion of the building near the former fuel oil USTs, documented an absence of significant levels of phthalates. This finding indicated that the free product present in the recovery well was not an admixture of industrial wastes and could continue to be managed as a petroleum release.
- LNAPL at MW-4 (eastern portion of the Site) was observed to have a light yellow color and was identified as a mixture of phthalates. Dark colored, sticky LNAPL was observed at the western portion of the property in MW-5 through MW-7, MW-15, MW-16, RW-2 through RW-6, and RW-8 through RW-12. LNAPL at RW-12 was identified as a mixture of phthalates and a high boiling point paraffinic, petroleum based oil (MW-4 did not contain a significant amount of petroleum based oil). LNAPL at MW-20 (off-site sidewalk on the southern side of Dupont Street) was identified as bis(2-ethylhexyl)phthalate (DEHP). The apparent depth of free product in monitoring wells ranged from approximately 0.2 to 4.9 feet.
- No LNAPL was detected in RW-1 and exterior wells MW-8 (located in the sidewalk directly north of the building) and MW-12, MW-13 and MW-14 (located to the northwest and west across the adjoining roadways).
- Groundwater was determined to be flowing from the east to the west across the property. Off-site monitoring wells MW-12 and MW-13 (located to the northwest of the Site) were determined to be tidally influenced; nearby monitoring well MW-14 (located west of the Site), and MW-1, MW-2 and MW-3 (located east of the Site), however, were not tidally influenced.

- Water quality samples from off-site monitoring wells without overt LNAPL contamination (MW-3, MW-10, MW-12, MW-13 and MW-14) were analyzed for VOCs and SVOCs (full list parameters). No significant levels of dissolved phthalates were detected. Trichloroethylene (TCE) was detected at 15 µg/L in off-site well MW-13. No other significant levels of analytes were found in any samples.

2.4 Proposed Future Use of the Site

Future use of the former NuHart Plastics Manufacturing property, which includes the Site, is expected to be either restricted-residential or mixed use (restricted-residential and commercial). No specific redevelopment designs have been set forth by the Site Owner or other interested parties.

3.0 SITE INVESTIGATION

ESI extended a total of 55 soil borings during performance of the RI, with an additional 8 borings extended solely for the collection of soil vapor. Permanent groundwater monitoring wells were installed at 22 of the soil boring locations.

The RI findings are supplemented by data collected from the extension of 7 soil borings in the adjoining spill site area, 3 of which were converted to permanent groundwater monitoring wells, and by groundwater quality and product identification data collected in 2010, documented in ESI's Interim Investigation Report.

Fieldwork activities, laboratory submission and a qualitative human health exposure analysis are presented below. Analytical results from a total of 146 samples (inclusive of supplemental data) are provided in Tables 1 through 13 and a summary of sample collection and submission to the laboratory is provided in Table 14, Appendix B. Soil boring logs are presented in Appendix C, driller's monitoring well construction logs are presented in Appendix D and results from the Community Air Monitoring Plan (CAMP) are provided in Appendix G.

3.1 General Provisions

3.1.1 Utility Markout

Prior to the initiation of fieldwork (and prior to any subsequent intrusive fieldwork), a request for a complete utility markout of the subject property was submitted by ESI as required by New York State Department of Labor regulations. Confirmation of underground utility locations was secured and a field check of the utility markout was conducted prior to the extension of soil borings and/or the installation of monitoring wells. Additional markout services were provided, as warranted, by private contractors prior to fieldwork conducted in public sidewalks.

3.1.2 Agency Notification

The NYSDEC was notified in writing and/or via email prior to the initiation of all fieldwork. Changes to fieldwork scheduling and interim updates were provided via email and/or telephone calls.

3.1.3 Equipment Decontamination and Calibration

Prior to the initiation of fieldwork, all field equipment used during the work was properly decontaminated in accordance with NYSDEC guidelines, and all field instruments were properly calibrated in accordance with procedures set forth by the equipment manufacturer(s).

A photo-ionization detector (PID) was utilized by ESI personnel to screen all encountered material for the presence of any volatile organic vapors where appropriate. Prior to the initiation of fieldwork, this PID was properly calibrated to read parts per million calibration vapor equivalents (ppm-cge) of isobutylene in accordance with protocols set forth by the equipment manufacturer.

3.1.4 Investigation Derived Waste

Waste materials generated during Site investigation were stored within the on-site structure and periodically disposed of off-site at permitted facilities. Water generated during development and sampling of wells was placed into intermediate bulk storage containers (approximately 250- to 400-

gallons) utilized for the storage of phthalates and phthalate/water mixes removed from recovery wells. Phthalates and phthalate/water mixes removed from the Site have been classified as hazardous wastes. Soil cuttings not returned to boreholes and used equipment (e.g., gloves, spent absorbent pads, bailers, etc.) were placed into labeled 55-gallon drums and disposed off-site at permitted facilities. Waste disposal manifests are provided in Appendix F.

3.1.5 Subcontractors

ESI supervised the advancement of soil borings and/or the installation of monitoring wells by Todd Syska, Inc. (Syska), Soil Testing, Inc. (Soil Testing), Zebra Environmental Corporation (Zebra), Haz-Probe, Inc. (HPI) and Associated Environmental Services, Ltd (AES). The Health and Safety Plan (HASP) prepared for the Work Plan was reviewed with all on-site subcontractors. ESI personnel served as the Site Health and Safety officer during all on-site work. ESI personnel developed all monitoring wells and collected all soil, soil vapor and groundwater samples.

Laboratory services were subcontracted to New York State Department of Health (NYSDOH) certified laboratories (York Analytical Laboratories, Inc. [York, ELAP Certification Number 10602] and Alpha Analytical [Alpha, ELAP Certification Number 11148]). Data Usability Summary services were completed by EnviroAnalytics of Utica, New York and ZDataReports of Syracuse, New York.

Waste disposal services for non-hazardous soil, and hazardous liquid and solid wastes, were provided by Miller Environmental Group of Westbury, New York.

3.1.6 Fieldwork Observations, Sample Collection and Sample Custody

An assessment of field conditions (e.g., soil type, indications of contamination, PID readings) was made during the collection of all samples. ESI personnel maintained field logs documenting all field observations and measurements (see soil boring logs in Appendix C).

All media samples were collected in a manner consistent with NYSDEC sample collection protocols. Dedicated, disposable gloves were worn by all personnel handling samples, and collected media was placed into laboratory-supplied containers. All sample containers were maintained at low temperature prior to, and during, transport to the laboratory for analytical testing. Appropriate chain-of-custody procedures were followed.

Non-dedicated sampling equipment was decontaminated prior to initiation of fieldwork and before each new sample location, as appropriate.

3.1.7 Standards, Criteria and Guidance

Standards, Criteria and Guidance (SCGs) applicable to media investigated during the RI are specified below.

Soil

SCGs for all compounds detected in soils are based on NYSDEC Remedial Program SCOs for Restricted-Residential Use (RRUSCOs) as provided in 6 NYCRR Subpart 375, Table 375-6.8(b) “Protection of Public Health” category, and on Supplemental SCOs and Soil Cleanup Levels (for gasoline and fuel oil contaminated Soils) presented in NYSDEC CP-51 Tables 1 through 3. Data summary tables for soil also provide SCOs for Unrestricted Use (UUSCOs) for comparative purposes.

