

MEEKERMAN
BROOKLYN, NEW YORK

Remedial Action Work Plan

NYC VCP Number: 15CVCP083K
NYC OER Project Number 14EHAZ261K

Prepared for:
Meekerman LLC
316 Douglass Street
Brooklyn, NY 11217

Prepared by:
Korlipara Engineering
150 Broadhollow Road, STE. PH7
Melville, NY 11747

and

CA RICH Consultants, Inc
17 Dupont Street
Plainview, NY 11803
(516) 576-8844

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REMEDIAL ACTION WORK PLAN

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LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
C/D	Construction/Demolition
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering and Institutional Controls
HASP	Health and Safety Plan
IRM	Interim Remedial Measure
VCA	Voluntary Cleanup Agreement
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYC VCP	New York City Voluntary Cleanup Program
NYC DEP	New York City Department of Environmental Protection
NYC DOHMH	New York State Department of Health and Mental Hygiene
NYCRR	New York Codes Rules and Regulations
NYC OER	New York City Office of Environmental Remediation
NYS DEC	New York State Department of Environmental Conservation
NYS DEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation
NYS DOH	New York State Department of Health
NYS DOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety

	Administration
PE	Professional Engineer
PID	Photo Ionization Detector
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan or Plan
RCA	Recycled Concrete Aggregate
RD	Remedial Design
RI	Remedial Investigation
RMZ	Residual Management Zone
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SVOC	Semi-Volatile Organic Compound
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

CERTIFICATION

I, Ravi Korlipara, P.E., am a Professional Engineer licensed in the State of New York. I have primary direct responsibility for implementation of the remedial action for the Meekerman Site; 15CVCP083K.

I, Victoria Whelan, CPG, QEP am a Qualified Environmental Professional as defined in §43-140. I have primary direct responsibility for implementation of the remedial action for the Meekerman Site; 15CVCP083K.

I certify that this Remedial Action Work Plan (RAWP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil, fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This RAWP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

Ravi Korlipara, P.E.

Name

070038

NYS PE License Number

Signature

Date

Ravi Korlipara
4/23/15



Victoria Whelan, CPG, QEP

QEP Name

QEP Signature

Date

Victoria Whelan
4/27/15



EXECUTIVE SUMMARY

Meekerman LLC has applied to enroll in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate an approximately 12,600-square foot site located at 406-408 Manhattan Avenue and 402 Meeker Avenue in Williamsburg Brooklyn, New York. A Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP). The remedial action described in this document provides for the protection of public health and the environment consistent with the intended property use, complies with applicable environmental standards, criteria and guidance and conforms with applicable laws and regulations.

Site Location and Current Usage

The Site is located at 406-408 Manhattan Avenue and 402 Meeker Avenue in the Williamsburg section of Brooklyn, New York, and is identified as Block 2734 and Lots 4, 5 and 7 on the New York City Tax Map.

The Site is approximately 12,600-square feet. Tax Lots 4 and 5 are currently developed with a recently vacated one-story masonry warehouse previously operating as a quilting and sewing factory, (Supreme Quilting). Tax Lot 7 houses a single-story recently-vacated masonry commercial building with a small outdoor parking area which was most recently occupied by a soda and beer distributor (Beverage World).

Surrounding properties include: Richardson Street and the Brooklyn Queens Expressway (a major thoroughfare) to the north, Block 2734 Lot 3, a multi-story residential building, to the south; Block 2734 Lots 35 and 38, a single-story industrial/manufacturing building and a vacant lot, respectively, to the east; and Manhattan Avenue and Block 2733 Lots 25 and 26, vacant land and a multi-story residential building to the west. A map of the Site is shown in Figure 1 and surrounding property usage is shown on Figure 2.

Summary of Proposed Redevelopment Plan

The proposed future use of the Site will consist of redeveloping the Site with a new slab-on-grade seven-story residential building. The ground floor of the building will be utilized for the residential lobby as well as a recreation room, offices, laundry, utilities, trash room, community room and residential apartments. The new development will also feature a landscaped rear yard with active and passive recreation space. The slab-on-grade construction will require excavation to a depth of roughly three feet below grade in the area of the building foundation. The rear yard excavation is anticipated at a depth of between two and three feet for grading purposes. Layout of the proposed Site development is presented in Figure 3. The current zoning designation is M1-2/R6 residential.

Summary of Environmental Findings

1. Elevation of the property is approximately 20-21 feet.
2. Depth to groundwater ranges from 5.38 feet to 6.1 feet at the Site.
3. Groundwater flow is generally from southeast to northwest beneath the Site.
4. Depth to bedrock at the Site is greater than 100 feet.
5. The stratigraphy of the Site, from the surface down, consists of three feet of historic fill underlain by native silty sands.
6. Soil/fill samples results were compared to New York State Department of Environmental Conservation (NYSDEC) Unrestricted Use Soil Cleanup Objectives and Restricted Residential Use Soil Cleanup Objectives (SCOs) as presented in 6NYCRR Part 375-6.8. Soil/fill samples collected at locations shown in Figure 4 during the RI showed no VOCs, pesticides or PCBs detected above Track 1 Unrestricted Use SCOs. Six SVOCs including benz(a)anthracene (maximum of 20,000 parts per billion (ppb)), benzo(a)pyrene (max of 17,000 ppb), benzo(b)fluoranthene (max. of 24,000 ppb), benzo(k)fluoranthene (max. of 5,700 ppb) chrysene (max. Of 21,000 ppb)dibenzo(a,h)anthracene (max. of 1,300 ppb) and indeno(1,2,3-cd)pyrene (3,800 ppb) were detected above their respective Track 2 Restricted Residential Use SCOs in both samples obtained from boring location B1(Figure 5). Subsets of the above parameters also exceeded the Track 2 Restricted

Residential Use SCOs at concentrations below the above stated maximums at boring locations B3, B4, and both depths at B6 (Figure 5). Eight metals including arsenic (max. of 165 ppm), barium (max. of 747 ppm), cadmium (only one detection of 5.43 ppm), copper (only one detection of 589 ppm), lead (max. of 2,210 ppm), mercury (max. of 10.1 ppm), nickel (max. of 31.8 ppm), and zinc (max. of 687 ppm) exceeded Unrestricted Use SCOs in one shallow and two deep soil samples. Of these metals, some or all of the metals arsenic, barium, cadmium, copper, lead, and mercury also exceeded Track 2 Restricted Residential Use SCOs in one or more soil borings (Figure 5). Overall, the findings were consistent with observations for historical fill sites in areas throughout NYC.

7. Groundwater sample results for samples collected during the RI (Figure 6) were compared to the New York State Technical and Operational Guidance Series 1.1.1 (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, June 1998 and Updates, including the New York State 6NYCRR Part 703.5 Class GA groundwater quality standards (GQS). Groundwater samples collected during the RI showed no VOCs, pesticides or PCBs detected above their GQSs. Five SVOCs including benzo(a)anthracene (max. of 0.63 ppb), benzo(b)fluoranthene (max. of 0.91 ppb), benzo(k)fluoranthene (max. of 0.29 ppb), chrysene (max. of 0.73 ppb), and indeno(1,2,3-cd)pyrene (max. of 0.26 ppb) were detected above their respective TOGS Guidance Values of 0.002 ppb in all four samples. Several metals were detected, but subsets of only iron (max. of 0.63 ppm), manganese (max. of 1.18 ppm), and sodium (max. of 268 ppm) exceeded their GQSs in one or more of the four groundwater samples (Figure 6).
8. Soil vapor samples collected during the 2008 Phase II were compared to the compounds listed by the NYSDOH located in the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion dated October 2006. Soil vapor samples collected during the RI show low levels of petroleum compounds and chlorinated VOCs. Concentrations of petroleum-related VOCs (BTEX) ranged from 32.46 $\mu\text{g}/\text{m}^3$ to 115.78 $\mu\text{g}/\text{m}^3$. Overall, the highest reported concentration was for acetone (144 $\mu\text{g}/\text{m}^3$). Tetrachloroethene (PCE) was detected in both of the soil vapor samples at

maximum concentration of 2.58 $\mu\text{g}/\text{m}^3$. Trichloroethene (TCE), carbon tetrachloride, and 1,1,1 trichloroethane (TCA) were not detected in any of the soil vapor samples. PCE was detected in soil vapor at concentrations well below the monitoring level ranges established within the New York State Department of Health (NYSDOH) Final Guidance on Soil Vapor Intrusion (October 2006).

Summary of the Remedy

The proposed Remedial Action achieves protection of public health and the environment for the intended use of the Property. The proposed Remedial Action achieves all of the remedial action objectives established for the project and addresses applicable standards, criterion, and guidance, is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants, is cost effective and implementable and uses standard methods that are well established in the industry.

The proposed Remedial Action will consist of:

1. Preparation of a Community Protection Statement and implementation of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
3. Establishment of Site Specific (Track 4) Soil Cleanup Objectives (SCOs).
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Excavation and removal of soil/fill exceeding Site specific Track 4 SCOs. The footprint of the new building will be excavated to a depth of approximately 3 feet below grade, and the rear yard will be excavated to approximately 2-3 feet below grade for development purposes. Additionally, the hotspot area identified at B-1/EP-1 will be excavated to remove soil/fill with metal concentrations above Track 4 Site-specific

SCOs or to groundwater whichever is shallower. Approximately, 2,000-2,500 tons of soils will be removed from this development project.

6. Three in-situ endpoint samples will be collected during waste classification testing for comparison to the Site Specific Track 4 SCOs. An in-situ endpoint sample will also be collected in the area of B-1/EP-1 at the anticipated excavation completion depth. Based on the laboratory analysis, if the sample does not meet SCOs, a two foot by two foot excavation will extend to groundwater and no further sampling in the area will be conducted.
7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-site.
8. Removal of underground storage tanks, if any, and closure of petroleum spills, if applicable, in compliance with applicable local, State and Federal laws and regulations.
9. Transportation and off-site disposal of all soil/fill material at permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this Plan. Sampling and analysis of excavated media will be performed as required by disposal facilities. Appropriate segregation of excavated media onsite.
10. Collection and analysis of in-situ confirmatory end-point samples to determine the performance of the remedy with respect to attainment of SCOs.
11. Demarcation of residual soil/fill in landscaped areas.
12. Import of materials to be used for backfill and cover in compliance with this Plan and in accordance with applicable laws and regulations.
13. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
14. Performance of all activities required for the Remedial Action, including permitting requirements and pretreatment requirements, in compliance with applicable laws and regulations.

15. Submission of a Remedial Action Report (RAR) that describes the remedial activities and certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this RAWP, and describes all Engineering and Institutional Controls to be implemented at the Site.
16. Installation of a vapor barrier system beneath the building slab and outside foundation sidewalls below grade. A Raven Industries' VaporBlock® Plus™ 20-mil vapor barrier will be installed in accordance with the manufacturer's installation procedures.
17. Construction and maintenance of an engineered composite cover consisting of concrete building slab, concrete pavers, poured rubber safety surface, and/or open space cover of two foot thick clean fill to prevent human exposure to residual soil/fill remaining under the Site.
18. Submission of an approved Site Management Plan (SMP) in the RAR for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
19. The property will continue to be registered with an E-Designation by the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER approval.

COMMUNITY PROTECTION STATEMENT

The Office of Environmental Remediation created the New York City Voluntary Cleanup Program (NYC VCP) to provide governmental oversight for the cleanup of contaminated property in NYC. This Remedial Action Work Plan (“cleanup plan”) describes the findings of prior environmental studies that show the location of contamination at the Site, and describes the plans to clean up the Site to protect public health and the environment.

This cleanup plan provides a very high level of protection for neighboring communities, and also includes many other elements that address common community concerns, such as community air monitoring, odor, dust and noise controls, hours of operation, good housekeeping and cleanliness, truck management and routing, and opportunities for community participation. The purpose of this Community Protection Statement is to explain these community protection measures in non-technical language to simplify community review.

Remedial Investigation and Cleanup Plan. Under the NYC VCP, a thorough cleanup study of this Property (called a remedial investigation) has been performed to identify past property usage, to sample and test soils, groundwater and soil vapor, and identify contaminant sources present on the Property. The cleanup plan has been designed to address all contaminant sources that have been identified during the study of this Property.

Identification of Sensitive Land Uses. Prior to selecting a cleanup, the neighborhood was evaluated to identify sensitive land uses nearby, such as schools, day care facilities, hospitals and residential areas. The cleanup program was then tailored to address the special conditions of this community.

Qualitative Human Health Exposure Assessment. An important part of the cleanup planning for the Site is the performance of a study to find all of the ways that people might come in contact with contaminants at the Site now or in the future. This study is called a Qualitative Human Health Exposure Assessment (QHHEA). A QHHEA was performed for this project. This Assessment has considered all known contamination at the Site and evaluated the potential for people to come in contact with this contamination. All identified public exposures will be addressed under this cleanup plan.

Health and Safety Plan. This cleanup plan includes a Construction Health and Safety Plan (CHASP) that is designed to protect community residents and on-site workers. The elements of this plan are in compliance with safety requirements of the United States Occupational Safety and Health Administration (OSHA). This plan includes many protective elements including those discussed below.

Site Safety Coordinator. This project has a designated Site safety coordinator to implement the Health and Safety Plan. The safety coordinator maintains an emergency contact sheet and protocol for management of emergencies. The Site safety coordinator is William Fitchett and can be reached at (516) 576-8844.

Community Air Monitoring Plan. Community air monitoring will be performed during this cleanup project to ensure that the community is properly protected from contaminants, dust and odors. Air samples will be tested in accordance with a detailed plan called the Community Air Monitoring Plan or CAMP. Results will be regularly reported to the NYC Office of Environmental Remediation. This cleanup plan also has a plan to address any unforeseen problems that might occur during the cleanup (called a ‘Contingency Plan’).

Odor, Dust and Noise Control. This cleanup plan includes actions for odor and dust control. These actions are designed to prevent off-site odor and dust nuisances and include steps to be taken if nuisances are detected. Generally, dust is managed by application of physical covers and by water sprays. Odors are controlled by limiting the area of open excavations, physical covers, spray foams and by a series of other actions (called operational measures). The project is also required to comply with NYC noise control standards. If you observe problems in these areas, please contact the Project Manager, Victoria Whelan at (516) 576-8844 or NYC Office of Environmental Remediation Project Manager, Horace Zhang at (212) 788-8484.

Quality Assurance. This cleanup plan requires that evidence be provided to illustrate that all cleanup work required under the plan has been completed properly. This evidence will be summarized in the final report, called the Remedial Action Report. This Report will be submitted to the NYC Office of Environmental Remediation and will be thoroughly reviewed.

Storm-Water Management. To limit the potential for soil erosion and discharge, this cleanup plan has provisions for storm-water management. The main elements of the storm water management include physical barriers such as tarp covers and erosion fencing, and a program for frequent inspection.

Hours of Operation. The hours for operation of cleanup will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. For this cleanup project, the hours of operation will be in accordance with the New York City Department of Buildings construction code requirements.

Signage. While the cleanup is in progress, a placard will be prominently posted at the main entrance of the Property with a laminated project Fact Sheet that states that the project is in the NYC Voluntary Cleanup Program, provides project contact names and numbers, and locations of project documents can be viewed.

Complaint Management. The contractor performing this cleanup is required to address all complaints. If you have any complaints, you can call the facility Project Manager Mark Zimet at (718) 388-9407, the NYC Office of Environmental Remediation Project Manager Horace Zhang at (212) 788-8484, or call 311 and mention the Site is in the NYC Voluntary Cleanup Program.

Utility Mark-outs. To promote safety during excavation in this cleanup, the contractor is required to first identify all utilities and must perform all excavation and construction work in compliance with NYC Department of Buildings regulations.

Soil and Liquid Disposal. All soil and liquid material removed from the Site as part of the cleanup will be transported and disposed of in accordance with all applicable City, State and Federal regulations, and all required permits will be obtained.

Soil Chemical Testing and Screening. All excavations will be supervised by a trained and properly qualified environmental professional. In addition to extensive sampling and chemical testing of soils on the Site, excavated soil will be screened continuously using hand-held instruments, by sight, and by smell to ensure proper material handling and management, and community protection.

Stockpile Management. Soil stockpiles will be kept covered with tarps to prevent dust, odors and erosion. Stockpiles will be frequently inspected. Damaged tarp covers will be promptly replaced. Stockpiles will be protected with silt fences, as necessary. Hay bales will be used, as needed to protect storm water catch basins and other discharge points.

Trucks and Covers. Loaded trucks leaving the Site will be covered in compliance with applicable laws and regulations to prevent dust and odor. Trucks will be properly recorded in logs and records and placarded in compliance with applicable City, State and Federal laws, including those of the New York State Department of Transportation. If loads contain wet material that can leak, truck liners will be used. All transport of materials will be performed by licensed truckers and in compliance with all laws and regulations.

Imported Material. All fill materials proposed to be brought onto the Site will comply with rules outlined in this cleanup plan and will be inspected and approved by a qualified worker located on-site. Waste materials will not be brought onto the Site. Trucks entering the Site with imported clean materials will be covered in compliance with applicable laws and regulations.

Equipment Decontamination. All equipment used for cleanup work will be inspected and washed, if needed, before it leaves the Site. Trucks will be cleaned as needed at a truck inspection station on the Property before leaving the Site.

Housekeeping. Locations where trucks enter or leave the Site will be inspected every day and cleaned regularly to ensure that they are free of dirt and other materials from the Site.

Truck Routing. Truck routes have been selected to: (a) limit transport through residential areas and past sensitive nearby properties; (b) maximize use of city-mapped truck routes; (c) limit total distance to major highways; (d) promote safety in entry to highways; (e) promote overall safety in trucking; and (f) minimize off-site line-ups (queuing) of trucks entering the Property. Operators of loaded trucks leaving the Site will be instructed not to stop or idle in the local neighborhood.

Final Report. The results of all cleanup work will be fully documented in a final report (called a Remedial Action Report) that will be available for review in the public document repositories located at Brooklyn Public Library Leonard Branch.

Long-Term Site Management. To provide long-term protection after the cleanup is complete, the Property Owner will be required to comply with an ongoing Site Management Plan that calls for continued inspection of protective controls, such as Site covers. The Site Management Plan will be evaluated and approved by the NYC Office of Environmental Remediation. Requirements that the property owner must comply with are established through a City environmental designation. A certification of continued protectiveness of the cleanup will be required from time to time to show that the approved cleanup is still effective.

REMEDIAL ACTION WORK PLAN

1.0 SITE BACKGROUND

Meekerman LLC has applied to enroll in the New York City Voluntary Cleanup Program (NYC VCP) to investigate and remediate a property located at 406-408 Manhattan Avenue and 402 Meeker Avenue in the Williamsburg section of Brooklyn, New York (the “Site”). A Remedial Investigation (RI) was performed to compile and evaluate data and information necessary to develop this Remedial Action Work Plan (RAWP) in a manner that will render the Site protective of public health and the environment consistent with the contemplated end use. This RAWP establishes remedial action objectives, provides a remedial alternatives analysis that includes consideration of a permanent cleanup, and provides a description of the selected remedial action. The remedial action described in this document provides for the protection of public health and the environment, complies with applicable environmental standards, criteria and guidance and applicable laws and regulations.

1.1 SITE LOCATION AND CURRENT USAGE

The Site is located at 406-408 Manhattan Avenue and 402 Meeker Avenue in the Greenpoint section of Brooklyn, New York, and is identified as Block 2734 and Lots 4, 5 and 7 on the New York City Tax Map.

The Site is 12,588 -square feet. Tax Lots 4 and 5 are currently developed with a one-story masonry warehouse which was previously operating as a quilting and sewing factory, (Supreme Quilting). Tax Lot 7 houses a single-story masonry commercial building with a small outdoor parking area which most recently was occupied by a soda and beer distributor (Beverage World).

Surrounding properties include: Richardson Street and the Brooklyn Queens expressway (a major thoroughfare) to the north, Block 2734 Lot 3, a multi-story residential building, to the south; Block 2734 Lots 35 and 38, a single-story industrial/manufacturing building and a vacant lot, respectively, to the east; and Manhattan Avenue and Block 2733 Lots 25 and 26, vacant land

and a multi-story residential building to the west. A map of the Site is shown in Figure 1 and the surrounding property usage is shown on Figure 2.

1.2 PROPOSED REDEVELOPMENT PLAN

The proposed future use of the Site will consist of redeveloping the Site with a new slab-on-grade seven-story residential building. The ground floor of the building will be utilized for the residential lobby as well as a recreation room, offices, laundry, utilities, trash room, community room and residential apartments. The new development will also feature a landscaped rear yard with active and passive recreation space. The slab-on-grade construction will require excavation to a depth of roughly three feet below grade in the area of the building foundation. The rear yard excavation is anticipated at a depth of between two and three feet for grading purposes. Layout of the proposed Site development is presented in Figure 3. The current zoning designation is M1-2/R6 residential.

1.3 DESCRIPTION OF SURROUNDING PROPERTY

The area surrounding the Site consists of a mix of residential and manufacturing/industrial properties. The surrounding land usage of the adjacent properties are listed below as well as additional properties located up to 500 feet away from the Site. No hospitals, daycare facilities or schools are located within a 250 ft radius of the Site.

North – Richardson Street and the Brooklyn Queens Expressway (a major thoroughfare)

South – Block 2734, Lot 3 (404 Manhattan Avenue) – Developed with a multi-story residential building.

East – Block 2734, Lots 35 and 38 (137 Frost Street) - Developed with a single-story industrial/manufacturing building and a vacant lot, respectively.

West – Block 2733, Lots 25 and 26 (397 Manhattan Avenue) – Developed with a multistory residential building (Lot 26) and associated uncapped parking area (Lot 25). Figure 2 shows the surrounding land usage.

1.4 REMEDIAL INVESTIGATION

A remedial Investigation was performed and the results are documented in a companion document called “*Remedial Investigation Report, 406-408 Manhattan Avenue*”, dated February 2014 (RIR) and a Phase II Investigation report called “*402 Meeker Avenue, Phase II Subsurface Investigation*”, dated February 2014.

406-408 Manhattan Avenue

Summary of Past Uses of Site and Areas of Concern

A Phase I was completed by EBC in November 2013. According to a review of Sanborn maps and City Directory Listings, EBC was able to establish a history for the Property dating back to 1887. In 1887, the Site was developed with a small stable. From 1905 to 1916, the Site was developed with multiple stables and a two-story dwelling that eventually changed to a club house.

By 1940, a portion of the Site (406 Manhattan Avenue) was redeveloped with a one-story building and operated by Bakst Isaac Pickles, a pickle works. Sometime between 1940 and 1945 a quilting company took over the Site and developed one large one-story factory. The same company ("Supreme Quilting Co." and "Able Quilting & Novelty Co.") and building have occupied the Site since then.

The AOCs identified for this Site include:

1. Historic fill layer is present at the Site from grade to depths as great as three-feet below grade.

Summary of the Work Performed under the Remedial Investigation

The following scope of work was performed:

1. Conducted a Site inspection to identify AOCs and physical obstructions (i.e. structures, buildings, etc.);
2. Installed three soil borings across the entire project Site, and collected six soil samples and one duplicate soil sample for chemical analysis from the soil borings to evaluate soil quality;

3. Installed three groundwater monitoring wells throughout the Site to establish groundwater flow and collected three groundwater samples and one duplicate groundwater sample for chemical analysis to evaluate groundwater quality; and
4. Installed two soil vapor probes across the Site and collected two samples for chemical analysis.