SCOs for soils are referenced in units of micrograms per kilogram (ug/kg, parts per billion [ppb]) for VOCs and SVOCs and milligrams per kilogram (mg/kg, parts per million [ppm]) for metals.

Water

SCGs for all compounds detected in water are based on Ambient Water Quality Standards and Guidance Values (AWQS) presented in NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 (TOGS 1.1.1). SCGs for groundwater are referenced in units of micrograms per liter (µg/L).

Soil Vapor

The State of New York does not have any standards, criteria or guidance values for volatile chemicals in subsurface vapors (either soil vapor or sub-slab vapor). Relatively high levels of VOCs in subsurface soil vapor are noted in the report text and in data summary tables in order to facilitate a discussion of investigative findings. The NYSDOH Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York (October 2006) identifies several Air Guideline Values to be used in evaluating indoor air quality, which may be used in conjunction with sub-slab soil vapor data when evaluating the potential for soil vapor intrusion within buildings.

3.1.8 Documented Variations from the Approved Work Plan

There were no significant deviations from the Work Plan that were critical to the validity of the conclusions and recommendations presented in Section 4.0.

Variations from the approved Work Plan are discussed in relevant sections of this RIR as follows:

- Soil Investigation: Several soil borings could not be extended due to site conditions (limited physical access and repeated subsurface refusal), and additional sampling locations were utilized to provide alternative sources of data and to further delineate known contaminant conditions (see Section 3.3).
- Groundwater Investigation: Proposed sampling was not conducted at several monitoring wells, based on either the presence of LNAPL or poor well recharge/absence of sufficient water (see Section 3.4).
- Installation of Recovery Wells: Proposed recovery wells RW-13 through RW-15 were not installed based on observations of slow/inefficient removal of LNAPL at existing recovery wells.

3.1.9 CAMP Findings

VOC screening was conducted during all fieldwork activities; no significant VOC readings or exceedances were observed. No dust monitoring was completed for any work conducted inside the building. Data document the absence of any exceedances of dust levels during all intrusive fieldwork for which monitoring was completed. Dust data are presented in Appendix G.

3.2 Soil Vapor Investigation

Soil vapor was collected at 14 on- and off-site locations (9 within the bounds of the IHWDS, 3 off-site within the eastern portion of the building and 2 off-site at the northern side of Clay Street). All soil

vapor sampling locations are shown on Figure 3, Sampling Location Map, Appendix A and a summary of sample collection and submission to the laboratory is provided in Table 14, Appendix B.

3.2.1 Sample Collection Methodology – Soil Vapor

A soil vapor survey was completed to determine the level of VOCs in the soil vadose zone beneath and near the building complex. Soil vapor samples were collected from borings SG-1 through SG-4 on February 2, 2012 (proposed in the RIWP), borings 2SB-2 through 2SB-4, 2SB-6 through 2SB-8 and 2SB-10 on July 31, 2013, and 2SB-16 on December 4, 2013 (proposed in the SRIWP), and from borings 3SB-1 and 3SB-2 on September 22, 2014 (proposed in the TCEWP). The 2SB and 3SB sampling rounds were implemented at the request of NYSDEC in order to delineate elevated levels of TCE initially detected at SG-4 (and subsequently documented in several groundwater monitoring wells). Vapor samples 2SB-7 and 2SB-8 were collected immediately east of the Site boundary (within the building), 2SB-10 was collected off-site at the far northeastern portion of the building near adjoining residential property, 2SB-16 was collected from the northern portion of the Site in close proximity to Clay Street and 3SB-1 and 3SB-2 were collected from the northern sidewalk on Clay Street. Survey points are shown on Figure 3, Sampling Location Map, Appendix A.

Sub-slab soil vapor sampling was conducted from borings that were extended directly through the building slab or sidewalk using mechanized Geoprobe equipment, consistent with the approved Work Plan. The end of the sample tubing (0.188 inch inner diameter Teflon) was attached to an “air stone” filter and inserted through the slab breach to a point approximately 1 to 2 feet above the water table, and the boring was backfilled with clean silica sand.

The top of the bore hole was sealed using a non-VOC containing caulk in order to prevent the infiltration of surface air. The space around the sampling point was enclosed and sealed (with a metal hemisphere and clay) in order to introduce a tracer gas (helium) into the area surrounding the probe point. Helium was introduced into the enclosure and a helium detector (Radiodetection Multi-vapor Leak Locator, model MDG 2002) was utilized to determine when the interior atmosphere reached a concentration of 80% (helium was not used at 2SB-16 due to a tank malfunction). A vacuum pump was then utilized to purge the standing air from the tubing and open the soil interval. At least three borehole and tubing volumes were purged prior to sample collection at a rate of 0.2 liters per minute. Following purging, sub-slab soil vapor samples were collected over a one-hour period using a six-liter stainless steel, laboratory supplied Summa canister with a one-hour calibrated flow controller. For each sampling canister, the pre- and post-sample canister pressure, start and stop times, and location of each sampling point was recorded.

3.2.2 Fieldwork Observations – Soil Vapor

Building slabs observed at the Site generally consisted of 4 to 8 inches of concrete in good condition, which allowed for the proper installation of monitoring points at the planned locations. No significant PID readings, odors or other evidence of contamination were noted during soil vapor sampling.

3.2.3 Laboratory Results – Soil Vapor

All soil vapor samples were analyzed for VOCs (USEPA Method TO-15) and helium. Soil vapor sampling locations and detections of TCE and related compounds are shown on Figure 5 in Appendix

A, soil vapor data are summarized in Tables 1 and 2 in Appendix B and laboratory reports are provided in Appendix J.

TCE and tetrachloroethylene (PCE) were detected at 35,000 µg/m^3 and 830 µg/m^3, respectively, at SG-3 during the first sampling round. The second sampling round documented a peak level of 43,000 µg/m^3 at 2SB-3, and 33,000 µg/m^3 at 2SB-2 (these sampling points are located in close proximity to each other north of SG-3 in the central portion of the building). TCE levels ranged from 5,600 to 14,000 µg/m^3 in samples 2SB-4 and 2SB-6 to 2SB-8. TCE was detected at 1,100 µg/m^3 at 2SB-16 (located near Clay Street). TCE levels at 3SB-1 and 3SB-2 were 6,130 µg/m^3 and 134 µg/m^3, respectively.

Peak levels of 1,1,1-TCA (1,000 µg/m^3 and 430 µg/m^3) were found in soil vapor samples 2SB-7 and 2SB-8, respectively. No significant levels of chlorinated VOCs (cVOCs) were detected in 2SG-10, collected off-site at the eastern portion of the building, near occupied residential properties.

Low levels of multiple compounds (BTEX and other petroleum constituents, solvents, etc.) were detected at all sampling points.

3.2.4 Nature and Extent of Contamination – Soil Vapor

Significant soil vapor contamination is present in a limited portion of the building immediately surrounding and to the north of SG-3, and beneath the northern sidewalk at Clay Street. TCE levels in soil (see Section 3.3) have been documented above UUSCOs (but below RRUSCOs) at the northeastern corner of the Site and at the adjoining northern sidewalk, in the vicinity of elevated TCE vapor levels (cVOCs in soil are below UUSCOs at all other sampling locations). High levels of dissolved TCE have also been detected in groundwater at MW-8, MW-34 and MW-40 (see Section 3.4). Significantly lower levels of dissolved TCE have been detected at the immediately downgradient monitoring wells MW-4, MW-7, MW-21 and MW-39, with only slightly elevated levels detected at several of the more distant downgradient wells (e.g., MW-12, MW-13, MW-29 and MW-32).

These data support the conclusion that the cause of elevated soil vapor levels at the Site may be due to a limited solvent “hot spot” in soil and/or groundwater in the vicinity of the northeastern portion of the Site (peak TCE levels in both soil and groundwater have been identified in the immediate vicinity of MW-8).

Limited sampling data indicate that cVOC impacted vapor is not present at the southwestern corner of the Site, or at the far northeastern corner of the building near adjoining eastern residential properties. Low-levels of other VOCs detected in sub-slab soil vapor throughout the building are consistent with levels typically encountered in urban settings and are likely due to the historical industrial use of this or other nearby sites. These compounds are not present at levels suggesting a threat to indoor air quality.

3.3 Soil Investigation

A total of 61 borings were extended during the soil investigation (57 mechanized borings [24 locations converted to groundwater monitoring] and 4 manual borings), with 86 soil samples collected from 60 locations submitted for laboratory analysis. All boring locations are shown on Figure 3, Sampling

Location Map, Appendix A and a summary of sample collection and submission to the laboratory is provided in Table 14, Appendix B.

Investigation of IHWDS

Soil conditions were investigated in accordance with the Work Plan by advancing borings at the Site, in off-site areas both within the building (including near the area associated with the petroleum spill event) and at sidewalks adjoining and in the vicinity of the Site, and within Greenpoint Playground. Proposed soil borings SB-62 and SB-64 were not extended due to repeated refusal, and SB-70 was not extended due to a lack of physical access. An additional soil boring, SB-60B, was extended immediately south of SB-60 in order to collect extra material from shallower soils. Soil boring 3SB-3 met refusal at 15 feet bsg and was finished by stepping out the location by 2 feet (initial boring labeled 3SB-3A and the proximate deeper boring labeled 3SB-3B). A boring for a potential contingency well, MW-33, to be located at the far western end of Greenpoint Playground, was not installed. Fieldwork observations were recorded, and at least one soil sample was collected, from each boring location (no sample was collected at SB-75/MW-20).

Investigation of NYSDEC Spill Site

Monitoring wells MW-17, MW-18 (proposed boring SB-76) and MW-19 were installed, and borings SB-MW-17, SB-MW-18, SB-77A and SB-78A were extended, in the eastern portion of the building and at the adjoining sidewalk at Clay Street, as part of an approved Work Plan implemented at the NYSDEC spill site. Findings from the spill site investigation have been used to supplement data generated during the investigation at the IHWDS, to the extent that such spill site data contribute to defining the nature and extent of constituents of concern identified at the IHWDS.

3.3.1 Sample Collection Methodology

Mechanized borings were extended using a truck-mounted or track-mounted Geoprobe direct-push corer, or with a hollow-stem, rotary drill using a split-spoon sampler. Borings were generally extended to a maximum depth of approximately 20 feet bsg, into saturated soils (MW-38 to MW-40 and the 3SB soil series were extended to approximately 25 feet bsg, with 3SB-6 extended to 30 feet bsg). Manual borings (2SB-12 through 2SB-15) were extended using a hand-held Geoprobe corer to a depth of 2 feet bsg to screen soils immediately beneath the building slab.

Material was removed directly from the disposable acetate sleeves of the Geoprobe or from the split-spoon sampler of the rotary drill. Samples from mechanically extended borings were collected from the soil/groundwater interface and (as warranted) from the interval exhibiting the most significant field indications of contamination and/or likely to contain sources of contamination (e.g., deeper soils in areas suspected of containing TCE contamination). Samples from manually extended borings were collected from the recovered soil interval (0 to 2 feet bsg). Field personnel wore dedicated disposable gloves and placed samples directly into laboratory-supplied glassware. Samples were maintained at cool temperatures, under proper chain of custody procedures. Prior to and after the collection of each material sample, the sample collection instrument (barrel of Geoprobe or split-spoon sampler) were decontaminated to avoid cross-contamination between samples.

All soil sampling for VOCs was conducted according to USEPA Method 5035 fieldwork protocols, utilizing laboratory sampling kits (disposable plastic syringes and prepared 40-ml glass vials).

3.3.2 Fieldwork Observations

Subsurface soils encountered at mechanized soil borings generally consisted of poorly-graded, variable texture sands (including fill beneath the building slab), with sandy silt, sandy and silty clay, and clay noted in deeper saturated intervals (see Section 2.2.2, boring logs provided in Appendix C and driller's well construction logs provided in Appendix D).

LNAPL was observed at the groundwater interface in the western portion of the Site (SB-60, SB-61, SB-67, SB-68 and SB-71/MW-22) and in off-site locations west and southwest of the Site (SB-72, SB-75/MW-20, MW-25 and MW-26). These findings are generally consistent with observations of LNAPL in monitoring and recovery wells (see Section 3.4). Additional evidence of contamination (unambiguous odors and/or staining) was observed at SB-60B, SB-63/MW-21, SB-66 and SB-73. Positive PID readings were recorded in soils at and near the groundwater interface at the northeastern portion of the Site and at off-site areas to the east and to the north along Clay Street (3SB-3A through 3SB-9, and MW-40). A likely thin layer of petroleum-impacted material was observed at the groundwater interface at MW-39, near abandoned fill ports on Clay Street, associated with a former gasoline station.

No evidence of contamination was observed in borings extended at: SB-65 and SB-69 in the central portion of the Site; SB-74 in the sidewalk to the north at Clay Street; MW-23 and MW-24, MW-27 through MW-32, and MW-36 and MW-37 in off-site sidewalks to the south and west; or in MW-41 and MW-42 in Greenpoint Playground.

Petroleum odors, staining and/or LNAPL was observed in borings at the adjoining spill site in MW-18 and MW-19, located to the northwest and south of the former petroleum USTs. No evidence of contamination was observed at MW-17, located to the north, or at borings SB-77A and SB-78A, located to the west, south of MW-18.

Subsurface soils encountered to 2 feet bsg at manual soil borings consisted of uniform fine to medium texture brown sands (likely fill material). No evidence of contamination was observed at these locations.

Soil boring logs, documenting subsurface conditions and all fieldwork observations, are presented in Appendix C.