Summary of Environmental Findings

1. Elevation of the property is approximately 20-21 feet.
2. Depth to groundwater ranges from 5.38 feet to 6.1 feet at the Site.
3. Groundwater flow is generally from southeast to northwest beneath the Site.
4. Depth to bedrock at the Site is greater than 100 feet.
5. The stratigraphy of the Site, from the surface down, consists of three feet of historic fill underlain by native silty sands.
6. Soil/fill samples results were compared to New York State Department of Environmental Conservation (NYSDEC) Unrestricted Use Soil Cleanup Objectives and Restricted Residential Use Soil Cleanup Objectives (SCOs) as presented in 6NYCRR Part 375-6.8. Soil/fill samples collected at locations shown in Figure 4 during the RI showed no VOCs, pesticides or PCBs detected above Track 1 Unrestricted Use SCOs. Six SVOCs including benz(a)anthracene (maximum of 20,000 parts per billion (ppb)), benzo(a)pyrene (max of 17,000 ppb), benzo(b)fluoranthene (max. of 24,000 ppb), benzo(k)fluoranthene (max. of 5,700 ppb) chrysene (max. Of 21,000 ppb)dibenzo(a,h)anthracene (max. of 1,300 ppb) and indeno(1,2,3-cd)pyrene (3,800 ppb) were detected above their respective Track 2 Restricted Residential Use SCOs in both samples obtained from boring location B1(Figure 5). Subsets of the above parameters also exceeded the Track 2 Restricted Residential Use SCOs at concentrations below the above stated maximums at boring locations B3, B4, and both depths at B6 (Figure 5). Eight metals including arsenic (max. of 165 ppm), barium (max. of 747 ppm), cadmium (only one detection of 5.43 ppm), copper (only one detection of 589 ppm), lead (max. of 2,210 ppm), mercury (max. of 10.1 ppm), nickel (max. of 31.8 ppm), and zinc (max. of 687 ppm) exceeded

Unrestricted Use SCOs in one shallow and two deep soil samples. Of these metals, some or all of the metals arsenic, barium, cadmium, copper, lead, and mercury also exceeded Track 2 Restricted Residential Use SCOs in one or more soil borings (Figure 5). Overall, the findings were consistent with observations for historical fill sites in areas throughout NYC.

7. Groundwater sample results for samples collected during the RI (Figure 6) were compared to the New York State Technical and Operational Guidance Series 1.1.1 (TOGS 1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations, June 1998 and Updates, including the New York State 6NYCRR Part 703.5 Class GA groundwater quality standards (GQS). Groundwater samples collected during the RI showed no VOCs, pesticides or PCBs detected above their GQSs. Five SVOCs including benzo(a)anthracene (max. of 0.63 ppb), benzo(b)fluoranthene (max. of 0.91 ppb), benzo(k)fluoranthene (max. of 0.29 ppb), chrysene (max. of 0.73 ppb), and indeno(1,2,3-cd)pyrene (max. of 0.26 ppb) were detected above their respective TOGS Guidance Values of 0.002 ppb in all four samples. Several metals were detected, but subsets of only iron (max. of 0.63 ppm), manganese (max. of 1.18 ppm), and sodium (max. of 268 ppm) exceeded their GQSs in one or more of the four groundwater samples (Figure 6).
8. Soil vapor samples collected during the 2008 Phase II were compared to the compounds listed by the NYSDOH located in the New York State Department of Health (NYSDOH) Final Guidance for Evaluating Soil Vapor Intrusion dated October 2006. Soil vapor samples collected during the RI show low levels of petroleum compounds and chlorinated VOCs. Concentrations of petroleum-related VOCs (BTEX) ranged from 32.46 $\mu\text{g}/\text{m}^3$ to 115.78 $\mu\text{g}/\text{m}^3$. Overall, the highest reported concentration was for acetone (144 $\mu\text{g}/\text{m}^3$). Tetrachloroethene (PCE) was detected in both of the soil vapor samples at maximum concentration of 2.58 $\mu\text{g}/\text{m}^3$. Trichloroethene (TCE), carbon tetrachloride, and 1,1,1 trichloroethane (TCA) were not detected in any of the soil vapor samples. PCE was detected in soil vapor at concentrations well below the monitoring level ranges established within the New York State Department of Health (NYSDOH) Final Guidance on Soil Vapor Intrusion (October 2006).

Summary of Past Usage

406-408 Meeker Avenue

According to a review of Sanborn maps and City Directory Listings, EBC was able to establish a history for the property dating back to 1887. In 1887, the Site was developed with a small stable. From 1905 to 1916, the Site was developed with multiple stables and a 2-story dwelling that eventually changed to a club house. By 1940, a portion of the Site (406 Manhattan Avenue) was redeveloped with a 1-story building and operated by Bakst Isaac Pickles, a pickle works. Sometime between 1940 and 1945 a quilting company took over the Site and developed one large 1-story factory. The same company ("Supreme Quilting CO." and "Able Quilting & Novelty Co.") and building have occupied the Site since then.

402 Meeker Avenue

According to the Phase II Investigation, EBC was able to establish a history for the Site dating back to 1887 based upon Sanborn Fire Insurance Maps. In 1887 the Lot was vacant with the Manhattan Beach Railroad tracks occupying the southern portion of the Site. In 1916 the Lot remains vacant; however, the railroad tracks have been removed.

From 1942 through 1965 the Lot was occupied by a used auto sales and service company. At some point between 1965 and 1978 the used auto sale and service facility was replaced with a commercial tenant and remained that way to date. Currently, the Lot is occupied by a soda and beer distributor (Beverage World).

Summary of Work Performed

According to the Phase II Investigation and Remedial Investigation Report completed by Environmental Business Consultants, Three borings (B1 through B3) were performed within the existing building, and one (B4) was performed within the parking area. Each location within the existing building was completed utilizing an AMS dual purpose soil recovery probe with disposable plastic liners. At each soil sampling location, the probe was driven to a maximum depth of four-- feet below grade utilizing a slap hammer. Soil recovered from each boring within the plastic liner was characterized by an experienced environmental technician and field screened for the presence of volatile organic compounds (VOCs) using a photo-ionization detector (PID)

and visually inspected for evidence of contamination. Two soil samples were retained from each soil boring location representing the intervals 0 to 2 feet and 2 to 4 feet below grade.

Boring B4 soil was collected continuously from grade to a final depth of 10 feet below existing grade using a five foot steel macro-core sampler with acetate liners and Geoprobe direct-push equipment. Soil recovered from each of the soil borings was field screened for the presence of VOCs with a PID and visually inspected for evidence of contamination. Two soil samples were retained from the boring representing the intervals 0 to 2 feet and 6 to 8 feet below grade. One temporary one-inch diameter PVC monitoring well with five feet of 0.010 slot screen was installed at this location, within the outdoor parking area, set to intersect the water table. Groundwater was encountered at approximately six feet below grade; therefore the monitoring well was installed to a depth of 10 feet. One groundwater sample was collected.

A total of three soil vapor sampling points were installed across the site, as shown on Figure 4. Two soil vapor points (SG1 and SG2) were installed within the existing building and one soil vapor implant (SG3) was installed within the outdoor parking area.

Summary of Environmental Findings

Subsurface soil at the Site consisted of urban/historic fill, which was primarily comprised of brick, concrete, wood and other debris in a brown sandy matrix, to a depth of approximately three-five feet below grade, underlain by brown silty sands to the termination depth of 10 feet below grade. SVOCs, pesticides and metals detected in shallow soil are consistent with observations for historic fill sites in areas throughout NYC. Groundwater results indicated no VOCs, pesticides, or PCBs are present within the groundwater beneath the Site. The low concentrations of SVOCs and metals detected are typical of background levels in the area.

For more detailed results, consult the RIR and the Phase II Subsurface Investigation. Based on an evaluation of the data and information from the RIR, Phase II Subsurface Investigation, and this RAWP, disposal of significant amounts of hazardous waste is not suspected at this Site.

2.0 REMEDIAL ACTION OBJECTIVES

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

Groundwater

- Prevent direct exposure to contaminated groundwater.
- Prevent exposure to contaminants volatilizing from contaminated groundwater.

Soil

- Prevent direct contact with contaminated soil.
- Prevent exposure to contaminants volatilizing from contaminated soil.

Soil Vapor

- Prevent exposure to contaminants in soil vapor.
- Prevent migration of soil vapor into dwelling and other occupied structures.

Remedial and mitigation measures described herein will be performed in accordance with applicable laws and regulations, and the site-specific CHASP (Appendix C). This remedy is protective of public health and/or the environment for the intended use.

3.0 REMEDIAL ALTERNATIVES ANALYSIS

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment taking into consideration the current, intended and reasonably anticipated future use of the property. The remedy selection process begins by establishing RAOs for media in which chemical constituents were found in exceedance of applicable standards, criteria and guidance values (SCGs). A remedy is then developed based on the following ten criteria:

1. Protection of human health and the environment;
2. Compliance with SCGs;
3. Short-term effectiveness and impacts;
4. Long-term effectiveness and permanence;
5. Reduction of toxicity, mobility, or volume of contaminated material;
6. Implementability;
7. Cost effectiveness;
8. Community Acceptance;
9. Land use; and
10. Sustainability.

The following is a detailed description of the alternatives analysis and remedy selection to address impacted media at the Site. As required, a minimum of two remedial alternatives (including a Track 1 scenario) are evaluated, as follows:

Alternative 1 includes:

- Selection of NYSDEC 6NYCRR Part 375 Unrestricted Use (Track 1) Soil Cleanup Objectives.
- Removal of all soil/fill exceeding Unrestricted Use (Track 1) SCOs throughout the Site and confirmation that Track 1 SCOs have been achieved with post-excavation endpoint sampling. Based on the results of the Remedial Investigation, it is expected that this alternative would be achieved by excavation to a depth of approximately eight feet bgs. If

soil/fill containing analytes at concentrations above Track 1 SCOs is still present after removal of soil required for construction, then additional excavation will be performed to ensure complete removal of soil that does not meet Track 1 SCOs.

- No Engineering or Institutional Controls are required for a Track 1 cleanup but a waterproofing/ vapor barrier membrane would be installed beneath the slab as part of new development.
- As part of new development, placement of engineered composite cover system over the entire site.

Alternative 2 includes:

- Establishment of Track 4 Site-specific SCOs
- Removal of soil/fill exceeding Track 4 Site-specific SCOs and confirmation that SCOs have been achieved with pre-excavation in-situ endpoint sampling. Excavation for development purposes would take place to a depth of approximately three feet bgs.
- Placement of a final engineered composite cover system over the entire site to prevent exposure to remaining soil/fill.
- Installation of a waterproofing/ vapor barrier membrane.
- Establishment of use restrictions including prohibitions on the use of groundwater from the Site and prohibitions on sensitive Site uses, such as farming or vegetable gardening, to eliminate future exposure pathways.
- Establishment of an approved Site Management Plan (SMP) to ensure long-term management of engineering and institutional controls (EC/ICs) including the performance of periodic inspections and certification that the controls are performing as they were intended.
- Maintenance of the Hazardous Materials E-Designation to memorialize the remedial action and the Engineering and Institutional Controls to ensure that future owners of the Site continue to maintain these controls as required through the NYC Buildings Department.

3.1 THRESHOLD CRITERIA

Protection of Public Health and the Environment

This criterion is an evaluation of the remedy's ability to protect public health and the environment, and an assessment of how risks posed through each existing or potential pathway of exposure are eliminated, reduced or controlled through removal, treatment, and implementation of Engineering Controls or Institutional Controls. Protection of public health and the environment must be achieved for all approved remedial actions.

Alternative 1

Alternative 1 would be protective of human health and the environment by removing historic fill/soil exceeding Unrestricted Use Track 1 SCOs and groundwater protection standards, thus eliminating potential for direct contact with contaminated soil/fill once construction is complete and eliminating the risk of contamination leaching into groundwater.

Alternative 2

Alternative 2 would achieve comparable protections of human health and the environment by removing some of the contaminated soil/fill as well as by placement of Engineering and Institutional Controls (EC/ICs) including a composite cover system. The composite cover system would prevent direct contact with any remaining soil/fill. Implementing ICs including a Site Management Plan and continued registration of the E-designation of property would ensure that the composite cover system remains intact and protective. Establishment of Track 4 Site Specific SCOs would minimize the risk of contamination leaching into groundwater.

For both Alternatives, potential exposure to contaminated soils and groundwater during construction would be minimized by implementing a Construction Health and Safety Plan, an approved Soil and Materials Management Plan and Community Air Monitoring Plan (CAMP). Potential future migration of off-site vapors into the new building would be prevented by installing a vapor barrier/waterproofing system beneath the new building's basement slab and continuing the vapor barrier around foundation walls.

3.2. BALANCING CRITERIA

Compliance with Standards, Criteria and Guidance (SCGs)

This evaluation criterion assesses the ability of the alternative to achieve applicable standards, criteria and guidance.

Alternative 1 would achieve compliance with the remedial goals, chemical specific SCGs and RAOs for soil through removal of soil to achieve Track 1 Unrestricted Use SCOs and groundwater protection standards. Compliance with SCGs for soil vapor would also be achieved by installing a vapor barrier/waterproofing system beneath the new building's basement slab and continuing the vapor barrier around foundation walls as part of new development.

Alternative 2 would achieve compliance with the remedial goals, chemical specific SCGs and RAOs for soil through removal of soil to achieve Track 4 Site Specific SCOs. Compliance with SCGs for soil vapor would also be achieved by installing a vapor barrier/waterproofing system beneath the new building's basement slab and continuing the vapor barrier around foundation walls. A Site Management Plan would ensure that these controls remained protective for the long term. Compliance with groundwater SCGs would be achieved over the long term by excavation and removal of some soil exceeding Track 4 Site-specific SCOs.

Health and Safety measures contained in the CHASP and CAMP that comply with the applicable SCGs shall be implemented during Site redevelopment in this RAWP. For both Alternatives, focused attention on means and methods employed during the remedial action would ensure that handling and management of contaminated material would be in compliance with applicable SCGs. United States Occupational Health and Safety Administration (OSHA) requirements for on-site construction safety will also be followed by the Site contractors. These measures would protect on-site workers and the surrounding community from exposures to Site related to historic fill contaminants.

Short-term effectiveness and impacts

This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial action objectives are met. Under this criterion, alternatives

are evaluated with respect to their effects on public health and the environment during implementation of the remedial action, including protection of the community, environmental impacts, time until remedial response objectives are achieved, and protection of workers during remedial actions.

Both alternatives have similar short term impacts during their respective implementation. Short term impacts would be higher for Alternative 1 due to excavation of greater amounts of historical fill material. The most significant short-term adverse impacts and risks to the community would be the potential complications involved with designing support of excavation which would be greater for Alternative 1. Both Track 1 and Track 4 remedial alternatives would result in similar dust generation impacts associated with excavation, handling, load out of materials, and truck traffic. Truck traffic will be routed on the most direct course using major thoroughfares where possible and flaggers will be used to protect pedestrians at Site entrances and exits. Focused attention to means and methods during the remedial action, including community air monitoring and appropriate truck routing will minimize or negate the overall impact of these activities.

Both alternatives would employ appropriate measures to prevent short term impacts, including a CAMP, during all on-Site soil disturbance activities and would minimize the release of contaminants into the environment. Both alternatives provide short term effectiveness in protecting the surrounding community by decreasing the risk of contact with on-site contaminants. Construction workers operating under appropriate management procedures and a CHASP would be protected from on-site contaminants (personal protective equipment would be worn consistent with the document risk within the respective work zones).

Long-term effectiveness and permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual contamination remaining at the Site after response objectives have been met, such as permanence of the remedial alternative, magnitude of remaining contamination, adequacy of controls including the adequacy and suitability of ECs/ICs that may be used to manage contaminant residuals that remain at the Site and assessment of

containment systems and ICs that are designed to eliminate exposures to contaminants, and long-term reliability of Engineering Controls.

Alternative 1 – The Track 1 remedy would achieve long-term effectiveness and permanence related to on-site contamination by permanently removing all impacted soil/fill. Removal of on-site contaminant sources will also prevent continued and future groundwater contamination. Installation of a waterproofing/vapor barrier membrane would prevent potential future migration of soil vapors into the new building.

Alternative 2 – The Track 4 remedy would provide long-term effectiveness by removing the majority of on-site contamination and attaining Track 4 Site-specific SCOs; by establishing Engineering Controls including a composite cover system, and establishing Institutional Controls, including use restrictions, a SMP, and continuation of the E-designation to memorialize these controls for the long term. The SMP will ensure long-term effectiveness of all ECs and ICs by requiring periodic inspection and certification that these controls and use restrictions continue to be in place and are functioning as they were intended assuring that protections designed into the remedy would provide continued high level of protection in perpetuity.

Both alternatives would result in removal of soil contamination exceeding the SCOs providing a high level, effective and permanent remedy over the long-term with respect to a remedy for contaminated soil, which will prevent any migration to groundwater. The potential exists for residual VOC concentrations in groundwater and soil vapor due to an off-site source. Potential exposure by soil vapor VOC intrusion would be prevented by the installation of a vapor barrier. Therefore, the long-term effectiveness of this remedy will eliminate risks and satisfy the objectives of this criterion.

Reduction of toxicity, mobility, or volume of contaminated material

This evaluation criterion assesses the remedial alternative's use of remedial technologies that permanently and significantly reduce toxicity, mobility, or volume of contaminants as their principal element. The following is the hierarchy of source removal and control measures that are to be used to remediate a site, ranked from most preferable to least preferable: removal

and/or treatment, containment, elimination of exposure and treatment of source at the point of exposure. It is preferred to use treatment or removal to eliminate contaminants at a site, reduce the total mass of toxic contaminants, cause irreversible reduction in contaminants mobility, or reduce of total volume of contaminated media.

Alternative 1 – The Track 1 remedy provides the maximum reduction of toxicity, mobility, and volume of contaminated material through the removal of historic fill and soil exceeding Track 1 SCOs.

Alternative 2 – would remove most of the impacted soil present on the Site and some of the remaining soil beneath the composite cover would meet Track 4 Site-specific SCOs. Alternative 1 would eliminate a greater total mass of contaminants on Site.

Implementability

This evaluation criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation, including technical feasibility of construction and operation, reliability of the selected technology, ease of undertaking remedial action, monitoring considerations, administrative feasibility (e.g. obtaining permits for remedial activities), and availability of services and materials.

Both alternatives will utilize standard methods that are commonly available and routinely applied by the industry. They use standard materials and services that are well established technology. The reliability of the remedy is also high. There are no special difficulties associated with any of the activities proposed.

Cost effectiveness

This evaluation criterion addresses the cost of alternatives, including capital costs (such as construction costs, equipment costs, and disposal costs, engineering expenses) and Site management costs (costs incurred after remedial construction is complete) necessary to ensure the continued effectiveness of a remedial action.

Alternative 1 – Excavation and off-site disposal of historic fill and soil is necessary to accommodate the proposed development. As the Site will be remediated to an unrestricted-use

level, there are no operations, maintenance, or monitoring costs associated with the proposed remedy.

Alternative 2 – The Track 4 remedy is significantly less expensive than the Track 1 remedy. The short-term costs of Alternative 1 are significantly higher based on greater excavation quantities of historic fill material and excavation into the water table which is more expensive and may involve dewatering. Long-term costs associated with Alternative 2 are likely higher than Alternative 1 based on the implementation of an SMP and continued E-designation.

Community Acceptance

This evaluation criterion addresses community opinion and support for the remedial action. Observations here will be supplemented by public comment received on the RAWP.

Based on the overall goals of the remedial program, no adverse community opinion is anticipated for either alternative. However, this RAWP will be subject to and undergo public review under the NYC VCP and will provide the opportunity for public input on the selected remedial actions. Any public comments related to environmental remediation will be considered by New York City Office of Environmental Remediation (NYCOER) prior to approval of this Plan.

Land use

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

The current, intended, and reasonably anticipated future land use of the Site and its surroundings are compatible with the selected remedy of soil remediation. The proposed future use of the Site includes a seven-story residential building.

The proposed redevelopment of the Site is compatible with its current zoning and is consistent with recent development patterns. The areas surrounding the Site are urban and consist of predominantly, mixed residential and commercial buildings in zoning districts designated for commercial and residential uses. The development would replace the underutilized site with a modern residential building. The proposed development would create new employment opportunities, living spaces, and economic and fiscal benefits to the City and State in the form of economic revitalization and tax revenue.

The proposed use will not cause or increase a disproportionate burden on the community in which the Site is located. In addition, temporary short-term project impacts are being mitigated through Site management controls and truck traffic controls during remediation activities. Following remediation, the Site will meet either Track 1 Unrestricted Use SCOs or Track 4 Site-specific SCOs, which are appropriate for its planned residential use.

The Site is not in close proximity to important cultural resources, including Federal or State historic or heritage sites or Native American religious sites, natural resources, waterways, wildlife refuges, wetlands, or critical habitats of endangered or threatened species. The Site is located in an urban area with limited proximity to fish or wildlife. Both alternatives would prevent any potential exposure pathways of contaminant migration affecting fish or wildlife. Municipal water supply wells are not present in Brooklyn; therefore, groundwater from the Site cannot affect municipal water supply wells or recharge areas. The Site does not lie in a Federal Emergency Management Agency (FEMA)-designated flood plain. Both alternatives are equally protective of natural resources and cultural resources.

Sustainability of the Remedial Action

This criterion evaluates the overall sustainability of the remedial action alternatives and the degree to which sustainable means are employed to implement the remedial action including those that take into consideration NYC's sustainability goals defined in *PlaNYC: A Greener*,

Greater New York. Sustainability goals may include: maximizing the recycling and reuse of non-virgin materials; reducing the consumption of virgin and non-renewable resources; minimizing energy consumption and greenhouse gas emissions; improving energy efficiency; and promotion of the use of native vegetation and enhancing biodiversity during landscaping associated with Site development.

While Alternative 2 would potentially result in lower energy usage based on reducing the volume of material transported off-Site, both alternatives are comparable with respect to the opportunity to achieve sustainable remedial action. The overall sustainability of both alternatives is low. The excavated material would likely be landfilled (no recycling and reuse of non-virgin materials) and require consumption of virgin material resources as imported backfill. The remedial plan for either alternative would take into consideration the shortest trucking routes during off-Site disposal of historic fill and other soils, which would reduce greenhouse gas emissions and conserve energy used to fuel trucks. The New York City Clean Soil Bank program is available for reuse of any clean native soils under either alternative. A complete list of green remedial activities considered as part of the NYC VCP is included in a Sustainability Statement.

4.0 REMEDIAL ACTION

4.1 SUMMARY OF PREFERRED REMEDIAL ACTION

The preferred remedial action alternative is Alternative 2, the Track 4 Alternative. The preferred remedial action alternative achieves protection of public health and the environment for the intended use of the Property. The preferred remedial action alternative will achieve all of the remedial action objectives established for the project and addresses applicable SCGs. The preferred remedial action alternative is effective in both the short-term and long-term and reduces mobility, toxicity and volume of contaminants. The preferred remedial action alternative is cost effective and implementable and uses standards methods that are well established in the industry.

The proposed remedial action will consist of:

1. Preparation of a Community Protection Statement and implementation of all required NYC VCP Citizen Participation activities according to an approved Citizen Participation Plan.
2. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
3. Establishment of Site specific (Track 4) Soil Cleanup Objectives (SCOs).
4. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking & staking excavation areas.
5. Excavation and removal of some soil/fill exceeding Site specific Track 4 SCOs. The footprint of the new building will be excavated to a depth of approximately 3 feet below grade, and the rear yard will be excavated to approximately 2-3 feet below grade for development purposes. Additionally, the hotspot area identified at B-1 will be excavated to remove soil/fill with metals concentrations above Track 4 Site-specific SCOs or to groundwater whichever is shallower. Approximately, 2,000-2,500 tons of soils will be removed from this development project.

6. Three in-situ endpoint samples will be collected during waste classification testing for comparison to the Site Specific Track 4 SCOs. An in-situ endpoint sample will also be collected in the area of B-1/EP-1 at the anticipated excavation completion depth. Based on the laboratory analysis, if the sample does not meet SCOs, a two foot by two foot excavation will extend to groundwater and no further sampling in the area will be conducted.
7. Screening of excavated soil/fill during intrusive work for indications of contamination by visual means, odor, and monitoring with a PID. Appropriate segregation of excavated media on-site.
8. Removal of underground storage tanks, if any, and closure of petroleum spills, if applicable, in compliance with applicable local, State and Federal laws and regulations.
9. Transportation and off-site disposal of all soil/fill material at permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this Plan. Sampling and analysis of excavated media will be performed as required by disposal facilities. Appropriate segregation of excavated media onsite.
10. Collection and analysis of in-situ end-point confirmation samples to determine the performance of the remedy with respect to attainment of SCOs.
11. Demarcation of residual soil/fill in landscaped areas.
12. Import of materials to be used for backfill and cover in compliance with this Plan and in accordance with applicable laws and regulations.
13. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
14. Performance of all activities required for the Remedial Action, including permitting requirements and pretreatment requirements, in compliance with applicable laws and regulations.
15. Submission of a Remedial Action Report (RAR) that describes the remedial activities and certifies that the remedial requirements have been achieved, defines the Site

boundaries, lists any changes from this RAWP, and describes all Engineering and Institutional Controls to be implemented at the Site.