3.3.3 Laboratory Results – Soil

Soil samples collected from the "SB" soil series and from monitoring wells MW-21 to MW-32, MW-34 to MW-37, MW-1 and MW-42 were analyzed for full list SVOCs plus TICs utilizing USEPA Method 8270, with the exception of samples from off-site borings SB-72, SB-73 and SB-74 which were analyzed for base-neutrals only. At least half of these samples were analyzed for full list VOCs plus TICs utilizing USEPA Method 8260 and least 10% of the samples were analyzed for TAL metals utilizing USEPA Methods 6010 and 7471. Soil collected from boring series "2SB" and "3SB", and monitoring wells MW-38 to MW-40, which were specifically extended to further define the extent of TCE contamination, were submitted for a more limited list of analytes: VOCs and SVOCs (2SB-1 through 2SB-11) or VOCs only (all remaining borings).

Samples specifically collected as part of the remedial investigation at the adjoining spill site to the east were analyzed for SVOC and/or VOC full list parameters without TICs, or for base-neutral SVOCs (no metals analysis was conducted).

Soil sampling locations and detections of significant compounds in soil are shown on Figures 6 through 8, soil data are summarized in Tables 3 to 9 and laboratory submission of samples is summarized in Table 14, Appendix B, and laboratory reports are provided in Appendix J.

3.3.3.1 Soil Analysis: VOCs

No VOCs were detected in soil at levels above RRUSCOs at any boring location (75 total samples, including 5 samples collected at the spill site). Analyte levels above UUSCOs were detected in 22 boring locations: 1,2,4-trimethylbenzene and/or total xylenes at SB-60B and SB-65; TCE, cis-DCE and/or vinyl chloride (VC) at SB-1/MW-34, 3SB-3A, 3SB-3B, 3SB4, 3SB-5, 3SB-8 and 3SB-9; and acetone and/or methylene chloride at MW-19, SB-60, SB-60B, SB-63, SB-67, SB-71, 2SB-13, 2SB-14, 2SB-15, MW-39 and MW-40.

Soils were generally collected from the surface to 15 to 20 feet, with overall focus on deep soils at or below the groundwater interface and on any overtly impacted materials. Soil from several borings with known or suspected contamination by chlorinated solvents was additionally collected from the 20 to 25 feet interval (3SB-4, 3SB-6 and 3SB-9), the 20 to 30 feet interval (3SB-6, collected as representative deep samples for SB-1/MW-34), or was limited to the 0 to 5 feet interval to screen for the potential location of a surface release (2SB-12 to 2SB-15). Peak VOC levels were observed at soil boring SB-60B (15,000 ppb 1,2,4-trimethylbenzene at 6 to 8 feet) and at 3SB-3A (14,000 ppb TCE at 10 to 15 feet.

TICs were detected in 10 of 44 boring locations, with peak total levels reported in overtly impacted soil at SB-60B and MW-19 (27,200 ppb and 28,891 ppb, respectively). TICs generally appear to be related to petroleum.

VOCs at levels above UUSCOs are shown on Figure 6 and detected levels of TCE (and related compounds) are show on Figure 7, and VOC levels in soil are summarized in Tables 3, 4 and .

3.3.3.2 Soil Analysis: SVOCs

Elevated levels of DEHP (RRUSCO 50,000 ppb, UUSCO not established) were detected in 18 of 46 boring locations, with 5 locations additionally containing elevated levels of di-n-octyl phthalate (DOP, RRUSCO 100,000 ppb, UUSCO not established). Total phthalate levels exceeded 1,000,000 ppb in 11 samples (peak total level of 59,776,000 ppb at MW-22[12-14]). Benzyl butyl phthalate (RRUSCO not established) was detected at 48,300 ppb sample MW-22 (10-11). An elevated level of 2-methylnaphthalene (RRUSCO 410 ppb, UUSCO not established) was detected at the spill site at MW-19. No other significant SVOC levels were detected in soil samples.

TICs were detected in 11 of 27 boring locations, with a peak total level reported in overtly impacted soil at MW-21 (18,629 ppb; sample identified as SB-63[14]).

Phthalates at levels above RRUSCOs are shown on Figure 8, and SVOCs in soil are summarized in Tables 5, 6 and 9.

3.3.3.3 Soil Analysis: Metals

All TAL metals, with exception of mercury and silver, were detected in Site soil samples (14 boring locations). Elevated levels of iron (RRUSCO 2,700 ppm) were detected in all samples submitted for analysis, with levels ranging from 10,200 to 37,800 ppm. No other metals were detected at levels above RRUSCOs at any boring location. Metal levels above UUSCOs were detected in 7 locations, including relatively low levels of chromium, copper, lead, nickel, selenium and/or zinc. Metals in soil are summarized in Table 7.

3.3.4 Nature and Extent of Contamination – Soil

Significant soil contamination (i.e. analyte levels above RRUSCOs) is restricted to elevated levels of DEHP and DOP, encountered in soil located at and near the groundwater interface, in an area delimited by known LNAPL contamination (see Sections 3.2.2 and 3.3), and to contamination by 2-methylnaphthalene in overtly impacted soil at the spill site. Other than these areas, no SVOCs were identified at levels exceeding UUSCOs.

The total on-site volume of phthalate contaminated soils is estimated at 7,900 cubic yards. This estimate is calculated based on the lateral extent of free product (documented by LNAPL observed in soil and in monitoring/recovery wells) and assumes a uniform potential smear zone of four feet (the area directly impacted by the static height of LNAPL in the soil column, with allowance made for movement of the top and bottom of the LNAPL lens as groundwater elevations change over time. This estimate is considered to be highly conservative, given that product thickness as measured in wells are generally greater than actual thicknesses in the soil formation. Additional phthalate contaminated soil is present off-site.

Levels of iron in soil above RRUSCOs appear to be indicative of background conditions and are not likely to represent a significant environmental concern.

TCE and related compounds, as well as other VOCs documented in overtly impacted soils, are present at levels below RRUSCOs, but are a potential ongoing source of soil vapor contamination. Existing data suggest the presence of a limited solvent hot spot in soil (and/or groundwater) in the northeastern corner of the Site and off-site, particularly in the vicinity of at MW-8. No estimate of the volume of TCE-contaminated soil can be provided at this time.

Petroleum compounds released at the adjoining spill site to the east have not significantly impacted Site soils. Similarly, with the exception of phthalates associated with LNAPL contamination, contamination by organic and inorganic compounds has not significantly impacted soils beneath off-site sidewalks to the south, west and north, or in Greenpoint Playground.

The total on-site volume of petroleum contaminated soil is estimated at 800 cubic yards (excluding the volumes occupied by USTs that have been closed-in-place).

3.4 Groundwater Investigation

A total of 45 groundwater samples from 30 on- and off-site monitoring wells (8 pre-existing wells and 22 of 25 wells installed by ESI) were submitted for laboratory analysis. Several newly installed wells at the southwestern margin of the phthalate plume (MW-20, MW-25 and MW-26) were not sampled for groundwater based on the presence of LNAPL. All groundwater sampling locations are shown on

Figure 3, Sampling Location Map, Appendix A and a summary of sample collection and submission to the laboratory is provided in Table 14, Appendix B.

Investigation of IHWDS

A total of 22 new groundwater monitoring wells were installed at both the Site and in off-site areas in accordance with the Work Plan and subsequent NYSDEC communications. The RIWP called for completion of borings SB-75, SB-63, and SB-71 as groundwater monitoring wells (MW-20, MW-21 and MW-22), and the redevelopment of 8 existing monitoring wells (MW-4, MW-6, MW-7, MW-12, MW-13, MW-14, MW-15 and MW-16). An additional 3 wells were installed on- and off-site within the building in the vicinity of TCE contamination in soil vapor (MW-34, MW-35 and MW-40) and 16 additional monitoring wells were installed at exterior off-site locations (MW-23 through MW-32, and MW-36 and MW-37 in sidewalks to the southwest and west, MW-38 and MW-39 in the sidewalk north of Clay Street, and MW-41 and MW-42 within Greenpoint Playground).

Groundwater quality was investigated through the gauging and sampling of both the newly installed wells and selected wells from the pre-existing monitoring-well network (comparative data generated from well sampling conducted by ESI in 2010, prior to the approval of the Work Plan, has been included in the data tables).

Investigation of NYSDEC Spill Site

A total of 3 new monitoring wells (MW-17 through MW-19) were installed in the eastern portion of the building as part of the approved Work Plan implemented at the NYSDEC spill site. Findings from the spill site investigation have been used to supplement data generated during the investigation at the IHWDS.

3.4.1 Monitoring Well Installation

Monitoring wells MW-17 through MW-29 were installed by Soil Testing, MW-30 through MW-32, MW-34 and MW-35, and MW-38 through MW-40 were installed by Zebra, MW-36 and MW-37 were installed by HPI, and MW-41 and MW-42 were installed by AES. All fieldwork was conducted under the direct supervision of ESI field personnel. Monitoring well locations are illustrated on Figure 12, Direction of Groundwater Flow, Appendix A.

Each monitoring well was constructed of two-inch PVC casing with 10 feet of 0.01-inch slotted PVC well screening placed to extend 2 feet above the water table (monitoring wells MW-38 through MW-40 utilized 15 feet of well screen from 5 to 20 feet bsg). All wells points were set at approximately 20 feet bsg. The annular spaces between well screens and boreholes were backfilled with clean #1 silica sand to a depth of 1 to 2 feet above the well screen (monitoring wells MW-30 through MW-32, and MW-34 and MW-35 installed by Zebra utilized well screen “pre-packed” with sand). A one-foot thick bentonite seal was poured down the borehole above the sand pack and allowed to hydrate before grouting the remaining annular space with cement. All wells are equipped with a gripper casing cap and are secured with a drive over steel casing (with the exception of MW-34 and MW-35, which are stick-up wells within the building). Soil boring logs are presented in Appendix C and driller’s monitoring well construction logs are presented in Appendix D.

3.4.2 Monitoring Well Development

Wells were developed to enhance the natural hydraulic connection between the well screen and the surrounding soils. Well casings were first screened with a PID to document the presence of any volatile organic vapors. A submersible pump and dedicated polyethylene tubing were then used to clear fine-grained material that may have settled around the well screen and at the base of the well. Well development began at the top of the water column to prevent clogging of the pump by excessive sediment. The pump body acted as a surge-block by being raised and lowered within portions of the screened interval to force water back and forth through the screen. Repeated surging and pumping was conducted to the bottom of the well casing until the discharged water appeared free of sediment and indicator parameters (pH, temperature, turbidity, dissolved oxygen and specific conductivity) had stabilized. The pump assembly was removed from the well while the pump was still running to avoid discharge of purged water back into the well. Between wells, all non-dedicated equipment was decontaminated.

Newly installed monitoring wells MW-20, MW-21, MW-25 and MW-26, and pre-existing monitoring wells MW-4, MW-6, 7, 15, 16 were noted to contain LNAPL and were not developed. Previously existing monitoring wells MW-12 and MW-14 were dry during well sampling conducted in 2012.

3.4.3 Groundwater Flow and Tidal Influences

Groundwater flow was calculated using measurements collected in March 2014 from 7 of 35 monitoring wells, all of which did not have LNAPL. The general direction of groundwater flow was determined based on elevations of static groundwater using an electronic depth meter accurate to the nearest 0.01-foot (measured prior to any sample collection). Groundwater depth from the top of the well casing, as recorded during the March 2014 gauging event, ranged from between 6.94 (MW-13) and 10.69 feet (MW-29) bsg. These raw measurements were compared to existing well survey data to generate current groundwater elevation contours. Direction of groundwater flow was determined to be in a westerly direction, consistent with previous observations, which show general groundwater flow from east to west, toward the nearby East River and Newtown Creek. The rate of groundwater flow was not determined. Direction of groundwater flow is illustrated on Figure 12, Appendix A.

An assessment of tidal influences from the East River was completed using electronic level loggers installed in monitoring wells MW-1, MW-2, MW-3, MW-12, MW-13, and MW-14 on Friday February 12, 2010 (these wells were chosen based on an absence of LNAPL, as indicated in ASR reports). The level loggers were recovered on Monday February 15, 2010, providing data for approximately 72 hours.

Recording data indicated a rise and fall in groundwater elevation in all wells over the 72 hour testing period; however, a repeating pattern of groundwater rising and falling over approximately 12 hours cycles (indicating tidal influence) was evident only in MW-12 and MW-13, which are located on the western side of Commercial Street and are closest to the confluence of Newtown Creek and the East River. MW-14, the next closest well to the on-site building, and MW-1, MW-2, and MW-3, located off-site in the eastern portion of the building, did not have repeating water level patterns, indicating minimal or no tidal influence. Tidal assessment data are presented in the Interim Investigation Report, provided in Appendix E.

3.4.4 LNAPL in Monitoring wells

Previous environmental investigations by ASR and ESI documented the presence of LNAPL in on-site monitoring and recovery wells, and in multiple off-site monitoring wells located in sidewalks immediately adjacent to the on-site building. LNAPL at MW-4 was identified as a mixture of phthalates, and LNAPL at RW-12 was identified as a mixture of phthalates and a high boiling point petroleum based oil. LNAPL at off-site monitoring well MW-20 was identified during the RI as DEHP. The source of this material is likely to have been failing USTs formerly containing plasticizers and lubricating oil, rather than the former piping network (significant phthalate contamination is not present in surface soil). The areal extent of LNAPL contamination is shown on Figure 13, Appendix A, and laboratory reports identifying LNAPL constituents are provided in Appendix H.

A total of 22 new monitoring wells (5 interior and 17 exterior) were installed by ESI during the implementation of the Work Plan, with an additional 3 new wells (1 interior and 2 exterior) installed at the spill site. LNAPL has been observed in 5 of these new wells (interior wells MW-21 and MW-22, and exterior wells MW-20, MW-25 and MW-26).

Monthly gauging events conducted during the RI and the ongoing IRM document a LNAPL plume beneath approximately 80% of the defined footprint of the IHWDS, which extends off-site to the southwest, with free product observed at the northwestern and southeastern corners of Dupont and Franklin Streets. Historical gauging data for LNAPL (the 25 most recent fieldwork events) are presented in Table 15, Appendix B.