16. Installation of a vapor barrier system beneath the building slab and outside foundation sidewalls below grade. A Raven Industries' VaporBlock® Plus™ 20-mil vapor barrier will be installed in accordance with the manufacturer's installation procedures and the project engineer's design specifications.
17. Construction and maintenance of an engineered composite cover consisting of concrete building slab, concrete sidewalks and pavers, poured rubber safety surface, and/or open space cover of two foot thick clean fill to prevent human exposure to residual soil/fill remaining under the Site.
18. Submission of an approved Site Management Plan (SMP) in the RAR for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
19. The property will continue to be registered with an E-Designation by the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this RAWP and a requirement that management of these controls must be in compliance with an approved SMP. Institutional Controls will include prohibition of the following: (1) vegetable gardening and farming; (2) use of groundwater without treatment rendering it safe for the intended use; (3) disturbance of residual contaminated material unless it is conducted in accordance with the SMP; and (4) higher level of land usage without OER approval.

4.2 SOIL CLEANUP OBJECTIVES AND SOIL/FILL MANAGEMENT

Track 4 Soil Cleanup Objectives (SCOs) are proposed for this project. The SCOs for this Site are listed below.

Contaminant	Track 4 SCOs
Total SVOCs	250 PPM
Arsenic	24 PPM
Lead	1,000 PPM
Mercury	2.5 PPM

Soil and materials management on-Site and off-Site, including excavation, handling and disposal, will be conducted in accordance with the Soil/Materials Management Plan in Appendix 3. The location of planned excavations is shown in Figure 7. Discrete contaminant sources (such as hotspots) identified during the remedial action will be provided in the Remedial Action Report.

Estimated Soil/Fill Removal Quantities

The total quantity of soil/fill expected to be excavated and disposed off-site is approximately 3,000 tons. Disposal facilities will be reported to OER when they are identified and prior to the start of remedial action.

End-Point Sampling

Removal actions for development purposes under this Plan will be performed in conjunction with confirmation soil sampling. Three in-situ endpoint samples will be collected during waste classification testing for comparison to the Site Specific Track 4 SCOs; analytes will only include trigger compounds. One sample will be collected at the base of the excavation in the location of B-1/EP-1 on Tax Lot 7 within the proposed building footprint; which was previously determined by OER in the pre-application meeting on October 29, 2014. The area of B-1 soil will be excavated to the associated SCOs or to groundwater whichever is shallower. An endpoint

sample will be collected in the area of B-1/EP-1 at the anticipated excavation completion depth. Based on the laboratory analysis, if the sample does not meet SCOs, a two foot by two foot excavation will extend to groundwater and no further sampling in the area will be conducted. Endpoint sample results will not be utilized to determine excavation depths; excavation is for construction purposes only. Endpoint samples will be analyzed and documented in the RAR to have an understanding of what remains in the ground. Endpoint sample locations are shown on Figure 9.

In-situ end point sampling will be conducted during waste classification sampling. During the exploratory test pits for composite waste samples, confirmatory endpoint samples will be collected. After the endpoint samples are collected poly-sheeting will be placed at the base of the test pit as an excavation depth place holder for future soil removals.

Hot-Spot Removals

At the time of this RAWP, no hotspot removals/endpoint sampling are required. Hot-spot removal actions that could potentially be identified during the remedial excavation, will be fully removed or extended to groundwater, whichever is shallower.

Analytes for hot spot removal endpoint sampling will be those parameters that are driving the hot-spot removal action and will be approved by OER. Frequency for hot-spot end-point sample collection is as follows:

1. For hot spot excavations less than 20 feet in total perimeter, at least one bottom sample and one sidewall sample biased in the direction of surface runoff.
2. For hot spot excavations 20 to 300 feet in perimeter:
 - For surface removals, one sample from the top of each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.
 - For subsurface removals, one sample from each sidewall for every 30 linear feet of sidewall and one sample from the excavation bottom for every 900 square feet of bottom area.

3. For sampling of volatile organics, bottom samples should be taken within 24 hours of excavation, and should be taken from the zero to six-inch interval at the excavation floor. Samples taken after 24 hours should be taken at six to twelve inches.

4. For hot-spot soil removal, post remediation soil samples for laboratory analysis should be taken immediately after contaminated soil removal. If the excavation is enlarged horizontally, additional soil samples will be taken pursuant to bullets 1-3 above.

Hot spot post-remediation end-point sample locations and depth will be biased towards the areas and depths of highest contamination identified during previous sampling episodes unless field indicators such as field instrument measurements or visual contamination identified during the remedial action indicate that other locations and depths may be more heavily contaminated. In all cases, post-remediation samples should be biased toward locations and depths of the highest expected contamination. New York State ELAP certified labs will be used for all confirmation and end-point sample analyses. Labs performing confirmation and end-point sample analyses will be reported in the RAR. The RAR will provide a tabular and map summary of all confirmation and end-point sample results and will include all data including non-detects and applicable standards and/or guidance values. End-point samples will be analyzed for compounds and elements as described above utilizing the following methodology, as applicable:

Soil analytical methods will be based on specific compounds identified during either hot spot sampling or the trigger compounds for above referenced in situ endpoint point sampling. Analytical methodologies may include

- Volatile organic compounds by EPA Method 8260;
- Semi-volatile organic compounds by EPA Method 8270;
- Target Analyte List metals; and
- Pesticides/PCBs by EPA Method 8081/8082.

If either LNAPL and/or DNAPL are detected, appropriate samples will be collected for characterization and “finger print analysis” and required regulatory reporting (i.e. Spills Hotline) will be performed.

Quality Assurance/Quality Control

The fundamental QA objective with respect to accuracy, precision, and sensitivity of analysis for laboratory analytical data is to achieve the QC acceptance of the analytical protocol. The accuracy, precision and completeness requirements will be addressed by the laboratory for all data generated.

Collected samples will be appropriately packaged, placed in coolers, and shipped via overnight courier or delivered directly to the analytical laboratory by field personnel. Samples will be containerized in appropriate laboratory provided glassware and shipped in plastic coolers. Samples will be preserved through the use of ice or “cold-paks” to maintain a temperature of 4°C.

Dedicated disposable sampling materials will be used for the collection endpoint samples, eliminating the need to prepare field equipment (rinsate) blanks. However, if non-disposable equipment is used, (stainless steel scoop, etc.) field rinsate blanks will be prepared at the rate of one (1) for every eight (8) samples collected.

Decontamination of non-dedicated sampling equipment will consist of the following:

- Gently tap or scrape to remove adhered soil
- Rinse with tap water
- Wash withalconox® detergent solution and scrub
- Rinse with tap water
- Rinse with distilled or deionized water

Field blanks will be prepared by pouring distilled or deionized water over decontaminated equipment and collecting the water in laboratory provided containers. Trip blanks will be used whenever samples are transported to the laboratory for analysis of VOCs. Trip blanks will not be used for samples to be analyzed for metals, SVOCs, or pesticides. One blind duplicate sample will be prepared and submitted for analysis every 20 samples.

One duplicate and one matrix spike/matrix spike duplicate will be collected for every 20 samples.

Import and Reuse of Soils

It is not anticipated at this time that soil will need to be imported to the Site. If importation of soils is necessary during construction it will be performed in conformance with the Soil/Materials Management Plan in Appendix 3.

4.3 ENGINEERING CONTROLS

Engineering Controls were employed in the Remedial Action to address residual contamination remaining at the site. The Site has two primary Engineering Control Systems. These are:

- Composite cover system consisting of the building footprint of an impervious hard surface cover in the form of a nine-inch concrete slab and the rear yard that will be covered by concrete pavers, poured rubber safety surface, and/or open space cover of two foot thick clean fill;
- Soil vapor barrier beneath the building slab and up foundation walls with a minimum thickness of 20-mil;

Composite Cover System

Exposure to residual soil/fill will be prevented by an engineered, composite cover system to be built on the Site. The building footprint will be capped with impervious hard surface cover in the form of a nine-inch concrete slab. The rear yard will be covered by concrete pavers, poured rubber safety surface, and/or open space cover of two foot thick clean fill.

Open landscaped areas will be capped with a minimum of two feet of clean fill/top soil or gravel imported from an approved facility/source, underlain by a highly visible demarcation barrier (i.e. orange geo-synthetic material or equivalent). For clean soil or top soil, it will be segregated at the source or facility. Qualified environmental personnel will collect representative soil samples at a frequency of one sample for every 250 cubic yards; analyze the samples for 6 NYCRR Part 375 VOCs, SVOCs, pesticides, PCBs and metals by a NYSDOH ELAP-certified laboratory. The clean soil or top soil will not be transported to the Site until it is

confirmed that the import criteria are met. The clean soil or top soil will not be comprised of any construction and demolition debris.

The composite cover system is a permanent engineering control for the Site. The system will be inspected and reported at specified intervals as required by this RAWP and the SMP. A Soil Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the Remedial Action is complete. Maintenance of this composite cover system will be described in the Site Management Plan in the RAR.

Figure 8 shows the location of each cover type built at the Site.

Vapor Barrier

Migration of soil vapor will be mitigated with a combination of building slab and vapor barrier. A VaporBlock® Plus™ 20-mil vapor barrier will be installed in accordance with the manufacturer's installation procedures and the project engineer's specifications beneath the entire building foundation and up any subgrade sidewalls. Raven Industries' VaporBlock 20 Plus, which is a seven layer co-extruded barrier made from state-of-the-art polyethylene and EVOH resins. The vapor barrier will be installed prior to pouring the building's concrete slab. The vapor barrier will extend throughout the area occupied by the footprint of the new buildings and up the foundation sidewalls in accordance with manufacturer specifications. The specifications for installation will be provided to the construction management company and the foundation contractor or installer of the liner. The specifications state that all vapor barrier seam, penetrations, and repairs will be sealed by tape method.

Prior to pouring the concrete slab, the Remedial Engineer or his designee will visit the Site to inspect and photograph the installed material. A set of the installation photos, as-built drawings and diagrams, and a PE/RA certified letter (on company letterhead) from primary contractor responsible for installation oversight and field inspections will be included in the RAR. The technical specifications for the VaporBlock® Plus™ vapor barrier are included as Appendix 5.

The Vapor Barrier System is a permanent engineering control and will be inspected and its performance certified at specified intervals as required by this RAWP and the Site Management Plan. A Soil and Materials Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying vapor barrier system is disturbed after the remedial action is complete. Maintenance of these systems will be described in the Site Management Plan in the Remedial Action Report.

4.4 INSTITUTIONAL CONTROLS

Institutional Controls (IC) have been incorporated in this remedial action to manage residual soil/fill and other media and render the Site protective of public health and the environment. Institutional Controls are listed below. Long-term employment of EC/ICs will be implemented under a Site-specific Site Management Plan (SMP) that will be included in the RAR.

Institutional Controls for this Remedial Action are:

- The Property will continue to be registered with an E-Designation by the NYC Buildings Department. This RAWP includes a description of all ECs and ICs and summarizes the requirements of the Site Management Plan which will note that the property owner and property owner's successors and assigns must comply with the approved SMP;
- Submittal of a Site Management Plan in the RAR for approval by OER that provides procedures for appropriate operation, maintenance, monitoring, inspection, reporting and certification of ECs. SMP will require that the property owner and property owner's successors and assigns will submit to OER a periodic written statement that certifies that: (1) controls employed at the Site are unchanged from the previous certification or that any changes to the controls were approved by OER; 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. OER retains the right to enter the Site in order to evaluate the continued maintenance of any controls. This certification shall be submitted at a frequency to be determined by OER in the SMP and will comply with RCNY §43-1407(1)(3).

- Vegetable gardens and farming on the Site are prohibited in contact with residual soil materials;
- Use of groundwater underlying the Site is prohibited without treatment rendering it safe for its intended use;
- All future activities on the Site that will disturb residual material must be conducted pursuant to the soil management provisions in an approved SMP;
- The Site will be used for residential use and will not be used for a higher level of use without prior approval by OER.

4.5 SITE MANAGEMENT PLAN

Site Management is the last phase of remediation and begins with the approval of the Remedial Action Report and issuance of the Notice of Completion (NOC) for the Remedial Action. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure implementation of all ECs and ICs that are required by this RAWP. The Site Management Plan is submitted as part of the RAR but will be written in a manner that allows its use as an independent document. Site Management continues until terminated in writing by OER. The property owner is responsible to ensure that all Site Management responsibilities defined in the Site Management Plan are implemented.

The SMP will provide a detailed description of the procedures required to manage residual soil/fill left in place following completion of the remedial action in accordance with the Brownfield Cleanup Agreement with OER. This includes a plan for: (1) implementation of EC's and ICs; (2) operation and maintenance of EC's; and (3) inspection and certification of EC's.

Site management activities, reporting, and EC/IC certification will be scheduled on a periodic basis to be established in the SMP and will be subject to review and modification by OER. The Site Management Plan will be based on a calendar year and certification reports will be due for submission to OER by July 30 of the year following the reporting period.

4.6 QUALITATIVE HUMAN HEALTH EXPOSURE ASSESSMENT

The objective of the qualitative exposure assessment is to identify potential receptors and pathways for human exposure to the contaminants of concern (COC) that are present at, or migrating from, the Site. The identification of exposure pathways describes the route that the COC takes to travel from the source to the receptor. An identified pathway indicates that the potential for exposure exists; it does not imply that exposures actually occur.

Investigations reported in the Remedial Investigation Report (RIR) are sufficient to complete a Qualitative Human Health Exposure Assessment (QHHEA). As part of the VCP process, a QHHEA was performed to determine whether the Site poses an existing or future health hazard to the Site's exposed or potentially exposed population. The sampling data from the RI were evaluated to determine whether there is any health risk by characterizing the exposure setting, identifying exposure pathways, and evaluating contaminant fate and transport. This QHHEA was prepared in accordance with Appendix 3B and Section 3.3 (b) 8 of the NYSDEC Draft DER-10 Technical Guidance for Site Investigation and Remediation.

Known and Potential Sources

Based on the Remedial Investigation and Phase II Investigation, the COCs are summarized below by media type:

Soil COCs

- SVOCs including benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, dibenzo(a,h)anthracene, chrysene and indeno(1,2,3-c,d)pyrene were detected above Restricted Residential SCOs.
- Metals including arsenic, barium, cadmium, copper, lead, and mercury were detected above Restricted Residential SCOs.

Groundwater COCs

- SVOCs including benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene and indeno(1,2,3-c,d)pyrene were detected above their TOGS Class GA guidance values.

- Metals including iron, sodium, and manganese were detected above their TOGS Class GA guidance values.

Soil Vapor COCs

- Low level detections of 1,2,4-trimethylbenzene, 4-methyl-2-pentanone, acetone, benzene, carbon disulfide, chloroform, cyclohexane, dichlorofluoromethane, ethanol, ethylbenzene, heptane, hexane, isopropyl alcohol, methyl ethyl ketone, propylene, styrene, tetrachloroethene, toluene, trichlorofluoromethane, trichlorofluoroethane, and m,p-xylene were detected at low concentrations.

Nature, Extent, Fate and Transport of Contaminants

SVOCs and metals are present in the historic fill material throughout the Site. SVOC contaminants found in soil were found in groundwater samples at low concentrations over the GQS. Dissolved metals including iron and manganese were detected above GQS. The chlorinated VOCs in soil vapor were not detected or were well below guidance issued by New York State DOH and were not found in any of the on-site soil or groundwater samples collected.

Potential Routes of Exposure

The five elements of an exposure pathway are: (1) a contaminant source; (2) contaminant release and transport mechanisms; (3) a point of exposure; (4) a route of exposure; and, (5) a receptor population. An exposure pathway is considered complete when all five elements of an exposure pathway are documented. A potential exposure pathway exists when any one or more of the five elements comprising an exposure pathway cannot be documented. An exposure pathway may be eliminated from further evaluation when any one of the five elements comprising an exposure pathway has not existed in the past, does not exist in the present, and will never exist in the future. Three potential primary routes exist by which chemicals can enter the body:

- Ingestion of water, fill, or soil;
- Inhalation of vapors and particulates; and,
- Dermal contact with water, fill, soil, or building materials.

Potential Exposure Points

Current Conditions

The Site is currently covered with concrete building slabs and a parking lot. The potential for exposure to surficial historic fill does not exist under current conditions. Groundwater is not exposed at the Site, and because the Site is served by the public water supply and groundwater use for potable supply is prohibited, groundwater is not used at the Site and there is no potential for exposure. There are structures on Site where low level concentrations of soil vapor could accumulate.

Construction/ Remediation Activities

Once redevelopment activities begin, construction workers will come into direct contact with surface and subsurface soils and potentially groundwater, as a result of on-site construction and excavation activities. On-site construction workers potentially could ingest, inhale or have dermal contact with any exposed impacted soil, and fill. Similarly, off-site receptors could be exposed to dust and vapors from on-site activities. Due to the depth of groundwater, direct contact with groundwater is not expected. During construction, on-site and off-site exposures to contaminated dust from on-site will be addressed through the Soil/Materials Management Plan, dust controls, and through the implementation of the Community Air-Monitoring Program and a Construction Health and Safety Plan.

Proposed Future Conditions

Under future remediated conditions, some soils in excess of Track 4 Site-specific SCOs will be removed. The Site will be fully covered, preventing potential direct exposure to soil and groundwater remaining in place; and a waterproofing/vapor barrier system will prevent any exposure to potential off site soil vapors in the future. The Site is served by a public water supply, and groundwater is not used at the Site for potable supply. There are no plausible off-Site pathways for oral, inhalation, or dermal exposure to contaminants derived from the Site under future conditions.

Receptor Populations

On-Site Receptors

The Site is currently vacant, and on-Site receptors are limited to trespassers, site representatives, and visitors granted access to the property. During redevelopment of the Site, the on-site potential receptors will include construction workers, site representatives, and visitors. Once the Site is redeveloped, the on-site potential sensitive receptors will include adult and child building residents, workers and visitors.

Off-Site Receptors

Potential off-site receptors within a 0.25-mile radius of the Site include adult and child residents, commercial and construction workers, pedestrians, trespassers, and cyclists, based on the following:

1. Commercial Businesses (up to 0.25 mile) – existing and future
2. Residential Buildings (up to 0.25 mile) – existing and future
3. Parks (up to 0.25 mile) – existing and future
4. Pedestrians, Trespassers, Cyclists (up to .25 mile) – existing and future
5. Schools (up to .25 mile) – existing and future
6. Child Health Center (up to 0.25 mile) – existing and future

Overall Human Health Exposure Assessment

There is a potential complete exposure pathway that requires mitigation during implementation of the remedy. There is no complete exposure pathway under future conditions after the site is developed. This assessment takes into consideration the reasonably anticipated use of the site, which includes a residential structure and a two-foot clean fill buffer in landscaped areas, and a subsurface vapor barrier system for the building. Potential post-construction use of groundwater is not considered an option because groundwater in this area of New York City is not used as a potable water source. There are no surface waters in close proximity to the Site that could be impacted or threatened.

During the remedial action, on-site exposure pathways will be eliminated by preventing access to the site; through implementation of soil/materials management, stormwater pollution prevention, and dust controls; employment of a community air monitoring plan; and, implementation of a CHASP. After the Remedial Action is complete, there will be no remaining exposure pathways to on-site soil/fill, as the composite cover system and use restrictions will prevent contact with residual soil or groundwater, and a vapor barrier system will have been installed. Continued protection after the Remedial Action will be achieved by the implementation of Site Management including periodic inspection and certification of the performance of remedial controls.

5.0 REMEDIAL ACTION MANAGEMENT

5.1 PROJECT ORGANIZATION AND OVERSIGHT

Principal personnel who will participate in the Remedial Action include Site Safety Officer, William Fitchett and Project Manager Victoria Whelan. The Professional Engineer (PE) Qualified Environmental Professionals (QEP) for this project are Ravi Korlipara P.E. and Victoria Whelan QEP; respectively.

5.2 SITE SECURITY

Site access will be controlled by a gated entrance and an entirely fenced Property.

5.3 WORK HOURS

The hours for operation of remedial construction will be in accordance with the New York City Department of Buildings construction code requirements.

5.4 CONSTRUCTION HEALTH AND SAFETY PLAN

The Health and Safety Plan is included in Appendix 4. The Site Safety Coordinator will be William Fitchett. Remedial work performed under this RAWP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the remedial construction work will ensure that performance of work is in compliance with the HASP and applicable laws and regulations. The HASP pertains to remedial and invasive work performed at the Site until the issuance of the Notice of Completion.

Personnel overseeing the excavation of the contaminated soil will be properly trained by the Site Safety Coordinator. The Site Safety Coordinator will also designate and train a site worker, such as a foreman, to act as his/her designee. Prior to any work, all workers involved with the project will be aware of the potential chemical, physical and biological hazards discussed in this document, as well as the general safety practices at a safety briefing by the on-site designee at

the outset of work activities. The Site Safety Coordinator will assure appropriate training of field oversight personnel. Individuals assigned to perform these activities will be identified prior to the commencement of field activities, and any changes to these personnel during field activities will be noted in the daily reports.

Personnel entering any exclusion zone will be trained in the provisions of the HASP and be required to sign an HASP acknowledgment. Site-specific training will be provided to field personnel. Additional safety training may be added depending on the tasks performed. Emergency telephone numbers will be posted at the site location before any remedial work begins. A safety meeting will be conducted prior to commencement of work. Topics to be discussed include task hazards and protective measures (physical, chemical, environmental); emergency procedures; PPE levels and other relevant safety topics. Meetings will be documented in a log book or specific form.

An emergency contact sheet with names and phone numbers is included in the HASP. That document will define the specific project contacts for use in case of emergency.

5.5 COMMUNITY AIR MONITORING PLAN

Real-time air monitoring for volatile organic compounds (VOCs) and particulate levels at the perimeter of the exclusion zone or work area will be performed. Continuous monitoring will be performed for all ground intrusive activities and during the handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, soil/waste excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells.

Periodic monitoring for VOCs will be performed during non-intrusive activities such as the collection of soil and sediment samples or the collection of groundwater samples from existing monitoring wells. Periodic monitoring during sample collection, for instance, will consist of taking a reading upon arrival at a sample location, monitoring while opening a well cap or overturning soil, monitoring during well baling/purging, and taking a reading prior to leaving a sample location. Depending upon the proximity of potentially exposed individuals, continuous monitoring may be performed during sampling activities. Examples of such situations include

groundwater sampling at wells on the curb of a busy urban street, in the midst of a public park, or adjacent to a school or residence. Exceedences of action levels observed during performance of the Community Air Monitoring Plan (CAMP) will be reported to the OER Project Manager and included in the Daily Report.

VOC Monitoring, Response Levels, and Actions

Volatile organic compounds (VOCs) will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated at least daily for the contaminant(s) of concern or for an appropriate surrogate. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below.

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities 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 will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the exclusion zone or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less; but in no case less than 20 feet, is below 5 ppm over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shutdown.

Readings will be recorded at 30-minute increments and will be available for OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone 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 should be visually assessed during all work activities.

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter (mcg/m^3) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $150 \text{ mcg}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $150 \text{ mcg}/\text{m}^3$ above the upwind level, work will be stopped and a re-evaluation of activities initiated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \text{ mcg}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

Readings will be recorded every 30-minutes and be available for OER personnel to review.

5.6 AGENCY APPROVALS

All permits or government approvals required for remedial construction have been or will be obtained prior to the start of remedial construction. Approval of this RAWP by OER does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

5.7 SITE PREPARATION

Pre-Construction Meeting

OER will be invited to attend the pre-construction meeting at the Site with all parties involved in the remedial process prior to the start of remedial construction activities.