The lateral extent of contamination is defined by an absence of LNAPL at additional wells installed: along the perimeter and within Greenpoint Playground to the west (MW-30 to MW-32, MW-41 and MW-42); at the southwestern corner of Dupont and Franklin Streets (MW-24, MW-36 and MW-37) and farther along the roadways (MW-23 and MW-27 to MW-29); along Clay Street to the north (MW-38 and MW-39) and east (MW-17 and MW-18); and within the building in the northeastern quadrant of the IHWDS (MW-34 and MW-35) and off-site to the east at MW-19 and MW-40.

The total volume of free product at this Site is estimated at 32,900 gallons on-site and an additional 9,000 gallons off-site, with an expressed error range of 50%. This estimate is calculated from the relative apparent thicknesses of product at all wells with meaningful product thicknesses, assuming consistent thicknesses in areas between data points and assuming linear reductions beyond data points. Boring logs generally demonstrate variable texture sand above the static water levels (that is, in the stratum where floating product is present) and therefore a co-efficient of 0.35 is used to represent available space for product within the soil column.

It is recognized that gauging data represent the apparent thicknesses of LNAPL measured in wells of varying diameters and over periods of time during which the water table fluctuated. As result of capillary forces and other processes operating within wells, particularly under changing water table conditions, the apparent thickness of LNAPL in wells is generally greater than the actual thickness in the formation. Therefore, LNAPL volume estimates made using well gauging data tend to overestimate the actual volume of LNAPL in the formation.

3.4.5 Sample Collection Methodology

Groundwater samples were collected in February 2010 (prior to implementation of the Work Plan), March, April, and September 2012, August and November 2013, and in April, October and December 2014. Monitoring wells MW-20, MW-21, MW-25 and MW-26, and pre-existing monitoring wells MW-4, MW-6, 7, 15 and 16 were not sampled during fieldwork conducted prior to November 2013 based on the presence of LNAPL within the casing. Monitoring wells MW-12 and MW-14 were found to be dry during the 2012 groundwater quality sampling event. A total of 45 water samples (excluding duplicates) were collected.

Prior to sampling, each monitoring well casing was opened and the well column was immediately screened with a PID to document the presence of any volatile organic vapors. All wells were purged and sampled following USEPA low stress ("low flow") purging and sampling procedures. All sampling was conducted using a Horiba® U-52 multi-parameter water quality meter, dedicated plastic tubing and a peristaltic pump.

Sample collection occurred after wells were purged for at least 15 minutes and field parameters stabilized (achieved when three consecutive readings were within the required parameters specified by the USEPA protocol). Each groundwater sample was collected in laboratory supplied glassware (40 ml vials, 1 liter amber jars and 250 ml plastic jars, preserved with acid as appropriate for the specific analysis). No groundwater samples were filtered prior to submission to the laboratory. After sample collection, the containers were placed in a cooler prior to laboratory pick-up. All samples were accompanied by proper chain of custody documentation.

Sample collection methodology at monitoring wells MW-4 and MW-21 was modified during the November 2013 and April 2014 sampling events (delineation of TCE contamination) in an attempt to collect groundwater from beneath the LNAPL layer. The wells were gauged prior to sampling to determine the heights of both the water column and the LNAPL layer. Based on these data points, a 1 inch diameter PVC pipe of an appropriate length, with a tethered, friction-fitted cap at the bottom, was lowered into each well and the cap was knocked loose with a stiff rod after the invert of the pipe was within the calculated water column. Although the procedure failed in November 2013 (LNAPL was drawn into the sampling tubing), samples were successfully collected for VOC analysis in April 2014. This successful procedure was repeated at LNAPL-impacted monitoring wells MW-7 and MW-22 during the October 2014 sampling event (follow-up TCE investigation).

3.4.6 Laboratory Results – Groundwater

Samples were analyzed for VOCs (USEPA Method 8260), SVOCs (USEPA Method 8270), and/or TAL metals (USEPA Methods 6010) in accordance with the Work Plan. Laboratory results for groundwater are summarized in Tables 10 to 13 and laboratory submission of samples is summarized in Table 14, Appendix B, and laboratory reports are provided in Appendix J.

3.4.6.1 Water Analysis: VOCs

Significantly elevated levels of TCE (AWQS 5 µg/L) and cis-DCE (AWQS 5 µg/L) were detected at MW-8 (peak values 33,000 µg/L and 2,700 µg/L, respectively), MW-40 (7,400 µg/L and 530 µg/L, respectively), MW-34 (peak values 3,000 µg/L and 740 µg/L, respectively), MW-39 (210 µg/L and 33 µg/L, respectively) and MW-35 (160 µg/L and 61 µg/L, respectively). Elevated levels of vinyl chloride

(AWQS 2 µg/L) were detected at MW-8 (16 µg/L), MW- 34 (12 µg/L), MW-12 (8.5 µg/L) and MW-35 (2.9 µg/L). Low-level exceedances of TCE were detected in MW-13 (15 µg/L), MW-17 (7 µg/L), MW-18 (16 µg/L), MW-38 (47 µg/L), and MW-29 (13 µg/L) and a single low-level exceedance of PCE (AWQS 5 µg/L) was detected in MW-8.

TCE and related compounds were detected at levels below AWQS at MW-4, MW-7, MW-10, MW-14, MW-17, MW-19, MW-21 and MW-23.

Several petroleum compounds were detected below AWQS in MW-3, MW-18, MW-19 and MW-29.

An elevated estimated level of acetone (AWQS 50 µg/L) was detected at MW-8 (420 µg/L) in April 2014 (this sample was noted to contain the analyte in the method blank, indicating possible cross-contamination, and acetone was non-detect in the well during the October 2014 sampling event). No other significant acetone levels were noted. Marginal exceedances of methylene chloride (AWQS 5 µg/L) were reported for multiple monitoring wells; this compound, however, is a common laboratory contaminant which was also found in the method blanks, and is not considered representative of actual site conditions.

TICs were detected in 6 of 25 groundwater samples. Total TICs were reported at spill site wells MW-10 and MW-18 at 59 and 110 µg/L, respectively, and at MW-21 and MW-22 (installed within the LNAPL plume) at 6,624 µg/L and 69 µg/L, respectively. Total TIC levels at MW-19, MW-23 and MW-35 were below 7 µg/L.

TCE and related compounds in groundwater are shown on Figure 9 and TCE isoconcentrations in groundwater are shown on Figure 10, and VOC levels in groundwater are summarized in Tables 10 and 13.

3.4.6.2 Water Analysis: SVOCs

Elevated levels of DEHP (AWQS 5 µg/L) were detected at MW-22 (1,750 µg/L), MW-29 (209 µg/L), MW-34 (59 µg/L), MW-19 (39.6 µg/L), and at MW-3, MW-17, MW-23 and MW-27 at levels below 13 µg/L. An elevated level of DOP (87.1 µg/L, AWQS 50 µg/L) was detected at MW-34 in November 2013 (DOP was detected in this well at 6.51 µg/L in August 2013). No other SVOCs were detected in any groundwater samples.

TICs were detected in 3 of 16 groundwater samples. Total TICs were reported at spill site wells MW-18 and MW-19 at 32 and 6 µg/L, respectively, and at off-site well MW-42 at 4.96 µg/L.