Mobilization

Mobilization will be conducted as necessary for each phase of work at the Site. Mobilization includes field personnel orientation, equipment mobilization (including securing all sampling equipment needed for the field investigation), marking/staking sampling locations and utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

Utility Marker Layouts, Easement Layouts

The presence of utilities and easements on the Site will be fully investigated prior to the performance of invasive work such as excavation or drilling under this plan by using, at a minimum, the One-Call System (811). Underground utilities may pose an electrocution, explosion, or other hazard during excavation or drilling activities. All invasive activities will be performed in compliance with applicable laws and regulations to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the Markout Ticket will be retained by the contractor prior to the start of drilling, excavation or other invasive subsurface operations. Overhead utilities may also be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

Proper safety and protective measures pertaining to utilities and easements, and compliance with all laws and regulations will be employed during invasive and other work contemplated under this RAWP. The integrity and safety of on-site and off-site structures will be maintained during all invasive, excavation or other remedial activity performed under the RAWP.

Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations.

Stabilized Construction Entrance

Steps will be taken to ensure that trucks departing the Site will not track soil, fill or debris off-site. Such actions may include use of cleaned asphalt or concrete roads or use of stone or other aggregate-based egress paths between the truck inspection station and the property exit. Measures will be taken to ensure that adjacent roadways will be kept clean of project related soils, fill and debris.

Truck Inspection Station

An outbound-truck inspection station will be set up close to the Site exit. Before exiting the NYC VCP Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Soil and debris will be removed. Brooms, shovels and potable water will be utilized for the removal of soil from vehicles and equipment, as necessary.

Extreme Storm Preparedness and Response Contingency Plan

Damage from flooding or storm surge can include dislocation of soil and stockpiled materials, dislocation of Site structures and construction materials and equipment, and dislocation of support of excavation structures. Damage from wind during an extreme storm event can create unsafe or unstable structures, damage safety structures and cause downed power lines creating dangerous Site conditions and loss of power. In the event of emergency conditions caused by an extreme storm event, the enrollee will undertake the following steps for Site preparedness prior to the event and response after the event.

Storm Preparedness

Preparations in advance of an extreme storm event will include the following: containerized hazardous materials and fuels will be removed from the property; loose materials will be secured

to prevent dislocation and blowing by wind or water; heavy equipment such as excavators and generators will be removed from holes, trenches and depressions on the Property to high ground or removed from the property; an inventory of the Property with photographs will be performed to establish conditions for the Site and equipment prior to the event; stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers; stockpiled hazardous wastes will be removed from the Property; stormwater management systems will be inspected and fortified, including, as necessary: clean and reposition silt fences, haybales; clean storm sewer filters and traps; and secure and protect pumps and hosing.

Storm Response

At the conclusion of an extreme storm event, as soon as it is safe to access the Property, a complete inspection of the Property will be performed. A Site inspection report will be submitted to OER at the completion of site inspection and after the site security is assessed. Site conditions will be compared to the inventory of Site conditions and material performed prior to the storm event and significant differences will be noted. Damage from storm conditions that result in acute public safety threats, such as downed power lines or imminent collapse of buildings, structures or equipment will be reported to public safety authorities via appropriate means such as calling 911. Petroleum spills will be reported to NYS DEC within two hours of identification and consistent with State regulations. Emergency and spill conditions will also be reported to OER. Public safety structures, such as construction security fences will be repaired promptly to eliminate public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will be collected and appropriately managed. Support of excavation structure will be inspected and fortified as necessary. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Storm-water control systems and structures will be inspected and maintained as necessary. If soil or fill materials are discharged off site to adjacent properties, property owners and OER will be notified and corrective measure plan designed to remove and clean dislocated material will be submitted to

OER and implemented following approval by OER and granting of site access by the property owner. Impacted off-site areas may require characterization based on site conditions, at the discretion of OER. If on-Site petroleum spills are identified, a qualified environmental professional will determine the nature and extent of the spill and report to NYS DEC's spill hotline at DEC 800-457-7362. If the source of the spill is ongoing and can be identified, it should be stopped if this can be done safely. Potential hazards will be addressed immediately, consistent with guidance issued by NYS DEC.

Storm Response Reporting

A site inspection report will be submitted to OER at the completion of site inspection. An inspection report established by OER is available on OER's website (www.nyc.gov/oer) and will be used for this purpose. Site conditions will be compared to the inventory of site conditions and material performed prior to the storm event and significant differences will be noted. The site inspection report will be sent to the OER project manager and will include the site name, address, tax block and lot, site primary and alternate contact name and phone number. Damage and soil release assessment will include: whether the project had stockpiles; whether stockpiles were damaged; photographs of damage and notice of plan for repair; report of whether soil from the site was dislocated and whether any of the soil left the site; estimates of the volume of soil that left the site, nature of impact, and photographs; description of erosion damage; description of equipment damage; description of damage to the remedial program or the construction program, such as damage to the support of excavation; presence of onsite or offsite exposure pathways caused by the storm; presence of petroleum or other spills and status of spill reporting to NYS DEC; description of corrective actions; schedule for corrective actions. This report should be completed and submitted to OER project manager with photographs within 24 hours of the time of safe entry to the property after the storm event.

5.8 TRAFFIC CONTROL

Drivers of trucks leaving the NYC VCP Site with soil/fill will be instructed to proceed without stopping in the vicinity of the site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the site is to utilize the neighboring major thoroughfare, the Brooklyn Queens Expressway.

5.9 DEMOBILIZATION

Demobilization will include:

- As necessary, restoration of temporary access areas and areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management areas, and access area);
- Removal of sediment from erosion control measures and truck wash and disposal of materials in accordance with applicable laws and regulations;
- Equipment decontamination, and;
- General refuse disposal.

Equipment will be decontaminated and demobilized at the completion of all field activities. Investigation equipment and large equipment (e.g., soil excavators) will be washed at the truck inspection station as necessary. In addition, all investigation and remediation derived waste will be appropriately disposed.

5.10 REPORTING AND RECORD KEEPING

Daily Reports

Daily reports providing a general summary of activities for each day of *active remedial work* will be emailed to the OER Project Manager by the end of the following business day. Those reports will include:

- Project number and statement of the activities and an update of progress made and locations of work performed;

- Quantities of material imported and exported from the Site;
- Status of on-site soil/fill stockpiles;
- A summary of all citizen complaints, with relevant details (basis of complaint; actions taken; etc.);
- A summary of CAMP excursions, if any;
- Photograph of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with OER project manager based on planned project tasks. Daily email reports are not intended to be the primary mode of communication for notification to OER of emergencies (accidents, spills), requests for changes to the RAWP or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the RAWP will be communicated directly to the OER project manager by personal communication. Daily reports will be included as an Appendix in the Remedial Action Report.

Record Keeping and Photo-Documentation

Job-site record keeping for all remedial work will be performed. These records will be maintained on-Site during the project and will be available for inspection by OER staff. Representative photographs will be taken of the Site prior to any remedial activities and during major remedial activities to illustrate remedial program elements and contaminant source areas. Photographs will be submitted at the completion of the project in the RAR in digital format (i.e. jpeg files).

5.11 COMPLAINT MANAGEMENT

All complaints from citizens will be promptly reported to OER. Complaints will be addressed and outcomes will also be reported to OER in daily reports. Notices to OER will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

5.12 DEVIATIONS FROM THE REMEDIAL ACTION WORK PLAN

All changes to the RAWP will be reported to the OER Project Manager and will be documented in daily reports and reported in the Remedial Action Report. The process to be followed if there are any deviations from the RAWP will include a request for approval for the change from OER noting the following:

- Reasons for deviating from the approved RAWP;
- Effect of the deviations on overall remedy; and
- Determination that the remedial action with the deviation(s) is protective of public health and the environment.

6.0 REMEDIAL ACTION REPORT

A Remedial Action Report (RAR) will be submitted to OER following implementation of the Remedial Action defined in this RAWP. The RAR will document that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The RAR will include:

- Information required by this RAWP;
- As-built drawings for all constructed remedial elements, required certifications, manifests and other written and photographic documentation of remedial work performed under this remedy;
- Site Management Plan;
- Description of any changes in the remedial action from the elements provided in this RAWP and associated design documents;
- Tabular summary of all end-point sampling results and all material characterization results, QA/QC results for end-point sampling, and other sampling and chemical analysis performed as part of the remedial action and DUSR;
- Test results or other evidence demonstrating that remedial systems are functioning properly;
- Account of the source area locations and characteristics of all contaminated material removed from the Site including a map showing source areas;
- Account of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material.
- Account of the origin and required chemical quality testing for material imported onto the Site.
- Continue registration of the Property with an E-Designation by the NYC Department of Buildings; and

- Reports and supporting material will be submitted in digital form.

Remedial Action Report Certification

The following certification will appear in front of the Executive Summary of the Remedial Action Report. The certification will include the following statements:

I, Ravi Kolipara, P.E., am currently a professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the Meekerman Site number, [15CVCP083K](#).

I, Victoria Whelan, QEP, CPG, am a Qualified Environmental Professional. I had primary direct responsibility for implementation remedial program for the Meekerman Site number, [15CVCP083K](#) .

I certify that the OER-approved Remedial Action Work Plan dated to be determined and Stipulations in a letter dated to be determined; if any were implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

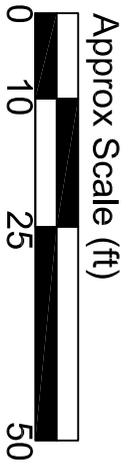
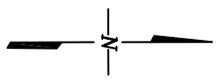
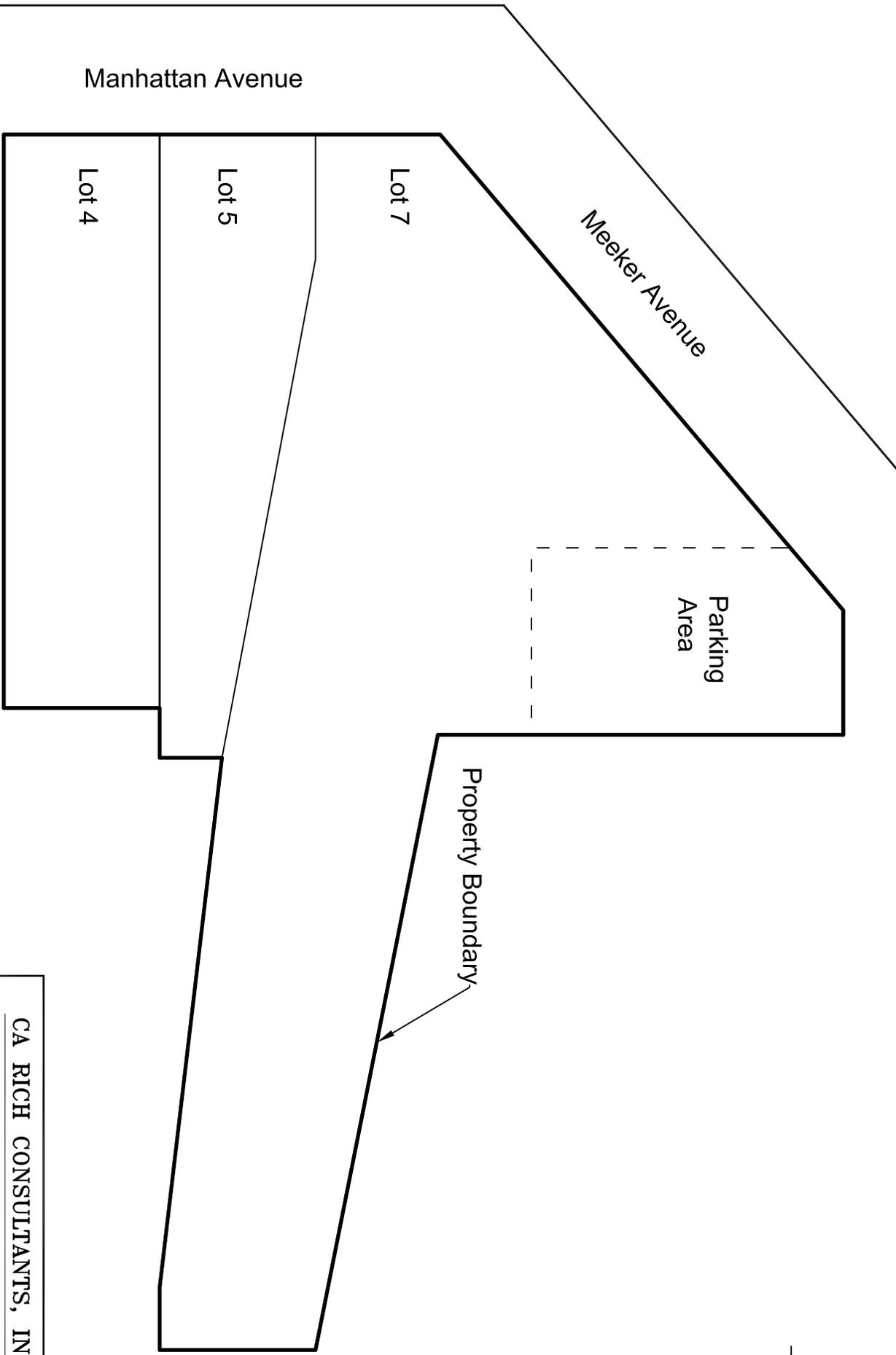
7.0 SCHEDULE

The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to OER. Currently, an eighteen month remediation period is anticipated.

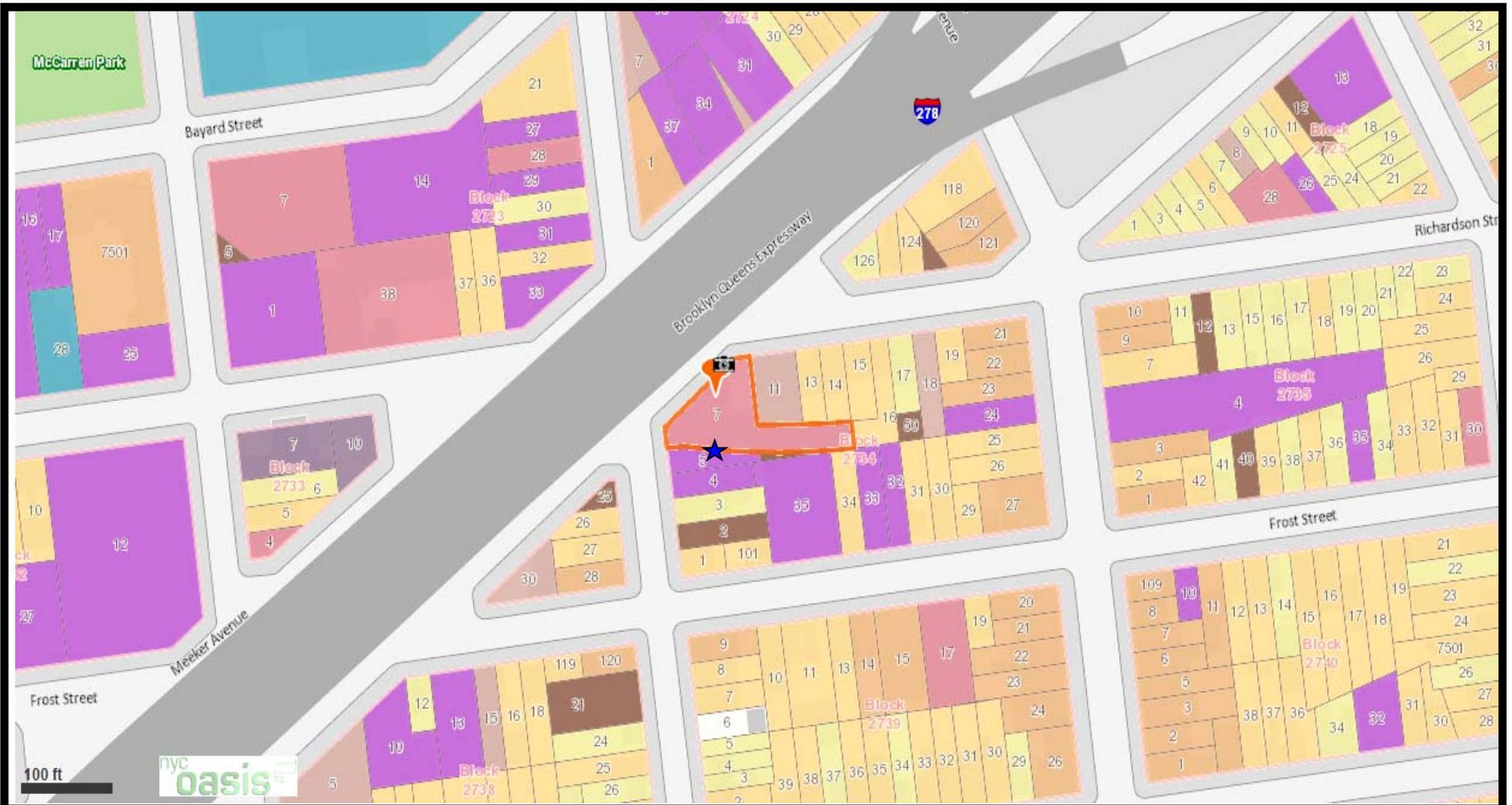
Remediation work is expected to begin shortly after closing on construction financing, anticipated to take place in May 2015 or June 2015. Removal and disposal of contaminated material will occur during the first phase of construction concurrent with excavation and foundation work, as will the installation of a 20-mil vapor barrier. The installation of the rear yard concrete pavers, poured rubber safety surface, and landscaping will occur near the end of construction period which is estimated to be roughly eighteen months. The Closure Report will be submitted once remedial work has been completed and once the report is prepared, potentially in November or December of 2016.

Schedule Milestone	Weeks from Remedial Action Start	Duration (weeks)
OER Approval of RAWP	0	-
Fact Sheet 2 announcing start of remedy	0	-
Mobilization	1	1
Remedial Excavation	1	12
Demobilization	66	6
Submit Remedial Action Report	72	x

Figures



CA RICH CONSULTANTS, INC.		Environmental Specialists Since 1982	
17 Dupont Street, Plainview, New York 11803			
Site Plan			
FIGURE:	1	DATE:	10/27/2014
DRAWING NO.:	402 Meeker Avenue 406-408 Manhattan Avenue Brooklyn, NY	SCALE:	As Shown
DRAWN BY:	T.R.B.	APPR. BY:	V.W.



- Land Use**
- Block/Lot Boundaries
 - (Building footprints in gray)
 - 1 & 2 Family Residential
 - Multi-family Residential
 - Mixed Use
 - Open space & outdoor recreation
 - Commercial
 - Institutions
 - Industrial
 - Parking
 - Transportation / Utilities
 - Vacant Lots



Adapted from Oasis.net



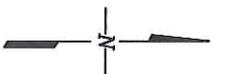
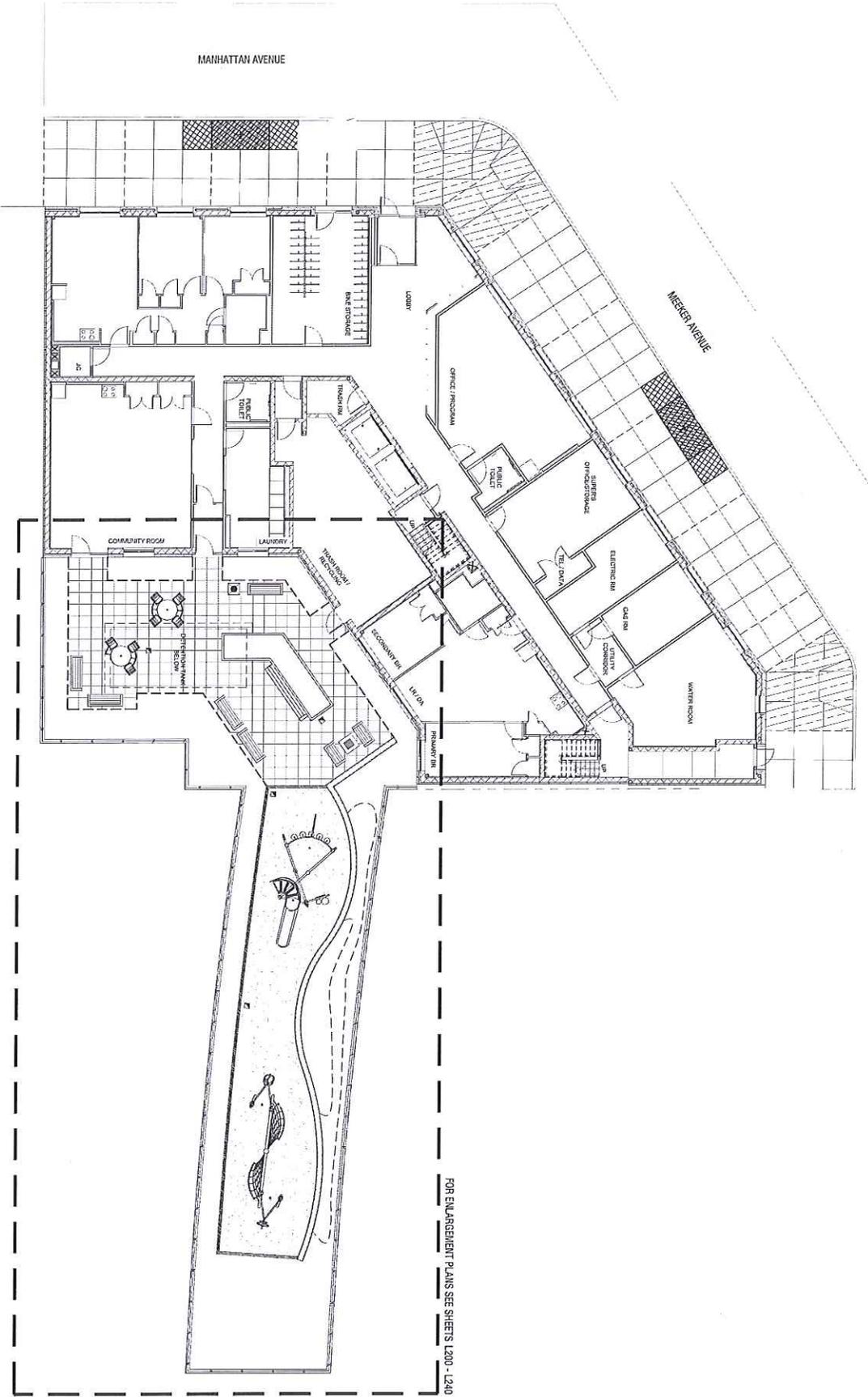
CA RICH CONSULTANTS, INC.
17 Dupont Street,
Plainview, NY 11803

TITLE:

Surrounding Land Use

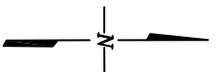
FIGURE: **2**

**402 Meeker Avenue and 406-408 Manhattan Avenue
Brooklyn, NY**



FOR ENGAGEMENT PLANS SEE SHEETS 1200-1240

<p>CA RICH CONSULTANTS, INC. Environmental Specialists Since 1982 17 Dupont Street, Plainview, New York 11803</p>		<p>DATE: 4/2/2015</p>
<p>Development Plans</p>		<p>SCALE: N.T.S.</p>
<p>FIGURE: 3</p>	<p>402 Meeker Avenue 406-408 Manhattan Avenue Brooklyn, NY</p>	<p>DRAWN BY: T.R.B.</p>
<p>DRAWING NO: 2014-6</p>		<p>APPR. BY: V.W.</p>



Legend

-  Groundwater Sampling Location
-  Soil Boring Location
-  Soil Gas Sampling Location

Approx Scale (ft)



<p>CA RICH CONSULTANTS, INC. Environmental Specialists Since 1982 17 Dupont Street, Plainview, New York 11803</p>		DATE:	10/27/2014
		TITLE:	Sample Location Map
FIGURE:	4	DRAWN BY:	T.R.B.
DRAWING NO.:	406-408 Meeker Avenue 408 Manhattan Avenue Brooklyn, NY	APPR. BY:	V.W.

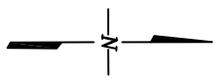
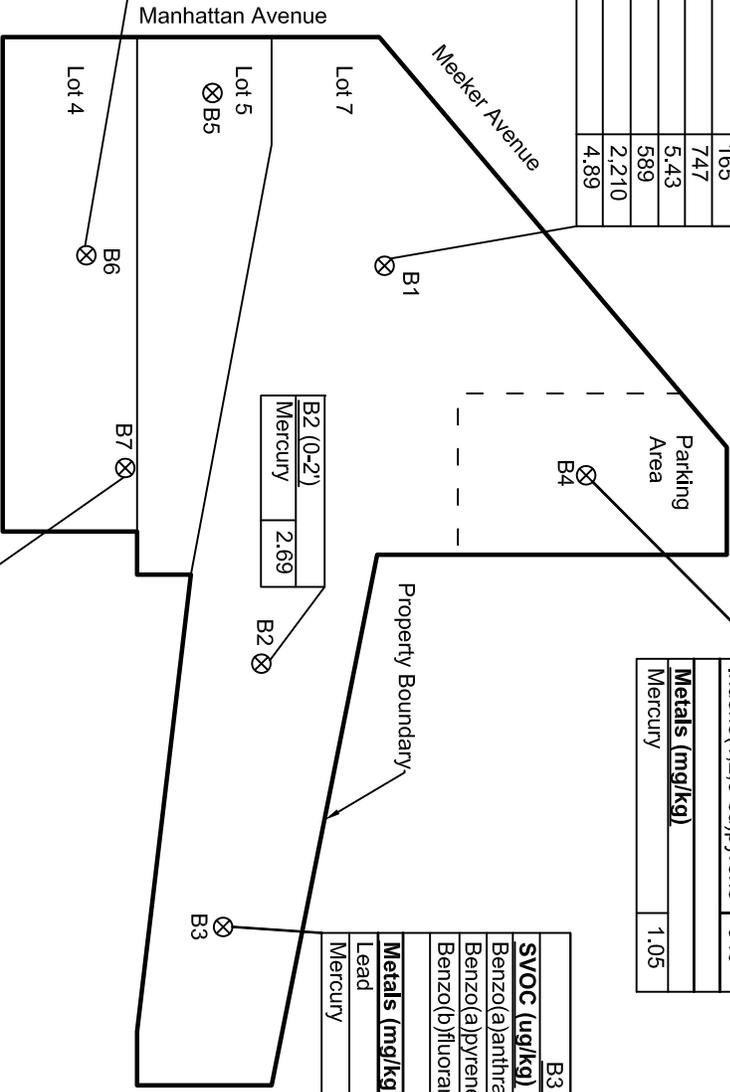
B1 (0-2')		B1 (2-4')	
SVOC (ug/kg)		SVOC (ug/kg)	
Benzo(a)anthracene	6,900	Benzo(a)anthracene	20,000
Benzo(a)pyrene	5,900	Benzo(a)pyrene	17,000
Benzo(b)fluoranthene	8,200	Benzo(b)fluoranthene	24,000
Benzo(k)fluoranthene	2,200	Benzo(k)fluoranthene	5,700
Chrysene	6,700	Chrysene	21,000
Dibenzo(a,h)anthracene	720	Dibenzo(a,h)anthracene	1,300
Indeno(1,2,3-cd)pyrene	2,200	Indeno(1,2,3-cd)pyrene	3,800
Metals (mg/kg)		Metals (mg/kg)	
Arsenic	51.4	Arsenic	165
Barium	430	Barium	747
Lead	901	Cadmium	5.43
Mercury	3.69	Copper	589
		Lead	2,210
		Mercury	4.89

B4 (0-2')	
SVOC (ug/kg)	
Benzo(a)anthracene	3,000
Benzo(a)pyrene	2,500
Benzo(b)fluoranthene	3,800
Indeno(1,2,3-cd)pyrene	640
Metals (mg/kg)	
Mercury	1.05

B3 (0-2')	
SVOC (ug/kg)	
Benzo(a)anthracene	1,200
Benzo(a)pyrene	1,100
Benzo(b)fluoranthene	1,600
Metals (mg/kg)	
Lead	886
Mercury	1.73

B6 (0-2')		B6 (6-8')	
SVOC (ug/kg)		SVOC (ug/kg)	
Benzo(a)anthracene	1,700	Benzo(a)anthracene	1,200
Benzo(a)pyrene	1,500	Benzo(b)fluoranthene	1,200
Benzo(b)fluoranthene	1,800	Chrysene	1,200
Chrysene	1,700		
Indeno(1,2,3-cd)pyrene	870	Metals (mg/kg)	
		Mercury	4.52
Metals (mg/kg)			
Lead	546		
Mercury	4.62		

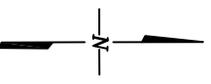
B7 (6-8')	
Metals (mg/kg)	
Arsenic	27
Barium	568
Lead	1,220
Mercury	10.1



Legend
 ⊗ Soil Boring Location

Note:
 Soil Exceedances above 6NYCRR Part 375 Restricted Residential Source:
 Remedial Investigation Report 406-408 Manhattan Avenue, by Environmental Business Consultants, dated February 2014
 Phase II Subsurface Investigation 402 Meeker Avenue, by Environmental Business Consultants, dated February 2014

CA RICH CONSULTANTS, INC.	
Environmental Specialists Since 1982	
17 Dupont Street, Plainview, New York 11803	
TITLE: Soil Exceedances Above Restricted Residential SCOs	
FIGURE: 5	DATE: 4/27/2015
DRAWING NO: 2014-4	SCALE: As Shown
402 Meeker Avenue Brooklyn, NY	DRAWN BY: T.R.B.
	APPR. BY: V.W.

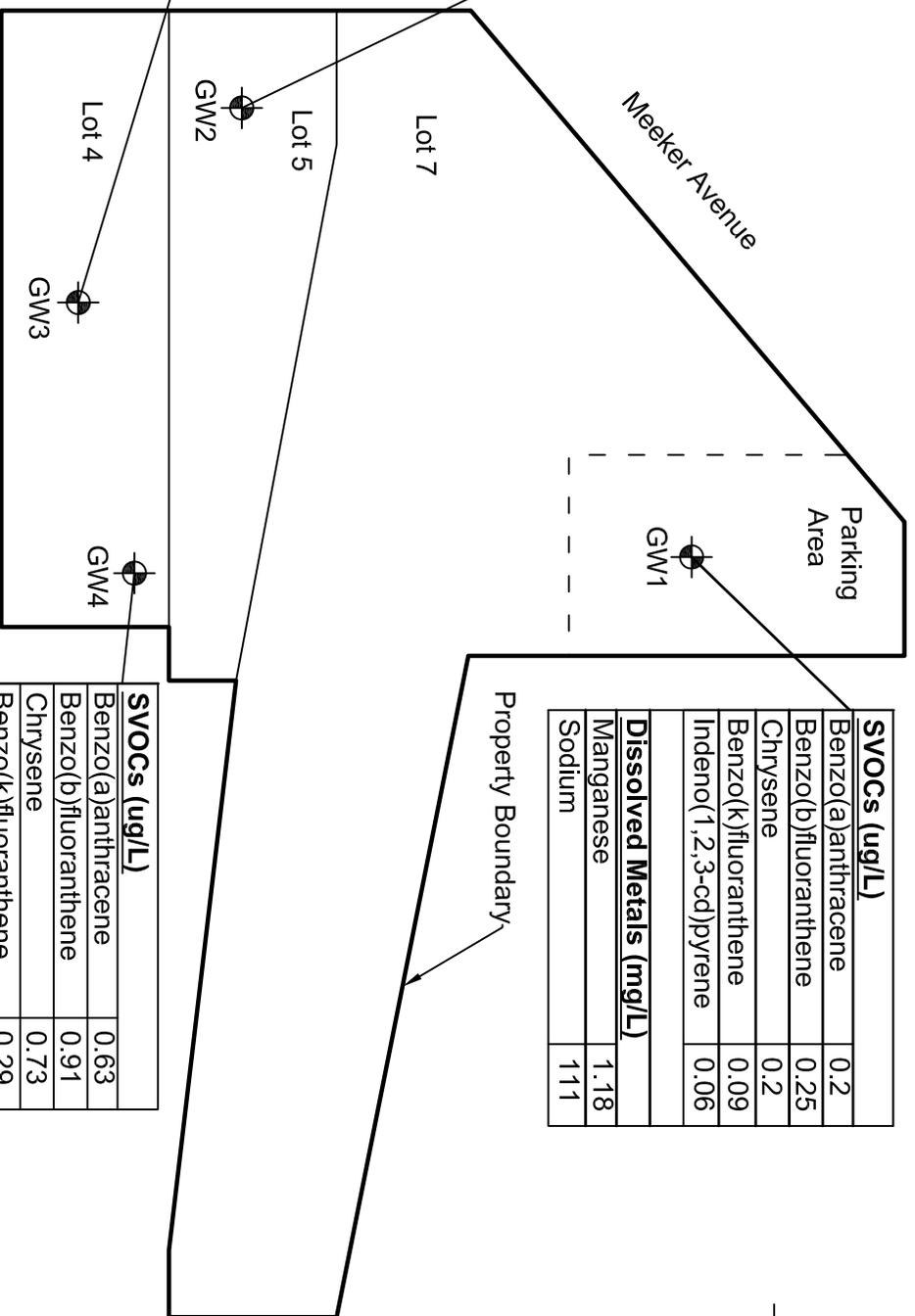


SVOCs (ug/L)	
Benzo(a)anthracene	0.2
Benzo(b)fluoranthene	0.25
Chrysene	0.2
Benzo(k)fluoranthene	0.09
Indeno(1,2,3-cd)pyrene	0.06
Dissolved Metals (mg/L)	
Manganese	1.18
Sodium	111

SVOCs (ug/L)	
Benzo(a)anthracene	0.32
Benzo(b)fluoranthene	0.44
Chrysene	0.36
Benzo(k)fluoranthene	0.15
Indeno(1,2,3-cd)pyrene	0.13
Dissolved Metals (mg/L)	
Manganese	0.696
Sodium	268

SVOCs (ug/L)	
Benzo(a)anthracene	0.63
Benzo(b)fluoranthene	0.91
Chrysene	0.73
Benzo(k)fluoranthene	0.29
Indeno(1,2,3-cd)pyrene	0.26
Dissolved Metals (mg/L)	
Iron	0.63
Manganese	0.648
Sodium	99

SVOCs (ug/L)	
Benzo(a)anthracene	0.22
Benzo(b)fluoranthene	0.23
Chrysene	0.23
Benzo(k)fluoranthene	0.11
Indeno(1,2,3-cd)pyrene	0.1
Dissolved Metals (mg/L)	
Iron	0.524
Sodium	177



Legend
 Groundwater Sampling Location



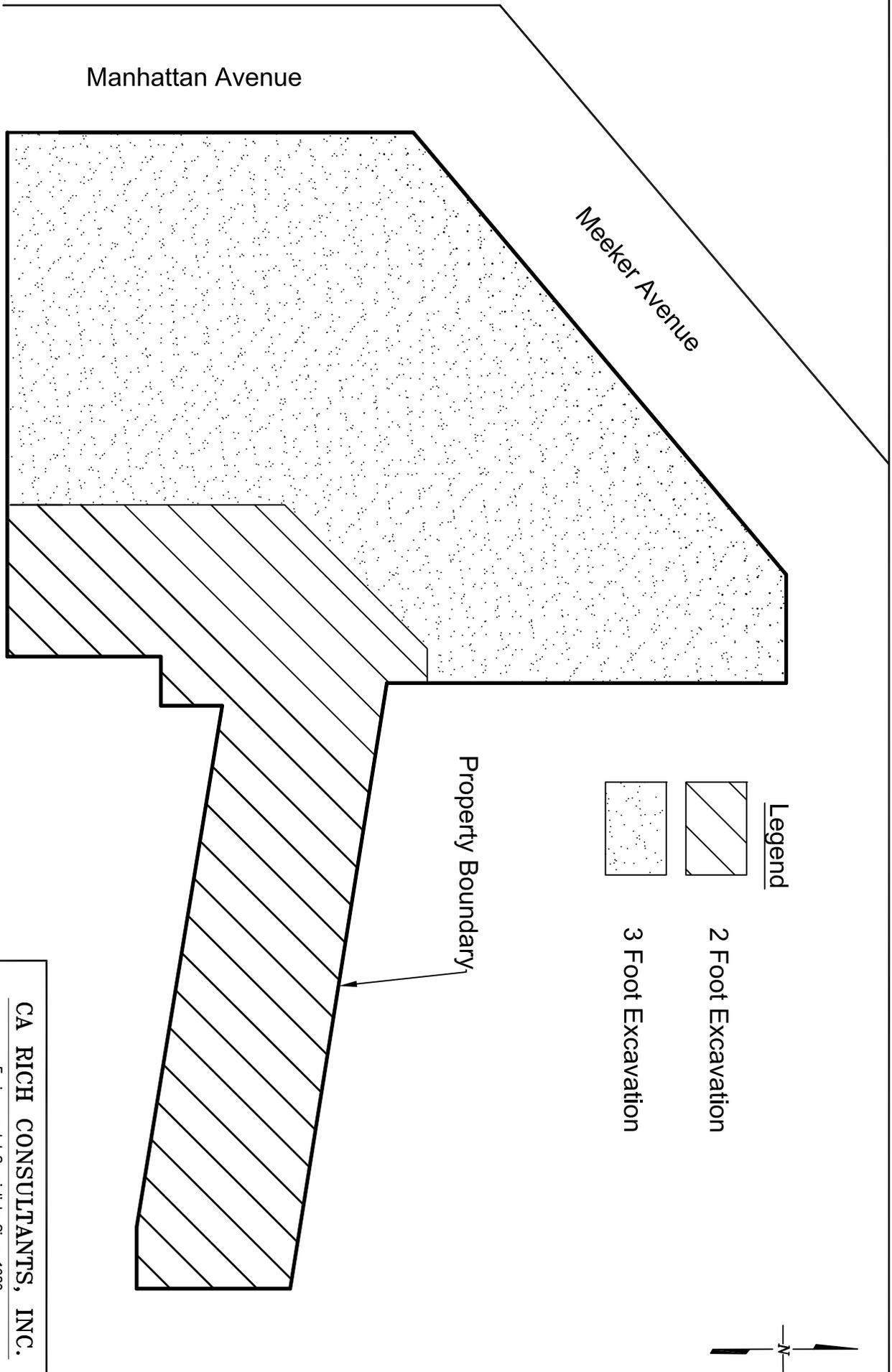
Note:

Groundwater Exceedances Above NYSDEC Technical and Operational Guidance Series (1.1.1) Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations June 1998 and updates

Source:

Remedial Investigation Report 406-408 Manhattan Avenue, by Environmental Business Consultants, dated February 2014
 Phase II Subsurface Investigation 402 Meeker Avenue, by Environmental Business Consultants, dated February 2014

CA RICH CONSULTANTS, INC.	
Environmental Specialists Since 1982	
17 Dupont Street, Plainview, New York 11803	
TITLE: Groundwater Exceedances Above TOGS	
FIGURE: 6	402 Meeker Avenue 406-408 Manhattan Avenue Brooklyn, NY
DRAWING NO.: 2014-3	
DATE: 4/27/2015	DRAWN BY: T.R.B.
SCALE: As Shown	APPR. BY: V.W.



Manhattan Avenue

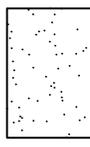
Meeker Avenue

Property Boundary

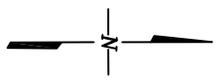
Legend



2 Foot Excavation



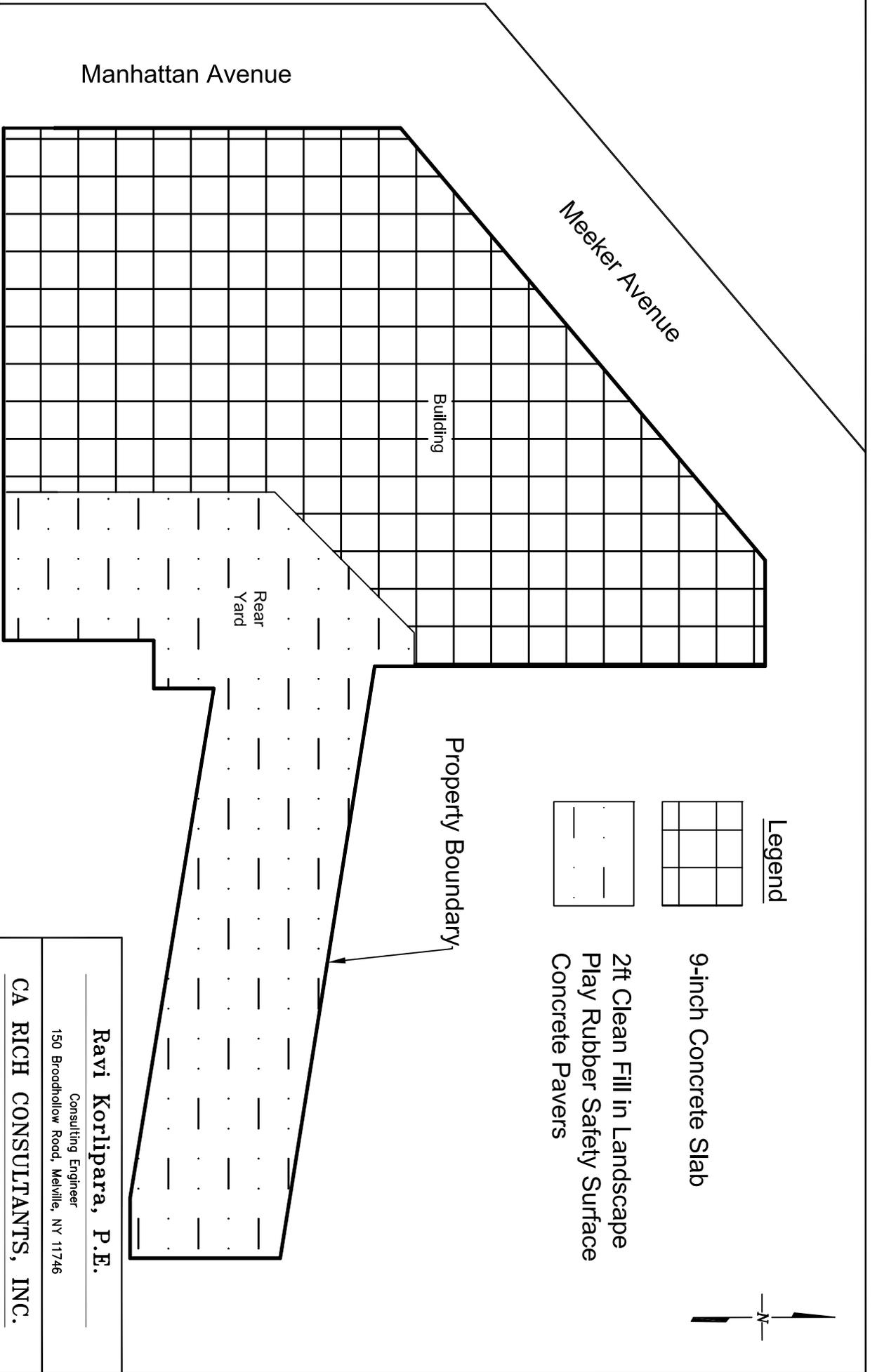
3 Foot Excavation



Approx Scale (ft)



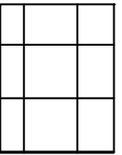
CA RICH CONSULTANTS, INC.	
Environmental Specialists Since 1982	
17 Dupont Street, Plainview, New York 11803	
Excavation Plan	
FIGURE: 7	DATE: 2/11/2015
DRAWING NO.: 2014-7	SCALE: As Shown
402 Meeker Avenue 406-408 Manhattan Avenue Brooklyn, NY	DRAWN BY: T.R.B.
	APPR. BY: V.W.



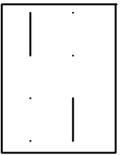
Approx Scale (ft)



Legend



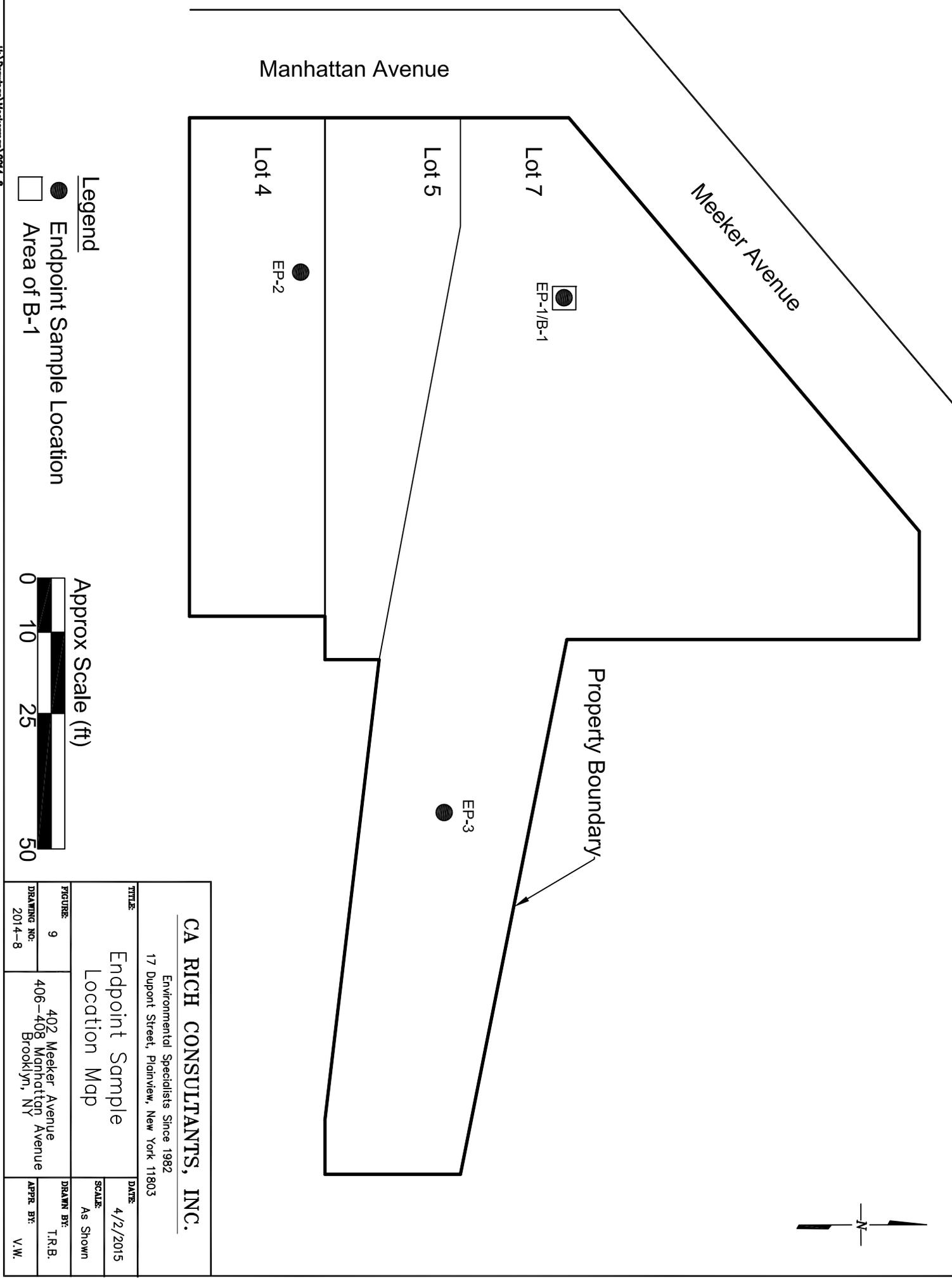
9-inch Concrete Slab



2ft Clean Fill in Landscape
Play Rubber Safety Surface
Concrete Pavers

Property Boundary

<p>Ravi Korlipara, P.E. Consulting Engineer 150 Broadhollow Road, Melville, NY 11746</p>	
<p>CA RICH CONSULTANTS, INC. Environmental Specialists Since 1982 17 Dupont Street, Plainview, New York 11803</p>	
<p>TITLE: Composite Cover</p>	
FIGURE: 8	402 Meeker Avenue 406-408 Manhattan Avenue Brooklyn, NY
DRAWING NO.: 2014-9	
DATE: 4/22/2015	
SCALE: As Shown	
DRAWN BY: T.R.B.	
APPR. BY: V.W.	