Levels of phthalates in groundwater are shown on Figure 11, and SVOC levels in groundwater are summarized in Tables 11 and 13.

3.4.6.3 Water Analysis: Metals

Elevated levels of several TAL metals were detected: sodium (34.9 to 311 µg/L, AWQS 20 µg/L) in all 16 samples; iron (0.899 to 9.38 µg/L, AWQS 0.3 µg/L) in 9 samples; and, magnesium (39.4 to 80.1 µg/L, AWQS 0.02 µg/L) in 5 samples. No other TAL metals were reported at levels above AWQS (antimony, arsenic, beryllium, cadmium, mercury, silver, thallium and vanadium were non-detect in all samples). Metals in groundwater are summarized in Table 12.

3.4.6.4 Quality Control Samples (Blanks)

An elevated level of DEHP (849 µg/L) was detected in the rinse blank sample collected on February 2, 2012 (no other SVOCs or TICs were identified). No VOCs or significant metal levels were detected. No SVOCs were detected in the rinse blank collected on March 16, 2012. A low level of 4-methyl-2-pentanone (2 µg/L) and multiple TICs were detected in the trip blank prepared April 3, 2014. Low levels of acetone and methylene chloride were detected in several blanks; with the exception of acetone detected at 7 µg/L in the trip blank prepared August 16, 2013, however, all results are flagged to indicate that the analyte was also detected in the laboratory batch sample, indicating contamination during analysis.

3.4.7 Nature and Extent of Contamination – Groundwater

VOCs

Groundwater sampling in 2013 and 2014 documented peak levels of TCE (33,000 µg/L) and DCE (2,700 µg/L) at MW-8, with levels decreasing by an order of magnitude at MW-40 (7,400 µg/L and 530 µg/L) and MW-34 (3,000 µg/L and 740 µg/L), and by two orders of magnitude at MW-35 and MW-39 (peak values of 210 µg/L and 61 µg/L). TCE levels in nearby cross-gradient well MW-38 is similarly low (47 µg/L). Low-grade contamination (16 µg/L or less) is documented at peripheral wells MW-12, MW-13, MW-18 and MW-29. No significant TCE contamination was found in any other wells, including MW-3, MW-10 and MW-19 located at the eastern portion of the building (older data from 2012 documented low-level exceedances at MW-17 [7 µg/L]).

The steep reduction in TCE and DCE levels in monitoring wells located at the periphery of the northeastern quadrant of the Site suggests that the source area of the contamination is limited. The consistency of data across media suggest the presence of a release of cVOCs in the immediate vicinity of MW-8 and MW-34, affecting the integrity of the soil, groundwater and soil vapor.

No significant levels of other VOCs have been detected in groundwater. Trace to low-level petroleum compounds may be related to either the adjoining spill or poor water quality generally present in the surrounding industrial area.

SVOCs

Groundwater contamination by SVOCs is limited to phthalates (DEHP and DOP). Elevated levels of DEHP were detected in 3 of 12 wells sampled in 2013 and 2014, and 7 of 10 wells sampled in 2012. An elevated level of DOP was detected in one well in 2013. The peak DEHP level was detected at MW-22, collected prior to LNAPL entering the well casing (likely due to phthalates adhering to fines suspended in the groundwater). No other SVOCs have been detected in groundwater samples (low levels of TICs were found at MW-18 and MW-19 at the spill site).

Metals

Groundwater contamination by metals is limited to iron, magnesium and sodium. These findings are likely to be associated with suspended soil particles (samples were unfiltered) and/or may represent dissolved levels found in local area groundwater. The absence of significant heavy metal contamination supports the conclusion that previous industrial activities at the Site have not significantly impacted groundwater quality in relation to inorganic compounds.

3.5 Data Generation and Validation

Complete laboratory data packages (ASP Category B Deliverables, 25 separate reports), containing all laboratory data generated during execution of the Work Plan, were provided by the laboratories. (Several of the reports include soil and groundwater quality data generated during investigation at the spill site in February and March, 2012). These data packages were provided to independent, third-party data validators as specified in the Work Plan.

All data for detected analyte levels in soil, soil vapor and groundwater samples were usable and suited for analysis (with qualifications for several analytes). Laboratory data indicating "non-detect" levels were rejected for a minimal number of samples. A summary overview of the findings, and all Data Usability Summary Reports (DUSRs) provided by the validators, are provided in Appendix I.

3.6 Qualitative Human Health Exposure Assessment

An exposure assessment was conducted to qualitatively assess the potential impacts of known environmental contaminants associated with the Site on human health, with attention to all possible exposure pathways (i.e. ingestion, inhalation and direct contact). Both current (existing conditions) and future use (proposed restricted-residential or mixed restricted-residential/commercial use) scenarios were considered. Contaminants were assessed relative to specific impacted media.

The primary contaminants of concern at the Site are phthalates (DEHP and DOP) in subsurface soils and groundwater (and as LNAPL in both media), cVOCs in soil, soil vapor and groundwater, and low-grade petroleum VOCs in soil vapor. No significant metals contamination, or other significant contamination by VOCs or SVOCs, is present at the Site. On-site workers (or trespassers) present during remediation and/or future development activities are the most likely receptor population.

The following section evaluates the elements associated with exposure pathways, and describes how each of these elements pertains to the Site. For all media, the implementation of a HASP and a CAMP will mitigate possible impacts to both on-site and off-site receptor populations. Any on-site or off-site development activities that involve disturbance, exposure or contact with contaminated soil, soil vapor or groundwater will require monitoring and mitigation plans to address potential direct contact with media, dust generation and contaminant migration.

3.6.1 Soil

Direct contact, ingestion and/or inhalation (of particulate matter) are the primary exposure pathways for contaminated subsurface soils. People can come into contact if they participate in ground-intrusive work at the Site or at off-site areas impacted by the LNAPL plume, or are exposed to dust generated during construction activities, which disturb contaminated soil. Within excavation areas, the potential for contact is generally a concern for work conducted at depths approaching the seasonally high local groundwater elevation (approximately 7 to 12 feet bsg), and for soils located several feet above the water table in areas where LNAPL is present. Outside of excavation activities, there are no likely exposures to contaminated soil, either on the Site or at off-site areas.

The potential exists for low-level contamination to remain at both on-site and off-site areas after remediation and development activities. All potential exposure pathways (direct contact, ingestion or

inhalation) will likely be mitigated as subsurface soils would have been remediated and/or access to subsurface soils would be limited by paved areas and building foundations.

3.6.2 Soil Vapor

Potential exposure pathways include vapor intrusion within the structure (IHWDS and eastern interior off-site areas) and at off-site properties, and direct contact and/or inhalation of contaminated soil vapor generated during soil excavation or remedial construction. Exposure pathways within the building are likely to be insignificant, unless the building is reoccupied prior to remediation and development. A CAMP would be implemented at the Site (and, as required, at off-site areas) to monitor air quality and minimize potential exposures to vapors for both construction works and the public.

The potential for on-site and off-site exposure to soil vapor is expected to decrease after subsurface soils and groundwater have been remediated. Post-remediation sampling results will document contaminant levels in remaining media and will determine the need for any on-site and off-site vapor intrusion studies, and the need for any on-site engineering controls or building design features (e.g., sub-slab depressurization system or a fully ventilated ground floor garage) to mitigate soil vapor intrusion.