Legend

- Endpoint Sample Location
- Area of B-1

Approx Scale (ft)



<p>CA RICH CONSULTANTS, INC. Environmental Specialists Since 1982 17 Dupont Street, Plainview, New York 11803</p>	
<p>TITLE Endpoint Sample Location Map</p>	<p>DATE 4/2/2015</p>
<p>FIGURE 9</p>	<p>SCALE As Shown</p>
<p>DRAWING NO. 2014-8</p>	<p>DRAWN BY: T.R.B.</p>
<p>402 Meeker Avenue 406-408 Manhattan Avenue Brooklyn, NY</p>	<p>APPR. BY: V.W.</p>

APPENDIX 1**CITIZEN PARTICIPATION PLAN**

The NYC Office of Environmental Remediation and Meekerman LLC have established this Citizen Participation Plan because the opportunity for citizen participation is an important component of the NYC Voluntary Cleanup Program. This Citizen Participation Plan describes how information about the project will be disseminated to the Community during the remedial process. As part of its obligations under the NYC VCP, Office of Environmental Remediation will maintain a repository for project documents and provide public notice at specified times throughout the remedial program. This Plan also takes into account potential environmental justice concerns in the community that surrounds the project Site. Under this Citizen Participation Plan, project documents and work plans are made available to the public in a timely manner. Public comment on work plans is strongly encouraged during public comment periods. Work plans are not approved by the NYC Office of Environmental Remediation (OER) until public comment periods have expired and all comments are formally reviewed. An explanation of cleanup plans in the form of a public meeting or informational session is available upon request to OER's Project Manager assigned to this Site, Horace Zhang, who can be contacted about these issues or any others questions, comments or concerns that arise during the remedial process at (212) 788-8841

Project Contact List. OER has established a Site Contact List for this project to provide public notices in the form of Fact Sheets to interested members of the Community. Communications will include updates on important information relating to the progress of the cleanup program at the Site as well as to request public comments on the cleanup plan. The Project Contact List includes owners and occupants of adjacent buildings and homes, principal administrators of nearby schools, hospitals and day care centers, the public water supplier that serves the area, established document repositories, the representative Community Board, City Council members, other elected representatives and any local Brownfield Opportunity Area (BOA) grantee organizations. Any member of the public or organization will be added to the Site Contact List on request. A copy of the Site Contact List is maintained by OER's Project

Manager. If you would like to be added to the Project Contact List, contact NYC OER at (212) 788-8841 or by email at brownfields@cityhall.nyc.gov.

Repositories. A document repository is maintained by OER and can be accessed online at the nearest public library. This document repository is intended to house, for community review, all principal documents generated during the cleanup program including Remedial Investigation plans and reports, Remedial Action work plans and reports, and all Public Notices and Fact Sheets produced during the lifetime of the remedial project. OER will inspect the repositories to ensure that they are fully populated with project information. The repository for this project is:

Brooklyn Public Library (Leonard Branch)

81 Devoe Street at Leonard Street

Brooklyn, NY 11211

718-486-3365

Mon 10-6pm; Tues 1-8pm; Wed 10-6pm; Thu 10-6pm; Fri 10-6pm; Sat 10-5pm and Sun Closed

Digital Documentation. NYC OER strongly encourages the use of digital documents in repositories as a means of minimizing paper use while also increasing convenience in access and ease of use.

Public Notice and Public Comment. Public Notice to all members of the Project Contact List is required at three major steps during the performance of the cleanup program (listed below) and at other points that may be required by OER. Notices will include Fact Sheets with descriptive project summaries, updates on recent and upcoming project activities, repository information, and important phone and email contact information. All notices will be prepared by Meekerman LLC, reviewed and approved by OER prior to distribution and mailed by Meekerman LLC. Public comment is solicited in Public Notices for all work plans developed under the NYC Voluntary Cleanup Program. Final review of all work plans by OER will consider all public comments. Approval will not be granted until the public comment period has been completed.

Citizen Participation Milestones. Public notice and public comment activities occur at several steps during a typical NYC VCP project. See flow chart on the following page, which identifies when during the NYC VCP public notices are issued: These steps include:

- **Public Notice of the availability of the Remedial Investigation Report and Remedial Action Work Plan and a 30-day public comment period on the Remedial Action Work Plan.**

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the availability of the Remedial Investigation Report and Remedial Action Work Plan and the initiation of a 30-day public comment period on the Remedial Action Work Plan. The Fact Sheet summarizes the findings of the RIR and provides details of the RAWP. The public comment period will be extended an additional 15 days upon public request. A public meeting or informational session will be conducted by OER upon request.

- **Public Notice announcing the approval of the RAWP and the start of remediation**

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the approval of the RAWP and the start of remediation.

- **Public Notice announcing the completion of remediation, designation of Institutional and Engineering Controls and issuance of the Notice of Completion**

Public notice in the form of a Fact Sheet is sent to all parties listed on the Site Contact List announcing the completion of remediation, providing a list of all Institutional and Engineering Controls implemented for to the Site and announcing the issuance of the Notice of Completion.

APPENDIX 2

SUSTAINABILITY STATEMENT

This Sustainability Statement documents sustainable activities and green remediation efforts planned under this remedial action.

Reuse of Clean, Recyclable Materials. Reuse of clean, locally-derived recyclable materials reduces consumption of non-renewable virgin resources and can provide energy savings and greenhouse gas reduction.

An estimate of the quantity (in tons) of clean, non-virgin materials (reported by type of material) reused under this plan will be quantified and reported in the RAR.

Reduce Consumption of Virgin and Non-Renewable Resources. Reduced consumption of virgin and non-renewable resources lowers the overall environmental impact of the project on the region by conserving these resources.

An estimate of the quantity (in tons) of virgin and non-renewable resources, the use of which will be avoided under this plan, will be quantified and reported in the RAR.

Recontamination Control. Recontamination after cleanup and redevelopment is completed undermines the value of work performed, may result in a property that is less protective of public health or the environment, and may necessitate additional cleanup work later or impede future redevelopment. Recontamination can arise from future releases that occur within the property or by influx of contamination from off-site.

Remediation will include a 20-mil vapor barrier in the area of the building foundation and a cover system including the building slab, demarcation barrier, concrete pavers, poured safety surface and a landscaped area.

An estimate of the area of the Site that utilizes recontamination controls under this plan will be reported in the RAR in square feet.

Storm-water Retention. Storm-water retention improves water quality by lowering the rate of combined storm-water and sewer discharges to NYC's sewage treatment plants during periods of precipitation, and reduces the volume of untreated influent to local surface waters.

The building will feature a detention tank to slow storm water drainage and a landscaped area in the rear yard which will retain water runoff from rain events.

An estimate of the enhanced storm-water retention capability of the redevelopment project will be included in the RAR.

Linkage with Green Building. Green buildings provide a multitude of benefits to the city across a broad range of areas, such as reduction of energy consumption, conservation of resources, and reduction in toxic materials use.

The redevelopment will meet the requirements of Enterprise Green communities 2011 with an HPD overlay.

Paperless Brownfield Cleanup Program. Meekerman LLC is participating in OER's Paperless Brownfield Cleanup Program. Under this program, submission of electronic documents will replace submission of hard copies for the review of project documents, communications and milestone reports.

Low-Energy Project Management Program. Meekerman LLC is participating in OER's low-energy project management program. Under this program, whenever possible, meetings are held using remote communication technologies, such as videoconferencing and teleconferencing to reduce energy consumption and traffic congestion associated with personal transportation.

Trees and Plantings. Trees and other plantings provide habitat and add to NYC's environmental quality in a wide variety of ways. Native plant species and native habitat provide optimal support to local fauna, promote local biodiversity, and require less maintenance.

Existing street trees will be marked and protected during construction and new trees will be provided in accordance with NYC DOB requirements. The landscaped rear yard will contain new outdoor plantings.

Meekerman LLC

RAWP

April 2015

An estimate of the land area that will be vegetated, including the number of trees planted or preserved, will be reported in square feet in the RAR.

APPENDIX 3

SOIL/MATERIALS MANAGEMENT PLAN

1.1 SOIL SCREENING METHODS

Visual, olfactory and PID soil screening and assessment will be performed under the supervision of a Qualified Environmental Professional and/or the site designee and will be reported in the RAR. Soil screening will be performed during invasive work performed during the remedy and development phases prior to issuance of the Notice of Completion.

1.2 STOCKPILE METHODS

Excavated soil from suspected areas of contamination (e.g., hot spots, USTs, drains, etc.) will be stockpiled separately and will be segregated from clean soil and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. Soils that are exhibiting visual or olfactory contamination will be stockpiled on, at minimum, double layers of 8-mil minimum sheeting, will be kept covered at all times with appropriately anchored plastic tarps, and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

1.3 CHARACTERIZATION OF EXCAVATED MATERIALS

Soil/fill or other excavated media that is transported off-site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Soils proposed for reuse on-site will be managed as defined in this plan.

1.4 MATERIALS EXCAVATION, LOAD-OUT AND DEPARTURE

The PE/QEP and/or the trained designee overseeing the remedial action will:

- oversee remedial work and the excavation and load-out of excavated material;
- ensure that there is a party responsible for the safe execution of invasive and other work performed under this work plan;
- ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in this RAWP;
- ensure that the presence of utilities and easements on the Site has been investigated and that any identified risks from work proposed under this plan are properly addressed by appropriate parties;
- ensure that all loaded outbound trucks are inspected and cleaned if necessary before leaving the Site; and
- ensure that all egress points for truck and equipment transport from the Site will be kept clean of Site-derived materials during Site remediation.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to Site-derived materials.

Open and uncontrolled mechanical processing of historical fill and contaminated soil on-site will not be performed without prior OER approval.

1.5 OFF-SITE MATERIALS TRANSPORT

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364. If loads contain wet material capable of causing leakage from trucks, truck liners will be used. Queuing of trucks will be performed on-Site, when possible in order to minimize off Site disturbance. Off-site queuing will be minimized.

Outbound truck transport routes will avoid using local roadways by utilizing the neighboring thoroughfare, the Brooklyn Queens Expressway. This routing takes into account the following factors: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) minimizing off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport. To the extent possible, all trucks loaded with site materials will travel from the Site using these truck routes. Trucks will not stop or idle in the neighborhood after leaving the project Site.

1.6 MATERIALS DISPOSAL OFF-SITE

The following documentation will be established and reported by the PE/QEP for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms with applicable laws and regulations: (1) a letter from the PE/QEP or Enrollee to each disposal facility describing the material to be disposed and requesting written acceptance of the material. This letter will state that material to be disposed is regulated material generated at an environmental remediation Site in Brooklyn, New York under a governmental remediation program. The letter will provide the project identity and the name and phone number of the PE/QEP or Enrollee. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the RAR.

The Remedial Action Report will include an itemized account of the destination of all material removed from the Site during this remedial action. Documentation associated with disposal of all material will include records and approvals for receipt of the material. This information will be presented in the RAR.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated material and will be disposed in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-Site will be handled as solid waste and will not be disposed at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Waste characterization will be performed for off-Site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be reported in the RAR. A manifest system for off-Site transportation of exported materials will be employed. Manifest information will be reported in the RAR. Hazardous wastes derived from on-Site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

1.7 MATERIALS REUSE ON-SITE

Soil and fill that is derived from the property that meets the soil cleanup objectives established in this plan may be reused on-site. The soil cleanup objectives for on-Site reuse are listed in Section 4.2 of the RAWP. 'Reuse on-Site' means material that is excavated during the remedy or development, does not leave the property, and is relocated within the same Property and on comparable soil/fill material, and addressed pursuant to the NYC VCP agreement subject to Engineering and Institutional Controls. The PE/QEP will ensure that reused materials are segregated from other materials to be exported from the Site and that procedures defined for material reuse in this RAWP are followed.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing of the Site will not be buried on-site. Soil or fill excavated from the Site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

1.8 DEMARCATION

After completion of hotspot removal and any other invasive remedial activities, and prior to backfilling, the top of the residual soil/fill will be defined by one of three methods: (1) placement of a demarcation layer. The demarcation layer will consist of geosynthetic fencing or equivalent material to be placed on the surface of residual soil/fill to provide an observable reference layer. A description or map of the approximate depth of the demarcation layer will be provided in the SMP; or (2) a land survey of the top elevation of residual soil/fill before the placement of cover soils, pavement and associated sub-soils, or other materials or structures or, (3) all materials beneath the approved cover will be considered impacted and subject to site management after the remedy is complete. Demarcation may be established by one or any combination of these three methods. As appropriate, a map showing the method of demarcation for the Site and all associated documentation will be presented in the RAR.

This demarcation will constitute the top of the site management horizon. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan.

1.9 IMPORT OF BACKFILL SOIL FROM OFF-SITE SOURCES

It is not anticipated at this time that the development will need to import backfill from off-site sources. In the event importation of backfill is needed, this Section presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. All imported soil for use as clean soil cover will be uncontaminated, clean soil that meets the lesser of the NYSDEC 6 NYCRR Part 375-6.8(a) Restricted Residential Use SCOs and the NYSDEC 6 NYCRR Part 375-6.8 groundwater protection SCOs.

A process will be established to evaluate sources of backfill and cover soil to be imported to the Site, and will include an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations.
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations.
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the regulations of NYS DEC.
- Quarry sand and/or gravel.

All materials received for import to the Site will be approved by a PE/QEP and will be in compliance with provisions in this RAWP. The RAR will report the source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed.

Source Screening and Testing

Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:

- Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
- The PE/QEP is responsible to ensure that every truck load of imported material is inspected for evidence of contamination; and
- Fill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets

imported backfill or cover soil chemical requirements and is non-hazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the RAR. A PE/QEP is responsible to ensure that the facility is compliant with 6NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. RCA imported to the Site must be derived from recognizable and uncontaminated concrete. RCA material is not acceptable for, and will not be used as cover material.

1.10 FLUIDS MANAGEMENT

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations. Liquids discharged into the New York City sewer system will receive prior approval by New York City Department of Environmental Protection (NYC DEP). The NYC DEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYC DEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal at an off-site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a SPDES permit issued by New York State Department of Environmental Conservation.

1.11 STORM-WATER POLLUTION PREVENTION

Applicable laws and regulations pertaining to storm-water pollution prevention will be addressed during the remedial program. Erosion and sediment control measures identified in this RAWP (silt fences and barriers, and hay bale checks) will be installed around the entire

perimeter of the remedial construction area and inspected once a week and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective in preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by OER. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged due to weathering.

1.12 CONTINGENCY PLAN

This contingency plan is developed for the remedial construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to OER's Project Manager. Petroleum spills will be reported to the NYS DEC Spill Hotline. These findings will be included in the daily report. If previously unidentified contaminant sources are found during on-site remedial excavation or development-related excavation, sampling will be performed on contaminated source material and surrounding soils and reported to OER. Chemical analytical testing will be performed for TAL metals, TCL volatiles and semi-volatiles, TCL pesticides and PCBs, as appropriate.

1.13 ODOR, DUST AND NUISANCE CONTROL

Odor Control

If elevated PID readings occur during the regular course of air monitoring, all necessary means will be employed to prevent on- and off-site odor nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) use of foams to cover exposed odorous soils. If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include: (d)

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

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. OER will be notified of all odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying the Remedial Action Report.

Dust Control

Dust management during invasive on-Site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. OER will be notified of all dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's responsible for certifying the Remedial Action Report.

Other Nuisances

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

Meekerman LLC

RAWP

April 2015

Rodent control will be provided, during Site clearing and grubbing, and during the remedial program, as necessary, to prevent nuisances.

APPENDIX 4

Construction Health and Safety Plan



Construction Health & Safety Plan

**Meekerman
402 Meeker Avenue and 406-408 Manhattan Avenue
Brooklyn, New York 11222**

February 2015

Prepared for:

**Meekerman, LLC
316 Douglass Street, 2nd Floor
Brooklyn, NY 11217**

Prepared by:

**CA RICH CONSULTANTS, INC.
17 Dupont Street
Plainview, New York 11803-1614**

Construction Health & Safety Plan

Soil Excavation

406 Meeker Avenue and 406-408 Manhattan Avenue
Brooklyn, NY 11222
Block 2734; Lots 4, 5, and 7

1.0 INTRODUCTION

This Construction Health and Safety Plan ("CHASP") is developed for utilization during construction activities located at the above-referenced site in Brooklyn, New York (the Site or Property). The HASP is to be enforced by CA RICH's Project Health and Safety Manager, the on-site Health & Safety Coordinator (HSC) or their assignee. The on-site HSC will interact with the Project Manager and is vested with the authority to make field decisions including the termination of on-site activities if an imminent health and safety hazard, condition or related concern arises. Information and protocol in the CHASP is applicable to all on-site personnel who will be entering the designated work zone.

2.0 POTENTIAL HAZARDS

2.1 Chemical Hazards

The known chemicals or constituents of concern according to the Remedial Investigation Report (RIR) and the Phase II Subsurface Investigation prepared by Environmental Business Consultants, dated February 2014 consist of the metals; arsenic, barium, cadmium, copper, lead, and mercury and the SVOCs; benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno (1,2,3-cd)pyrene which were detected in Site soils above New York State Department of Environmental Conservation (NYSDEC) Part 375 guidance values.

During the construction activities, CA RICH will operate as if there is a potential hazard from the above-listed compounds. Physical properties and toxicological information is included in Appendix A.

2.2 Other Health & Safety Risks

Normal physical hazards associated with using excavation equipment and hand tools as well as hazards associated with adverse climatic conditions (heat & cold) or physical site-related debris represent a certain degree of risk to be assumed by on-site personnel.

Certain provisions in this Plan, specifically the use of personnel protective equipment, may tend to increase the risk of physical injury, as well as susceptibility to cold or heat stress. This is primarily due to restrictions in dexterity, hearing, sight, and normal body heat transfer inherent in the use of protective gear.

3.0 RISK MANAGEMENT

3.1 Work / Exclusion Zones

The subject Property currently a recently vacated warehouse. The buildings will soon be demolished. The Tax Map designation for the Property is Block 2734 and Lot(s) 4, 5, and 7. The project plans currently anticipate the excavation depth for the building to be 3 feet below grade. Additionally, the rear parking area excavation is anticipated to be between one foot for grading purposes. All work (including, but not limited to the grading and excavation) activities conducted will establish a work/exclusion zone. Access to this area will be limited to properly trained, properly protected personnel directly involved with the work. Enforcement of the work/exclusion zone boundaries is the responsibility of the on-site Health & Safety Coordinator (HSC) or his/her properly trained assignee.

3.2 Personnel Protection

Health & Safety regulatory personnel have developed different levels of personnel protection to deal with differing degrees of potential risks of exposure to chemical constituents. The levels are designated as **A**, **B**, **C**, and **D** and are ranked according to the amount of personnel protection afforded by each level. Level **A** is the highest level of protection and Level **D** is the lowest level of protection.

The different levels are primarily dependent upon the degree of respiratory protection necessary, in conjunction with appropriate protective clothing. Levels of protection mandate a degree of respiratory protection. However, flexibility exists within the lower levels (B, C, and D) concerning proper protective clothing.

The four levels of protection were developed for utilization in situations which involve suspected or known atmospheric and/or environmental hazards including airborne contamination and skin-affecting substances. It is anticipated that all of the work will be performed using Level D protection (no respiratory protection with protective clothing requirements limited to long sleeved shirts, long pants or coveralls, work gloves and leather work boots).

Level D may be modified by the HSC to include protective clothing or equipment (Saran-coated disposable coveralls or PVC splash suits, safety glasses, hard hat with face shield, and chemically resistant boots) based upon physical hazards, skin contact concerns, and real-time monitoring.

Real-time air monitoring for total airborne organics using either an Organic Vapor Analyzer (OVA) or a Photo-Ionization Detector (PID) will determine if and when an upgrade from Level D to a higher level of respiratory protection is warranted. Decisions for an upgrade from Level D to higher levels of protection, mitigative actions, and/or suspension of work are the responsibility of the Project Manager and/or the designated on-site HSC.

3.3 Air Monitoring

The HSC or his/her properly trained assignee will conduct "Real Time" air monitoring for total organic vapors and total particulates. 'Real-time' monitoring refers to the utilization of instrumentation, which yields immediate measurements. The utilization of real time monitoring helps determine immediate or long-term risks to on-site personnel and the general public, the appropriate level of personnel respiratory protection necessary, and actions to mitigate the recognized hazard.

3.3.1. Particulate Monitoring

A. Instrumentation

Dust particulates in air will be monitored using a light scattering technique MINIRAM Model PDM-3 Miniature Real-time Aerosol Monitor (MINIRAM) or equivalent. The MINIRAM is capable of measuring airborne dust particles within the range of 10 to 100,000 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). Particulate monitoring will only be necessary during major excavation activities.

B. Application

Dust monitoring will occur at regular intervals during major excavation activities. Monitoring will be conducted in upgradient and downgradient locations, relative to prevailing wind direction) along the perimeter of the work zone. The HSC or his assignee will perform the monitoring. As outlined in the NYSDOH Community Air Monitoring Plan, if particulate levels in the downwind location are $150 \text{ mg}/\text{m}^3$ greater than those measured in the upwind location, dust suppression techniques shall be employed.

3.3.2 Organic Vapor

A. Instrumentation

Real-time monitoring for total organic vapor (TOV) utilizes either a PID or flame ionization detector (FID). The appropriate PID is an intrinsically safe HNU Systems Model PI-101, MiniRae PID or equivalent, which is factory calibrated to benzene. The appropriate FID is a Foxboro model 128 OVA or equivalent, which is factory calibrated to methane.

B. Application

Organic vapor monitoring is performed as outlined in the NYSDOH Community Air Monitoring Plan. Specifically, monitoring shall be conducted at the downwind perimeter of the work zone periodically during work activities. If TOV levels exceed 5 milligrams per meter cubed (mg/m^3) above established pre-work background levels, work activities will be halted and monitoring will be continued under the provision of a Vapor Emission Response Plan (outlined in Section 5).

3.4 Worker Training

Personnel overseeing the excavation of the contaminated soil will be properly trained. This includes the Health & Safety Coordinator and the Project Health and Safety Manager.

Prior to any work, all workers involved with the project should be aware of the potential chemical, physical and biological hazards discussed in this document, as well as the general safety practices outlined below. A safety briefing by the on-site HSC and/or assistant assignee shall take place at the outset of work activities.

The HSC will be available to address environmentally-related health & safety issues a site worker (such as an equipment operator or laborer) may have regarding the site conditions. Once an issue is brought to the HCS's attention, he or she will evaluate the issue and apply the procedures outlined in this Health & Safety Plan.

3.5 General Safety Practices

The following safety practices shall be followed by all project personnel.

1. Avoid unnecessary skin exposure to subsurface materials. Sleeved shirts tucked into long pants (or coveralls), work gloves, and steel-toe leather work boots are required unless modified gear is approved by the HSC. Remove any excess residual soil from clothes prior to leaving the site.
2. No eating, drinking, gum or tobacco chewing, or smoking allowed in designated work areas. Thoroughly wash hands prior to these activities outside the work area. Avoid sitting on the ground during breaks or while eating and drinking. Thoroughly wash all exposed body areas at the end of the workday.
3. Some symptoms of acute exposure include: dizziness, light-headedness, drowsiness, headache, and nose/eye/skin irritation. If these symptoms are experienced or strong odor is detected, leave the work area and immediately report the incident to the on-site HSC.

3.6 Enforcement

Enforcement of the Site Safety Plan will be the responsibility of the HSC or the assignee. The Coordinator should be on-site as needed, based on the work being performed and performs or directly oversees all aspects of the Health & Safety Plan including: air monitoring; environmental mitigation; personnel respiratory and skin protection; general safety practices; documentation; emergency procedures and protocol; and reporting and recordkeeping as described below.