3.6.3 Groundwater

Direct contact and/or ingestion are the primary exposure pathways for contaminated groundwater. Impacted groundwater is not being used for drinking water (or any other purposes) at the Site or at off-site areas, as the area is served by the public water supply. No known private wells exist in the vicinity of the Site. People can come into contact if they participate in ground-intrusive work at the Site or at off-site areas impacted by the LNAPL plume or other site-related contamination. The potential for contact is generally a concern for work conducted at depths approaching the seasonally high local groundwater elevation (approximately 7 to 12 feet bsg), and for soils located several feet above the water table in areas where LNAPL is present. Levels of dissolved contaminants in groundwater downgradient of the Site are anticipated to diminish as a result of Site remediation.

4.0 FINDINGS AND CONCLUSIONS

This office has completed the environmental investigative services summarized in Section 3.0 for the Former NuHart Plastic Manufacturing Site, located at 280 Franklin Street, Brooklyn, New York. The investigative work was performed to document the extent of known contamination resulting from former manufacturing and industrial uses of the property, in accordance with a NYSDEC approved Work Plan, and to provide guidance on response actions warranted to address identified environmental conditions.

4.1 Findings

Phase I and Phase II environmental site assessment investigations of the NuHart facility, issued prior to inclusion in the IHWDS program, indicate that the Site has a long history of industrial use, including production of plastic and vinyl products. Underground storage tanks (USTs) formerly containing plasticizers, lubricating oil, chemicals and fuel oil were closed-in-place in 2006. Subsequent soil and groundwater investigations identified petroleum contamination in the vicinity of former fuel oil tanks at the northeastern portion of the building (NYSDEC spill site) and phthalate impacts at the western portion of the building (IHWD Site).

Phthalates were observed as LNAPL in groundwater wells, and elevated levels of phthalates were detected in soil and groundwater samples. Phthalates were generally detected in deep soil near the groundwater interface. No significant levels (above RRUSCOs) of other SVOCs, VOCs, metals, PCBs or pesticides were detected in soil samples.

LNAPL was identified as mixed phthalates at the central-eastern portion of the Site (MW-4), phthalates and paraffinic petroleum-based oil at the western portion (RW-12), and phthalates (DEHP) at an off-site monitoring well on Dupont Street (MW-20). Well gauging data (conducted monthly at both on-site and off-site wells) document a LNAPL plume extending beneath the western and central portions of the Site and beneath off-site sidewalk areas located along Dupont, Franklin and Clay Streets.

Elevated levels of phthalates and TCE, and low-level exceedances of petroleum-related VOCs, were detected in groundwater monitoring wells. Significant TCE contamination is restricted to the northeastern corner of the Site (MW-34 and MW-35) and immediately adjoining off-site areas to the north (MW-8) and east (MW-40). Elevated levels of TCE in soil vapor, and TCE at concentrations above UUSCOs (but below RRUSCOs) in soil, are generally collocated with impacted groundwater, suggesting the presence of a limited solvent “hot spot” in soil and/or groundwater.

With the exception of phthalates associated with LNAPL impacts, contamination by organic and inorganic compounds has not significantly impacted soils beneath off-site sidewalks to the north and south, or at downgradient areas to the west.

Environmental investigations conducted by ESI under the Work Plan document the following areas of concern:

1: NAPL in Soil and Groundwater

Phthalates and a mixture of phthalates/mineral oil are present as a LNAPL plume underlying the majority of the IHWDS and extending off-site to the southwest. The lateral extent of off-site contamination is defined by an absence of LNAPL at wells installed within and along the perimeter of the adjoining Greenpoint Playground to the west and at additional locations along Commercial, Franklin and Dupont Streets. Soil contamination above RRUSCOs is restricted to elevated levels of phthalates (DEHP and DOP), encountered in soil located at and near the groundwater interface, in an area delimited by known LNAPL contamination.

2: Dissolved Organic Compounds in Groundwater

Groundwater sampled in monitoring wells near the LNAPL plume is correspondingly contaminated by phthalates, possibly by suspended particles in the water column. Groundwater at the northeastern portion of the Site (MW-34) and at immediately adjoining off-site areas to the north (MW-8) and east (MW-40) contains significant cVOC contamination. Groundwater at nearby cross-gradient and/or downgradient wells (MW-35 and MW-39) are similarly contaminated, but analytes are present at significantly lower levels (by one or two orders of magnitude). An absence of significant cVOC levels at MW-4, MW-7 and MW-21 (wells immediately downgradient of the wells demonstrating the greatest impacts), and in MW-3, MW-10 and MW-19 (located in the eastern portion of the building), support the conclusion that TCE contamination is limited. Low-grade contamination (16 µg/L or less) is documented at peripheral wells MW-12, MW-13, MW-17, MW-18, MW-29 and MW-32. Petroleum-related VOCs have been detected at levels marginally above AWQS.

3: Soil Contamination (TCE)

TCE is present in soil above UUSCOs (but below RRUSCOs) in the vicinity of elevated levels in soil vapor and groundwater at the northeastern quadrant of the Site and in adjoining off-site areas, suggesting the presence of a limited TCE source area in soil.

4: Soil Vapor Contamination

Elevated levels of TCE and related cVOCs were detected in soil vapor collected at the northeastern and eastern-central portions of the Site, in the vicinity of TCE impacted soil and groundwater, and at nearby off-site locations to the east (within the building) and to the north on Clay Street (northward migration of soil vapor may be impacting commercial buildings in this area). Limited sampling data indicate that impacted vapor is not present at the southwestern corner of the Site, or at the far northeastern corner of the building near adjoining eastern residential properties.

5: Petroleum Contamination

Petroleum compounds released at the adjoining spill site to the east have not significantly impacted Site soils.

4.2 Conclusions

Site investigative work has been completed on IHWD Site #224136, including substantial work demonstrating the extent of contamination both on and off the Site. Soil, soil vapor, and groundwater investigations have been completed, with supplemental work completed in product identification and groundwater flow.

Based on this work, the following general conclusions are reached:

- Sufficient investigative work has been completed on the spatial dimensions of soil and groundwater (including free-product) contamination associated with phthalates and TCE. Additional work is warranted to identify and evaluate remedial options both on and off the Site and to remediate on-site soils that are considered source areas.
- Sufficient investigative work has been completed with respect to known petroleum contamination in soil, as well as the limited area of free-product petroleum. Additional work is warranted to identify and evaluate remedial options to address these known conditions
- Limited investigative work has been completed with respect to soil vapor concerns on and off the Site. An area of elevated cVOCs is present, in the general location of impacted soil and groundwater. Response actions to address cVOCs in other media (soil and groundwater) are expected to substantially reduce soil vapor levels. Additional documentation of soil vapor conditions, both on- and off-site, is warranted following construction to document the effectiveness of the remedial action.
- Sufficient investigative work has been completed with respect to metals, PCBs and pesticides in on-site soils and groundwater. None of these compounds were determined to be constituents of concern at this Site.