3.7 Reporting & Recordkeeping

Incidents involving injury, symptoms of exposure, discovery of potentially hazardous materials, or unsafe work practices and/or conditions should be immediately reported to the HSC.

A logbook must be maintained on-site to document all aspects of HASP enforcement. The log is paginated and dated with entries made on a daily basis in waterproof ink, initialed by the HSC or assignee. Log entries should include date and time of instrument monitoring, instrument type, measurement method, test results, calibration and maintenance information, as well as appropriate mitigative actions responding to detections. Miscellaneous information to be logged may include weather conditions, reported complaints or symptoms, regulatory inspections, and reasons to upgrade personnel protection above the normal specification (Level D).

3.8 Mitigative Measures

The primary mitigative measure anticipated for this project is dust suppression. Prior to commencing work each day, the excavation contractor should attach a hose to a nearby fire hydrant and attach a spray nozzle to the hose. This should be used to hose down trucks as they leave the Site and to set up a misting operation when excavating soil on dry days. The excavation contractor must obtain the necessary hydrant permit.

4.0 EMERGENCIES

4.1 EMERGENCY RESPONSE SERVICES

- | | | |
|-----|--|-----------------------|
| (1) | HOSPITAL
Woodhull Medical Center
760 Broadway
Brooklyn, NY 11206 | (718) 963-8000 |
| (2) | AMBULANCE | 911 |
| (3) | FIRE DEPARTMENT
HAZARDOUS MATERIALS | 911 |
| (4) | POLICE DEPARTMENT | 911 |
| (5) | POISON CONTROL CENTER | (800) 222-1222 |

The preceding list and associated attached map (Figure 1) illustrating the fastest route to the nearest hospital must be conspicuously posted in areas of worker congregation and adjacent to all on-site telephones (if any).

4.2 EMERGENCY PROCEDURES

4.2.1 Contact or Exposure to Suspected Hazardous Materials

In the event of a fire, chemical discharge, medical emergency, workers are instructed to immediately notify the HSC and proper emergency services (posted). Should physical contact with unknown or questionable materials occur, immediately wash the affected body areas with clean water and notify the HSC. Anyone experiencing symptoms of exposure should exit the work area, notify the HSC, and seek medical attention.

4.2.2 Ingress/egress

Clear paths of ingress/egress to work zones and site entrances/exits must be maintained at all times. Unauthorized personnel are restricted from accessing the site.

5.0 COMMUNITY AIR MONITORING PLAN

Real-time air monitoring, for volatile compounds and particulate levels at the perimeter of the work area is necessary. This plan includes the following:

- Volatile organic compounds must be monitored at the downwind perimeter of the work area on a continuous basis. If total organic vapor levels exceed 5 ppm above background, work activities must be halted and monitoring continued under the provisions of a Vapor Emission Response Plan. All readings must be recorded and be available for regulatory personnel to review.
- Particulates should be continuously monitored upwind, downwind and within the work area at temporary particulate monitoring stations during excavation activities. If the downwind particulate level is 150 $\mu\text{g}/\text{m}^3$ greater than the upwind particulate level, then dust suppression techniques must be employed. All readings must be recorded and be available for regulatory personnel to review.

Vapor Emissions Response Plan

If the ambient air concentration of organic vapors exceeds 5 ppm above background at the perimeter of the work area, activities will be halted and monitoring continued. If the organic vapor level decreases below 5 ppm above background, work activities can resume. If the organic vapor levels are greater than 5 ppm over background but less than 25 ppm over background at the perimeter of the work area, activities can resume provided:

- The organic vapor level 200 ft. downwind of the work area or half the distance to the nearest residential or commercial structure, whichever is less, is below 5 mg/m³ over background.

If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown. When work shutdown occurs, downwind air monitoring as directed by the Safety Officer will be implemented to ensure that vapor emission does not impact the nearest residential or commercial structure at levels exceeding those specified in the Major Vapor Emission section.

Major Vapor Emission

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work area or half the distance to the nearest residential or commercial property, whichever is less, the site soil will be misted with water and the downwind area will be monitored. If the water mist does not mitigate the elevated levels all work activities must be halted.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the work area, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 Foot Zone).

If efforts to abate the emission source are unsuccessful and, if organic vapor levels are approaching 5 ppm above background for more than 30 minutes in the 20 Foot Zone, then the Major Vapor Emission Response Plan shall automatically be placed into effect;

However, the Major Vapor Emission Response Plan shall be immediately placed into effect if organic vapor levels are greater than 10 ppm above background.

Major Vapor Emission Response Plan

Upon activation, the following activities will be undertaken:

1. All Emergency Response Contacts as listed in the Health & Safety Plan of the Remedial Action Plan will go into effect.
2. The local police authorities will immediately be contacted by the Safety Officer and advised of the situation.
3. Frequent air monitoring will be conducted at 30 minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the Safety Officer.

6.0 HEALTH & SAFETY PLAN REFERENCES

1. American Conference Governmental Industrial Hygienists, 1989; Threshold Limit Values and Biological Exposure Indices, 111 Pp.
2. Geoenvironmental Consultants, Inc.; 1987; Safety & Operations At Hazardous Materials Sites.
3. NIOSH Guide To Chemical Hazards, 2002, US Department Of Health And Human Services, Centers For Disease Control.
4. US Department Of Labor Occupational Safety & Health Administration, 1989; Hazardous Waste Operations And Emergency Response Interim Final Rule, 29 CFR Part 1910.
5. Sax, N. I. Dangerous Properties Of Industrial Materials; © 1984.

7.0 KEY PERSONNEL

<u>Responsibility</u>	<u>Name and Phone Number</u>	<u>Task Description</u>
Remedial Engineer	<u>Ravi Kolipara (631) 965-0181</u>	Oversee all technical aspects of the project
Project Manager	<u>Victoria Whelan (516) 576-8844</u>	Coordinate and facilitate implementation of all aspects of the project
Site Safety Officer	<u>William Fitchett (516) 576-8844</u>	Coordinate and inspect all health and safety operations from the project site
Site Contact	<u>Mark Zimet (718) 388-9407</u>	
Project Manager Alternate	<u>Richard Izzo (516) 576-8844</u>	
Site Safety Officer Alternate	<u>Victoria Whelan (516) 576-8844</u>	
Client Representative	<u>Mark Zimet (718) 388-9407</u>	

**Figure 1
Hospital Location & Directions**



Trip to:

760 Broadway

Brooklyn, NY 11206-5317

1.59 miles / 5 minutes

Estimated Fuel Cost: **\$.48**

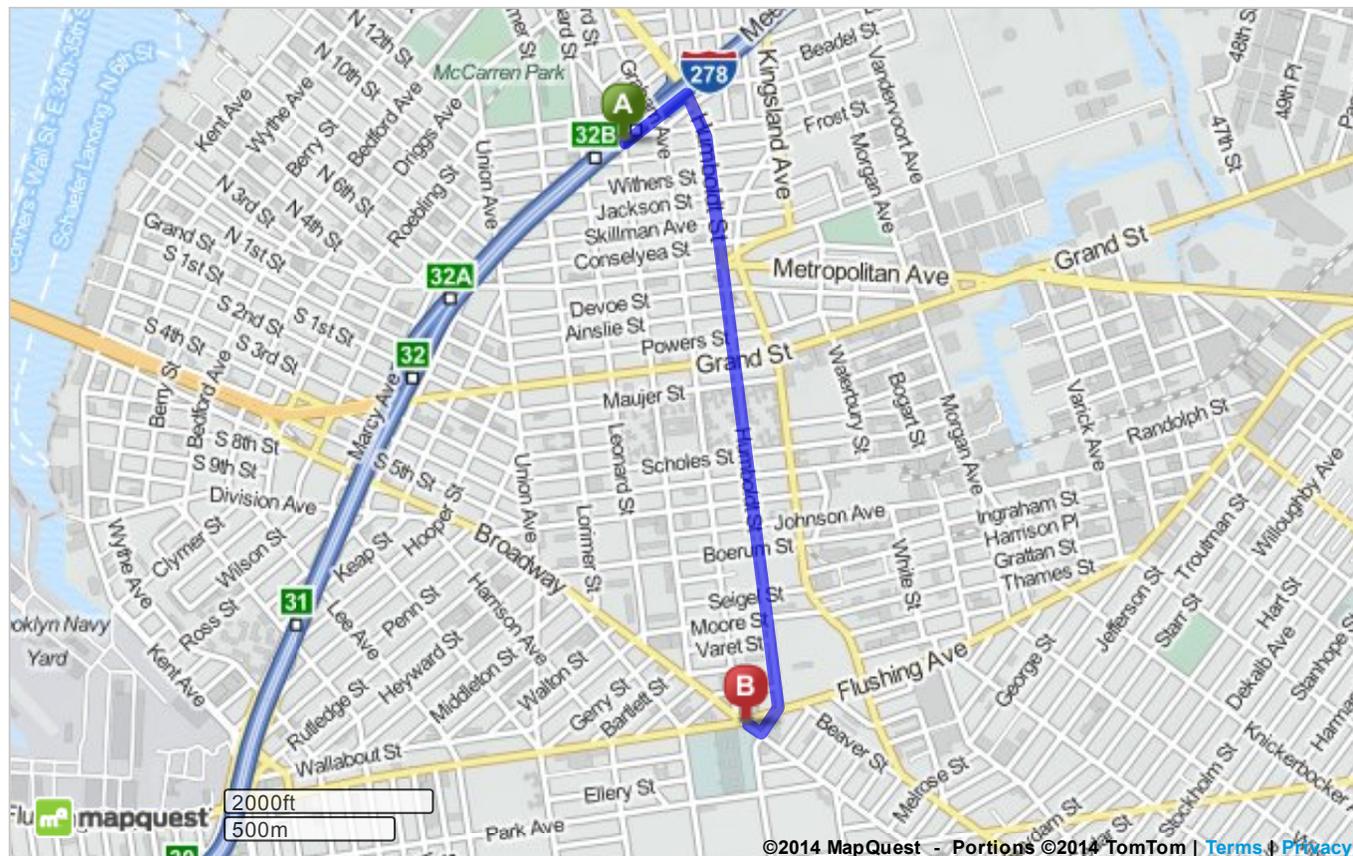
Notes

Figure 1

	406 Meeker Ave , Brooklyn, NY 11222-5012	Download Free App
	1. Start out going northeast on Meeker Ave toward Richardson St. Map	0.2 Mi <i>0.2 Mi Total</i>
	2. Turn right onto Humboldt St. Map <i>Humboldt St is just past Graham Ave Sunoco Gas Station is on the corner If you reach N Henry St you've gone a little too far</i>	1.3 Mi <i>1.5 Mi Total</i>
	3. Humboldt St becomes Sumner Pl. Map	0.07 Mi <i>1.6 Mi Total</i>
	4. Turn right onto Broadway. Map <i>Metro PCS is on the right If you are on Marcus Garvey Blvd and reach Ellery St you've gone a little too far</i>	0.03 Mi <i>1.6 Mi Total</i>
	5. 760 BROADWAY is on the left. Map <i>If you reach Flushing Ave you've gone a little too far</i>	
	760 Broadway , Brooklyn, NY 11206-5317	

Total Travel Estimate: **1.59 miles** - about **5 minutes**

Estimated Fuel Cost: **\$.48**



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APPENDIX A

Physical Properties and Toxicological Information



Search the Pocket Guide

SEARCH

Enter search terms separated by spaces.

Arsenic (inorganic compounds, as As)

Synonyms & Trade Names Arsenic metal: Arsenia

Other synonyms vary depending upon the specific As compound. [Note: OSHA considers "Inorganic Arsenic" to mean copper acetoarsenite and all inorganic compounds containing arsenic except ARSINE.]

CAS No. 7440-38-2 (metal)	RTECS No. CG0525000 (metal) (/niosh-rtecs/CG802C8.html)	DOT ID & Guide 1558 152 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=152) (http://www.cdc.gov/Other/disclaimer.html) (metal) 1562 152 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=152) (http://www.cdc.gov/Other/disclaimer.html) (dust)
Formula As (metal)	Conversion	IDLH Ca [5 mg/m ³ (as As)] See: 7440382 (/niosh/idlh/7440382.html)
Exposure Limits NIOSH REL : Ca C 0.002 mg/m ³ [15-minute] See Appendix A (nengapdx.html) OSHA PEL : [1910.1018] TWA 0.010 mg/m ³		Measurement Methods NIOSH 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 7900 (/niosh/docs/2003-154/pdfs/7900.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf); OSHA ID105 (http://www.osha.gov/dts/sltc/methods/inorganic/id105/id105.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Metal: Silver-gray or tin-white, brittle, odorless solid.

MW: 74.9	BP: Sublimes	MLT: 1135°F (Sublimes)	Sol: Insoluble	VP: 0 mmHg (approx)	IP: NA
Sp.Gr: 5.73 (metal)	Fl.P: NA	UEL: NA	LEL: NA		

Metal: Noncombustible Solid in bulk form, but a slight explosion hazard in the form of dust when exposed to flame.

Incompatibilities & Reactivities Strong oxidizers, bromine azide [Note: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.]

Exposure Routes inhalation, skin absorption, skin and/or eye contact, ingestion

Symptoms Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin, [potential occupational carcinogen]

Target Organs Liver, kidneys, skin, lungs, lymphatic system

Cancer Site [lung & lymphatic cancer]

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated/Daily
Remove: When wet or contaminated
Change: Daily
Provide: Eyewash, Quick drench

First Aid (See [procedures \(firstaid.html\)](#))
Eye: Irrigate immediately
Skin: Soap wash immediately
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations
 (See [Appendix E \(nengapdx.html\)](#))

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted acid gas canister having an N100, R100, or P100 filter.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0013 \(/niosh/ipcsneng/neng0013.html\)](#)
 See [MEDICAL TESTS: 0017 \(/niosh/docs/2005-110/nmed0017.html\)](#)

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Lead

Synonyms & Trade Names Lead metal, Plumbum

CAS No. 7439-92-1	RTECS No. OF7525000 (/niosh-rtecs/OF72D288.html)	DOT ID & Guide
Formula Pb	Conversion	IDLH 100 mg/m ³ (as Pb) See: 7439921 (/niosh/idlh/7439921.html)

Exposure Limits

NIOSH REL *: TWA (8-hour) 0.050 mg/m³ [See Appendix C \(nengapdxc.html\)](#) [*Note: The REL also applies to other lead compounds (as Pb) -- see Appendix C.]

OSHA PEL *: [1910.1025] TWA 0.050 mg/m³ [See Appendix C \(nengapdxc.html\)](#) [*Note: The PEL also applies to other lead compounds (as Pb) -- see Appendix C.]

Measurement Methods

NIOSH 7082 (</niosh/docs/2003-154/pdfs/7082.pdf>), **7105** (</niosh/docs/2003-154/pdfs/7105.pdf>), **7300** (</niosh/docs/2003-154/pdfs/7300.pdf>), **7301** (</niosh/docs/2003-154/pdfs/7301.pdf>), **7303** (</niosh/docs/2003-154/pdfs/7303.pdf>), **7700** (</niosh/docs/2003-154/pdfs/7700.pdf>), **7701** (</niosh/docs/2003-154/pdfs/7701.pdf>), **7702** (</niosh/docs/2003-154/pdfs/7702.pdf>), **9100** (</niosh/docs/2003-154/pdfs/9100.pdf>), **9102** (</niosh/docs/2003-154/pdfs/9102.pdf>), **9105** (</niosh/docs/2003-154/pdfs/9105.pdf>);

OSHA ID121
(<http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html>)
 (<http://www.cdc.gov/Other/disclaimer.html>), **ID125G**
(<http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html>)
 (<http://www.cdc.gov/Other/disclaimer.html>), **ID206**
(<http://www.osha.gov/dts/sltc/methods/inorganic/id206/id206.html>)
 (<http://www.cdc.gov/Other/disclaimer.html>)

See: [NMAM \(/niosh/docs/2003-154/\)](/niosh/docs/2003-154/) or [OSHA Methods \(http://www.osha.gov/dts/sltc/methods/index.html\)](http://www.osha.gov/dts/sltc/methods/index.html)
(<http://www.cdc.gov/Other/disclaimer.html>)

Physical Description A heavy, ductile, soft, gray solid.

MW: 207.2	BP: 3164°F	MLT: 621°F	Sol: Insoluble	VP: 0 mmHg (approx)	IP: NA
Sp.Gr: 11.34	Fl.P: NA	UEL: NA	LEL: NA		

Noncombustible Solid in bulk form.

Incompatibilities & Reactivities Strong oxidizers, hydrogen peroxide, acids



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Mercury compounds [except (organo) alkyls] (as Hg)

Synonyms & Trade Names Mercury metal: Colloidal mercury, Metallic mercury, Quicksilver
Synonyms of "other" Hg compounds vary depending upon the specific compound.

CAS No. 7439-97-6 (metal)

RTECS No.
OV4550000 (metal)
(/niosh-rtecs/OV456D7o.html)

DOT ID & Guide 2809 172 (<http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=172>)
(<http://www.cdc.gov/Other/disclaimer.html>) (metal)

Formula Hg
(metal)

Conversion

IDLH 10 mg/m³ (as Hg)
See: 7439976 (/niosh/idlh/7439976.html)

Exposure Limits

NIOSH REL :

Hg Vapor: TWA 0.05 mg/m³ [skin]
Other: C 0.1 mg/m³ [skin]

OSHA PEL † ([nengapdxg.html](http://www.nengapdxg.html)): TWA 0.1 mg/m³

Measurement Methods

NIOSH 6009  (/niosh/docs/2003-154/pdfs/6009.pdf);

OSHA ID140

(<http://www.osha.gov/dts/sltc/methods/inorganic/id140/id140.html>)
 (<http://www.cdc.gov/Other/disclaimer.html>)

See: **NMAM** (/niosh/docs/2003-154/) or **OSHA Methods**
(<http://www.osha.gov/dts/sltc/methods/index.html>)
(<http://www.cdc.gov/Other/disclaimer.html>)

Physical Description Metal: Silver-white, heavy, odorless liquid. [Note: "Other" Hg compounds include all inorganic & aryl Hg compounds except (organo) alkyls.]

MW:
200.6

BP:
674°F

FRZ:
-38°F

Sol:
Insoluble

VP: 0.0012 mmHg

IP: ?

Sp.Gr:
13.6
(metal)

Fl.P:
NA

UEL:
NA

LEL: NA

Metal: Noncombustible Liquid

Incompatibilities & Reactivities Acetylene, ammonia, chlorine dioxide, azides, calcium (amalgam formation), sodium carbide, lithium, rubidium, copper

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria

Target Organs Eyes, skin, respiratory system, central nervous system, kidneys

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))

Skin: Prevent skin contact

Eyes: No recommendation

Wash skin: When contaminated

Remove: When wet or contaminated

Change: Daily

First Aid (See [procedures \(firstaid.html\)](#))

Eye: Irrigate immediately

Skin: Soap wash promptly

Breathing: Respiratory support

Swallow: Medical attention immediately

Respirator Recommendations

Mercury vapor:

NIOSH

Up to 0.5 mg/m³:

(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern[†]

(APF = 10) Any supplied-air respirator

Up to 1.25 mg/m³:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern[†](canister)

Up to 2.5 mg/m³:

(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern[†]

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern[†]

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern(canister)

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m³:

(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

Any appropriate escape-type, self-contained breathing apparatus

Other mercury compounds: NIOSH/OSHA

Up to 1 mg/m³:

(APF = 10) Any chemical cartridge respirator with cartridge(s) providing protection against the compound of concern[†]

(APF = 10) Any supplied-air respirator

Up to 2.5 mg/m³:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode

(APF = 25) Any powered, air-purifying respirator with cartridge(s) providing protection against the compound of concern†(canister)

Up to 5 mg/m³:

(APF = 50) Any chemical cartridge respirator with a full facepiece and cartridge(s) providing protection against the compound of concern†

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern†

(APF = 50) Any supplied-air respirator that has a tight-fitting facepiece and is operated in a continuous-flow mode

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and cartridge(s) providing protection against the compound of concern(canister)

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

Up to 10 mg/m³:

(APF = 1000) Any supplied-air respirator operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against the compound of concern

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0056](#)

[\(/niosh/ipcsneng/neng0056.html\)](#) See MEDICAL TESTS: [0136 \(/niosh/docs/2005-110/nmed0136.html\)](#)

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Chromium metal

Synonyms & Trade Names Chrome, Chromium

CAS No. 7440-47-3	RTECS No. GB4200000 (/niosh-rtecs/GB401640.html)	DOT ID & Guide
Formula Cr	Conversion	IDLH 250 mg/m ³ (as Cr) See: 7440473 (/niosh/idlh/7440473.html)
Exposure Limits NIOSH REL : TWA 0.5 mg/m ³ See Appendix C (nengapdx.html) OSHA PEL *: TWA 1 mg/m ³ See Appendix C (nengapdx.html) [*Note: The PEL also applies to insoluble chromium salts.]		Measurement Methods NIOSH 7024 (/niosh/docs/2003-154/pdfs/7024.pdf), 7300 (/niosh/docs/2003-154/pdfs/7300.pdf), 7301 (/niosh/docs/2003-154/pdfs/7301.pdf), 7303 (/niosh/docs/2003-154/pdfs/7303.pdf), 9102 (/niosh/docs/2003-154/pdfs/9102.pdf) ; OSHA ID121 http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html (http://www.cdc.gov/Other/disclaimer.html), ID125G http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods http://www.osha.gov/dts/sltc/methods/index.html http://www.cdc.gov/Other/disclaimer.html

Physical Description Blue-white to steel-gray, lustrous, brittle, hard, odorless solid.

MW: 52.0	BP: 4788°F	MLT: 3452°F	Sol: Insoluble	VP: 0 mmHg (approx)	IP: NA
Sp.Gr: 7.14	Fl.P: NA	UEL: NA	LEL: NA		

Noncombustible Solid in bulk form, but finely divided dust burns rapidly if heated in a flame.

Incompatibilities & Reactivities Strong oxidizers (such as hydrogen peroxide), alkalis

Exposure Routes inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin; lung fibrosis (histologic)

Target Organs Eyes, skin, respiratory system

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))

Skin: No recommendation

Eyes: No recommendation

Wash skin: No recommendation

Remove: No recommendation

Change: No recommendation

First Aid (See [procedures \(firstaid.html\)](#))

Eye: Irrigate immediately

Skin: Soap wash

Breathing: Respiratory support

Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

Up to 2.5 mg/m³:

(APF = 5) Any quarter-mask respirator.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.*

Up to 5 mg/m³:

(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.*

(APF = 10) Any supplied-air respirator*

Up to 12.5 mg/m³:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.*

Up to 25 mg/m³:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

Up to 250 mg/m³:

(APF = 2000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](/niosh/npg/pgintrod.html) See ICSC CARD: [0029 \(/niosh/ipcsneng/neng0029.html\)](/niosh/ipcsneng/neng0029.html)

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Chromium(III) compounds (as Cr)

Synonyms & Trade Names Synonyms vary depending upon the specific Chromium(III) compound. [Note: Chromium(III) compounds include soluble chromic salts.]

CAS No.	RTECS No.	DOT ID & Guide
	Conversion	IDLH 25 mg/m ³ [as Cr(III)] See: cr3m3 (/niosh/idlh/cr3m3.html)
Exposure Limits NIOSH REL : TWA 0.5 mg/m ³ See Appendix C (nengapdxc.html) OSHA PEL : TWA 0.5 mg/m ³ See Appendix C (nengapdxc.html)		Measurement Methods NIOSH 7024  (/niosh/docs/2003-154/pdfs/7024.pdf), 7300  (/niosh/docs/2003-154/pdfs/7300.pdf), 7301  (/niosh/docs/2003-154/pdfs/7301.pdf), 7303  (/niosh/docs/2003-154/pdfs/7303.pdf), 9102  (/niosh/docs/2003-154/pdfs/9102.pdf) ; OSHA ID121 http://www.osha.gov/dts/sltc/methods/inorganic/id121/id121.html  (http://www.cdc.gov/Other/disclaimer.html), ID125G http://www.osha.gov/dts/sltc/methods/inorganic/id125g/id125g.html  (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods http://www.osha.gov/dts/sltc/methods/index.html  http://www.cdc.gov/Other/disclaimer.html

Physical Description Appearance and odor vary depending upon the specific compound.

Properties vary depending upon the specific compound.				

Incompatibilities & Reactivities Varies**Exposure Routes** inhalation, ingestion, skin and/or eye contact

Symptoms irritation eyes; sensitization dermatitis

Target Organs Eyes, skin

Personal

Protection/Sanitation (See [protection codes](#) ([protect.html](#)))

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: No recommendation

First Aid (See [procedures](#) ([firstaid.html](#)))

Eye: Irrigate immediately

Skin: Water flush promptly

Breathing: Respiratory support

Swallow: Medical attention immediately

Respirator Recommendations

NIOSH/OSHA

Up to 2.5 mg/m³:

(APF = 5) Any quarter-mask respirator.

[Click here](#) ([pgintrod.html#nrp](#)) for information on selection of N, R, or P filters.*

Up to 5 mg/m³:

(APF = 10) Any particulate respirator equipped with an N95, R95, or P95 filter (including N95, R95, and P95 filtering facepieces) except quarter-mask respirators. The following filters may also be used: N99, R99, P99, N100, R100, P100.

[Click here](#) ([pgintrod.html#nrp](#)) for information on selection of N, R, or P filters.*

(APF = 10) Any supplied-air respirator*

Up to 12.5 mg/m³:

(APF = 25) Any supplied-air respirator operated in a continuous-flow mode*

(APF = 25) Any powered, air-purifying respirator with a high-efficiency particulate filter.*

Up to 25 mg/m³:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

[Click here](#) ([pgintrod.html#nrp](#)) for information on selection of N, R, or P filters.

(APF = 50) Any powered, air-purifying respirator with a tight-fitting facepiece and a high-efficiency particulate filter*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

(APF = 50) Any supplied-air respirator with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-

contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator with an N100, R100, or P100 filter.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See [MEDICAL TESTS: 0052 \(/niosh/docs/2005-110/nmed0052.html\)](#)

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Benzene

Synonyms & Trade Names Benzol, Phenyl hydride

CAS No. 71-43-2	RTECS No. CY1400000 (/niosh-rtecs/CY155CCo.html)	DOT ID & Guide 1114 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula C ₆ H ₆	Conversion 1 ppm = 3.19 mg/m ³	IDLH Ca [500 ppm] See: 71432 (/niosh/idlh/71432.html)

Exposure Limits

NIOSH REL : Ca TWA 0.1 ppm ST 1 ppm See [Appendix A \(nengapdx.html\)](http://nengapdx.html)
OSHA PEL : [1910.1028] TWA 1 ppm ST 5 ppm See [Appendix F \(nengapdx.html\)](http://nengapdx.html)

Measurement Methods

NIOSH 1500 ([/niosh/docs/2003-154/pdfs/1500.pdf](http://niosh/docs/2003-154/pdfs/1500.pdf)), **1501** ([/niosh/docs/2003-154/pdfs/1501.pdf](http://niosh/docs/2003-154/pdfs/1501.pdf)), **3700** ([/niosh/docs/2003-154/pdfs/3700.pdf](http://niosh/docs/2003-154/pdfs/3700.pdf)), **3800** ([/niosh/docs/2003-154/pdfs/3800.pdf](http://niosh/docs/2003-154/pdfs/3800.pdf));
OSHA 12
(<http://www.osha.gov/dts/sltc/methods/organic/org012/org012.html>)
 (<http://www.cdc.gov/Other/disclaimer.html>), **1005**
(<http://www.osha.gov/dts/sltc/methods/validated/1005/1005.html>)
 (<http://www.cdc.gov/Other/disclaimer.html>)
See: **NMAM** ([/niosh/docs/2003-154/](http://niosh/docs/2003-154/)) or **OSHA Methods**
(<http://www.osha.gov/dts/sltc/methods/index.html>)
(<http://www.cdc.gov/Other/disclaimer.html>)

Physical Description Colorless to light-yellow liquid with an aromatic odor. [Note: A solid below 42°F.]

MW: 78.1	BP: 176°F	FRZ: 42°F	Sol: 0.07%	VP: 75 mmHg	IP: 9.24 eV
Sp.Gr: 0.88	Fl.P: 12°F	UEL: 7.8%	LEL: 1.2%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers, many fluorides & perchlorates, nitric acid

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude (weakness, exhaustion); dermatitis; bone marrow depression; [potential occupational carcinogen]

Target Organs Eves. skin. respiratory system. blood. central nervous system. bone marrow

Cancer Site [leukemia]**Personal Protection/Sanitation** (See [protection codes \(protect.html\)](#))**Skin:** Prevent skin contact**Eyes:** Prevent eye contact**Wash skin:** When contaminated**Remove:** When wet (flammable)**Change:** No recommendation**Provide:** Eyewash, Quick drench**First Aid** (See [procedures \(firstaid.html\)](#))**Eye:** Irrigate immediately**Skin:** Soap wash immediately**Breathing:** Respiratory support**Swallow:** Medical attention immediately**Respirator Recommendations**(See [Appendix E \(nengapdx.html\)](#))**NIOSH****At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0015 \(/niosh/ipcsneng/nengo015.html\)](#) See MEDICAL TESTS: [0022 \(/niosh/docs/2005-110/nmed0022.html\)](#)

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Ethyl benzene

Synonyms & Trade Names Ethylbenzol, Phenylethane

CAS No. 100-41-4	RTECS No. DAO700000 (/niosh- rtecs/DAAAE60.html)	DOT ID & Guide 1175 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula CH ₃ CH ₂ C ₆ H ₅	Conversion 1 ppm = 4.34 mg/m ³	IDLH 800 ppm [10%LEL] See: 100414 (/niosh/idlh/100414.html)
Exposure Limits NIOSH REL : TWA 100 ppm (435 mg/m ³) ST 125 ppm (545 mg/m ³) OSHA PEL † (nengapdxg.html): TWA 100 ppm (435 mg/m ³)		Measurement Methods NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf); OSHA 7 (http://www.osha.gov/dts/sltc/methods/organic/org001/org001.html) (http://www.cdc.gov/Other/disclaimer.html), 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor.

MW: 106.2	BP: 277°F	FRZ: -139°F	Sol: 0.01%	VP: 7 mmHg	IP: 8.76 eV
Sp.Gr: 0.87	Fl.P.: 55°F	UEL: 6.7%	LEL: 0.8%		

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers**Exposure Routes** inhalation, ingestion, skin and/or eye contact**Symptoms** irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma**Target Organs** Eyes, skin, respiratory system, central nervous system**Personal Protection/Sanitation** (See [protection codes \(protect.html\)](http://www.cdc.gov/Other/disclaimer.html))**Skin:** Prevent skin contact**Eyes:** Prevent eye contact**Wash skin:** When contaminated**Remove:** When wet (flammable)**Change:** No recommendation**First Aid** (See [procedures \(firstaid.html\)](http://www.cdc.gov/Other/disclaimer.html))**Eye:** Irrigate immediately**Skin:** Water flush promptly**Breathing:** Respiratory support**Swallow:** Medical attention immediately

Respirator Recommendations**NIOSH/OSHA****Up to 800 ppm:**

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0268 \(/niosh/ipcsneng/nengo268.html\)](#)

See MEDICAL TESTS: [0098 \(/niosh/docs/2005-110/nmed0098.html\)](#)

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m-Xylene

Synonyms & Trade Names 1,3-Dimethylbenzene; meta-Xylene; m-Xylol

CAS No. 108-38-3

RTECS No.
[ZE2275000 \(/niosh-rtecs/ZE22B6B8.html\)](#)

DOT ID & Guide 1307 130 (<http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130>) [☒](http://www.cdc.gov/Other/disclaimer.html)

Formula C₆H₄(CH₃)₂

Conversion 1 ppm =
4.34 mg/m³

IDLH 900 ppm
See: [95476 \(/niosh/idlh/95476.html\)](#)

Exposure Limits

NIOSH REL : TWA 100 ppm (435 mg/m³)
ST 150 ppm (655 mg/m³)
OSHA PEL † ([nengapdxg.html](#)): TWA 100 ppm
(435 mg/m³)

Measurement Methods

NIOSH 1501 [☒](#) ([/niosh/docs/2003-154/pdfs/1501.pdf](#)),
3800 [☒](#) ([/niosh/docs/2003-154/pdfs/3800.pdf](#));
OSHA 1002
(<http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html>)
[☒](http://www.cdc.gov/Other/disclaimer.html) (<http://www.cdc.gov/Other/disclaimer.html>)
See: **NMAM** ([/niosh/docs/2003-154/](#)) or **OSHA Methods**
(<http://www.osha.gov/dts/sltc/methods/index.html>) [☒](http://www.cdc.gov/Other/disclaimer.html)
(<http://www.cdc.gov/Other/disclaimer.html>)

Physical Description Colorless liquid with an aromatic odor.

MW:
106.2

BP:
282°F

FRZ:
-54°F

Sol:
Slight

VP: 9 mmHg

IP: 8.56 eV

Sp.Gr:
0.86

Fl.P:
82°F

UEL:
7.0%

LEL:
1.1%

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet (flammable)

First Aid (See [procedures \(firstaid.html\)](#))

Eye: Irrigate immediately

Skin: Soap wash promptly

Breathing: Respiratory support

Swallow: Medical attention immediately

Change: No recommendation

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0085 \(/niosh/ipcsneng/neng0085.html\)](#)

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o-Xylene

Synonyms & Trade Names 1,2-Dimethylbenzene; ortho-Xylene; o-Xylol

CAS No. 95-47-6	RTECS No. ZE2450000 (/niosh-rtecs/ZE256250.html)	DOT ID & Guide 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula C ₆ H ₄ (CH ₃) ₂	Conversion 1 ppm = 4.34 mg/m ³	IDLH 900 ppm See: 95476 (/niosh/idlh/95476.html)
Exposure Limits NIOSH REL : TWA 100 ppm (435 mg/m ³) ST 150 ppm (655 mg/m ³) OSHA PEL † (nengapdxg.html): TWA 100 ppm (435 mg/m ³)		Measurement Methods NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf); OSHA 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor.

MW: 106.2	BP: 292°F	FRZ: -13°F	Sol: 0.02%	VP: 7 mmHg	IP: 8.56 eV
Sp.Gr: 0.88	Fl.P: 90°F	UEL: 6.7%	LEL: 0.9%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet (flammable)

First Aid (See [procedures \(firstaid.html\)](#))

Eye: Irrigate immediately

Skin: Soap wash promptly

Breathing: Respiratory support

Swallow: Medical attention immediately

RECOMMENDATION: (See text)

Change: No recommendation

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0084 \(/niosh/ipcsneng/neng0084.html\)](#)

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p-Xylene

Synonyms & Trade Names 1,4-Dimethylbenzene; para-Xylene; p-Xylol

CAS No. 106-42-3	RTECS No. ZE2625000 (/niosh-rtecs/ZE280DE8.html)	DOT ID & Guide 1307 130 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130) (http://www.cdc.gov/Other/disclaimer.html)
Formula C ₆ H ₄ (CH ₃) ₂	Conversion 1 ppm = 4.41 mg/m ³	IDLH 900 ppm See: 95476 (/niosh/idlh/95476.html)
Exposure Limits NIOSH REL : TWA 100 ppm (435 mg/m ³) ST 150 ppm (655 mg/m ³) OSHA PEL † (nengapdxg.html): TWA 100 ppm (435 mg/m ³)		Measurement Methods NIOSH 1501 (/niosh/docs/2003-154/pdfs/1501.pdf), 3800 (/niosh/docs/2003-154/pdfs/3800.pdf); OSHA 1002 (http://www.osha.gov/dts/sltc/methods/mdt/mdt1002/1002.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless liquid with an aromatic odor. [Note: A solid below 56°F.]

MW: 106.2	BP: 281°F	FRZ: 56°F	Sol: 0.02%	VP: 9 mmHg	IP: 8.44 eV
Sp.Gr: 0.86	Fl.P: 81°F	UEL: 7.0%	LEL: 1.1%		

Class IC Flammable Liquid: Fl.P. at or above 73°F and below 100°F.

Incompatibilities & Reactivities Strong oxidizers, strong acids

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis

Target Organs Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))
Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)

First Aid (See [procedures \(firstaid.html\)](#))
Eye: Irrigate immediately
Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Change: No recommendation

Respirator Recommendations

NIOSH/OSHA

Up to 900 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0086 \(/niosh/ipcsneng/neng0086.html\)](#)

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Chlorodiphenyl (54% chlorine)

Synonyms & Trade Names Aroclor® 1254, PCB, Polychlorinated biphenyl

CAS No. 11097-69-1	RTECS No. TQ1360000 (/niosh-rtecs/TQ14Co80.html)	DOT ID & Guide 2315 171 (http://www.wapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=171) (http://www.cdc.gov/Other/disclaimer.html)
Formula C ₆ H ₃ Cl ₂ C ₆ H ₂ Cl ₃ (approx)	Conversion	IDLH Ca [5 mg/m ³] See: IDLH INDEX (/idlh/intridl4.html)
Exposure Limits NIOSH REL *: Ca TWA 0.001 mg/m ³ See Appendix A (nengapdxa.html) [*Note: The REL also applies to other PCBs.] OSHA PEL : TWA 0.5 mg/m ³ [skin]		Measurement Methods NIOSH 5503 (/niosh/docs/2003-154/pdfs/5503.pdf) ; OSHA PV2088 (http://www.osha.gov/dts/sltc/methods/partial/t-pv2088-01-8812-ch/t-pv2088-01-8812-ch.html) (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods (http://www.osha.gov/dts/sltc/methods/index.html) (http://www.cdc.gov/Other/disclaimer.html)

Physical Description Colorless to pale-yellow, viscous liquid or solid (below 50°F) with a mild, hydrocarbon odor.

MW: 326 (approx)	BP: 689-734°F	FRZ: 50°F	Sol: Insoluble	VP: 0.00006 mmHg	IP: ?
Sp.Gr(77°F): 1.38	Fl.P: NA	UEL: NA	LEL: NA		

Nonflammable Liquid, but exposure in a fire results in the formation of a black soot containing PCBs, polychlorinated dibenzofurans, and chlorinated dibenzo-p-dioxins.

Incompatibilities & Reactivities Strong oxidizers**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact**Symptoms** irritation eyes, chloracne; liver damage; reproductive effects; [potential occupational carcinogen]

Chlorodiphenyl

Target Organs Skin, eyes, liver, reproductive system

Cancer Site [in animals: tumors of the pituitary gland & liver, leukemia]

Personal Protection/Sanitation (See protection codes (protect.html))

Skin: Prevent skin contact

Eyes: Prevent eye contact

Wash skin: When contaminated

Remove: When wet or contaminated

Change: Daily

Provide: Eyewash, Quick drench

First Aid (See procedures (firstaid.html))

Eye: Irrigate immediately

Skin: Soap wash immediately

Breathing: Respiratory support

Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister having an N100, R100, or P100 filter.

[Click here \(pgintrod.html#nrp\)](#) for information on selection of N, R, or P filters.

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0939](#)

[\(/niosh/ipcsneng/nengo939.html\)](#) See MEDICAL TESTS: [0176 \(/niosh/docs/2005-110/nmed0176.html\)](#)

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Tetrachloroethylene

Synonyms & Trade Names Perchloroethylene, Perchloroethylene, Perk, Tetrachlorethylene

CAS No. 127-18-4	RTECS No. KX3850000 (/niosh-rtecs/KX3ABF10.html)	DOT ID & Guide 1897 160 (http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=160) (http://www.cdc.gov/Other/disclaimer.html)
Formula Cl ₂ C=CCl ₂	Conversion 1 ppm = 6.78 mg/m ³	IDLH Ca [150 ppm] See: 127184 (/niosh/idlh/127184.html)
Exposure Limits NIOSH REL : Ca Minimize workplace exposure concentrations. See Appendix A (nengapdx.html) OSHA PEL † (nengapdxg.html): TWA 100 ppm C 200 ppm (for 5 minutes in any 3-hour period), with a maximum peak of 300 ppm		Measurement Methods NIOSH 1003 (/niosh/docs/2003-154/pdfs/1003.pdf); OSHA 1001 http://www.osha.gov/dts/sltc/methods/mdt/mdt1001/1001.html (http://www.cdc.gov/Other/disclaimer.html) See: NMAM (/niosh/docs/2003-154/) or OSHA Methods http://www.osha.gov/dts/sltc/methods/index.html http://www.cdc.gov/Other/disclaimer.html

Physical Description Colorless liquid with a mild, chloroform-like odor.

MW: 165.8	BP: 250°F	FRZ: -2°F	Sol: 0.02%	VP: 14 mmHg	IP: 9.32 eV
Sp.Gr: 1.62	Fl.P: NA	UEL: NA	LEL: NA		

Noncombustible Liquid, but decomposes in a fire to hydrogen chloride and phosgene.

Incompatibilities & Reactivities Strong oxidizers; chemically-active metals such as lithium, beryllium & barium; caustic soda; sodium hydroxide; potash

Exposure Routes inhalation, skin absorption, ingestion, skin and/or eye contact

Symptoms irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]

Target Organs Eyes, skin, respiratory system, liver, kidneys, central nervous system

Cancer Site [in animals: liver tumors]

Personal Protection/Sanitation (See [protection codes \(protect.html\)](#))**Skin:** Prevent skin contact**Eyes:** Prevent eye contact**Wash skin:** When contaminated**Remove:** When wet or contaminated**Change:** No recommendation**Provide:** Eyewash, Quick drench**First Aid** (See [procedures \(firstaid.html\)](#))**Eye:** Irrigate immediately**Skin:** Soap wash promptly**Breathing:** Respiratory support**Swallow:** Medical attention immediately**Respirator Recommendations****NIOSH****At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:**

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0076](#)[\(/niosh/ipcsneng/neng0076.html\)](#) See MEDICAL TESTS: [0179 \(/niosh/docs/2005-110/nmedo179.html\)](#)

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Trichloroethylene

Synonyms & Trade Names Ethylene trichloride, TCE, Trichloroethene, Trilene**CAS No.** 79-01-6**RETECS No.** [KX456D70](http://www.niosh-rtecs.com/KX456D70.html)
([/niosh-rtecs/KX456D70.html](http://www.niosh-rtecs.com/KX456D70.html))**DOT ID & Guide** 1710 160 (<http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=160>)
(<http://www.cdc.gov/Other/disclaimer.html>)**Formula** ClCH=CCl₂**Conversion** 1 ppm = 5.37 mg/m³**IDLH** Ca [1000 ppm]
See: [79016](http://www.niosh.gov/IDLH/79016.html) ([/niosh/idlh/79016.html](http://www.niosh.gov/IDLH/79016.html))

Exposure Limits

NIOSH REL : Ca See [Appendix A](http://www.niosh.gov/AppendixA.html) ([nengapdxa.html](http://www.niosh.gov/AppendixA.html))
See [Appendix C](http://www.niosh.gov/AppendixC.html) ([nengapdxc.html](http://www.niosh.gov/AppendixC.html))**OSHA PEL** † ([nengapdxg.html](http://www.niosh.gov/AppendixG.html)): TWA 100 ppm C
200 ppm 300 ppm (5-minute maximum peak
in any 2 hours)

Measurement Methods

NIOSH 1022 ([/niosh/docs/2003-154/pdfs/1022.pdf](http://www.niosh.gov/docs/2003-154/pdfs/1022.pdf)),
3800 ([/niosh/docs/2003-154/pdfs/3800.pdf](http://www.niosh.gov/docs/2003-154/pdfs/3800.pdf));**OSHA 1001**(<http://www.osha.gov/dts/sltc/methods/mdt/mdt1001/1001.html>) (<http://www.cdc.gov/Other/disclaimer.html>)See: **NMAM** ([/niosh/docs/2003-154/](http://www.niosh.gov/docs/2003-154/)) or **OSHA Methods**(<http://www.osha.gov/dts/sltc/methods/index.html>) (<http://www.cdc.gov/Other/disclaimer.html>)**Physical Description** Colorless liquid (unless dyed blue) with a chloroform-like odor.**MW:**
131.4**BP:**
189°F**FRZ:** -99°F**Sol:** 0.1%**VP:** 58 mmHg**IP:** 9.45 eV**Sp.Gr:**
1.46**Fl.P:** ?**UEL(77°F):**
10.5%**LEL(77°F):**
8%

Combustible Liquid, but burns with difficulty.

Incompatibilities & Reactivities Strong caustics & alkalis; chemically-active metals (such as barium, lithium, sodium, magnesium, titanium & beryllium)**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact**Symptoms** irritation eyes, skin; headache, visual disturbance, lassitude (weakness, exhaustion), dizziness, tremor, drowsiness, nausea, vomiting; dermatitis; cardiac arrhythmias, paresthesia; liver injury; [potential occupational carcinogen]**Target Organs** Eyes, skin, respiratory system, heart, liver, kidneys, central nervous system**Cancer Site** [in animals: liver & kidney cancer]**Personal Protection/Sanitation** (See [protection codes](http://www.niosh.gov/protect.html) ([protect.html](http://www.niosh.gov/protect.html)))**First Aid** (See [procedures](http://www.niosh.gov/firstaid.html) ([firstaid.html](http://www.niosh.gov/firstaid.html)))**Eye:** Irrigate immediately

Control Measures

Skin: Prevent skin contact
Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet or contaminated
Change: No recommendation
Provide: Eyewash, Quick drench

First Aid Measures

Skin: Soap wash promptly
Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

At concentrations above the NIOSH REL, or where there is no REL, at any detectable concentration:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

Important additional information about respirator selection (pgintrod.html#mustread)

See also: INTRODUCTION (/niosh/npg/pgintrod.html) See ICSC CARD: 0081 (/niosh/ipcsneng/neng0081.html)

See MEDICAL TESTS: 0236 (/niosh/docs/2005-110/nmedo236.html)

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Page last updated: November 18, 2010

Content source: National Institute for Occupational Safety and Health (NIOSH) Education and Information Division

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Search the Pocket Guide

Enter search terms separated by spaces.

Toluene

Synonyms & Trade Names Methyl benzene, Methyl benzol, Phenyl methane, Toluol**CAS No.** 108-88-3**RTECS No.**XS5250000 (</niosh-rtecs/XS501BDo.html>)**DOT ID & Guide** 1294 130 (<http://wwwapps.tc.gc.ca/saf-sec-sur/3/erg-gmu/erg/guidepage.aspx?guide=130>)
(<http://www.cdc.gov/Other/disclaimer.html>)**Formula** C₆H₅CH₃**Conversion** 1 ppm =
3.77 mg/m³**IDLH** 500 ppm
See: [108883 \(/niosh/idlh/108883.html\)](/niosh/idlh/108883.html)**Exposure Limits****NIOSH REL** : TWA 100 ppm (375 mg/m³)ST 150 ppm (560 mg/m³)**OSHA PEL** † (nengapdxg.html): TWA 200 ppm C 300 ppm 500 ppm (10-minute maximum peak)**Measurement Methods****NIOSH 1500** (</niosh/docs/2003-154/pdfs/1500.pdf>), **1501** (</niosh/docs/2003-154/pdfs/1501.pdf>), **3800** (</niosh/docs/2003-154/pdfs/3800.pdf>), **4000** (</niosh/docs/2003-154/pdfs/4000.pdf>);**OSHA 111**(<http://www.osha.gov/dts/sltc/methods/organic/org111/org111.html>) (<http://www.cdc.gov/Other/disclaimer.html>)See: **NMAM** (</niosh/docs/2003-154/>) or **OSHA Methods**(<http://www.osha.gov/dts/sltc/methods/index.html>) (<http://www.cdc.gov/Other/disclaimer.html>)**Physical Description** Colorless liquid with a sweet, pungent, benzene-like odor.**MW:**

92.1

BP:

232°F

FRZ:

-139°F

Sol(74°F):

0.07%

VP: 21 mmHg**IP:** 8.82 eV**Sp.Gr:**

0.87

Fl.P:

40°F

UEL:

7.1%

LEL: 1.1%

Class IB Flammable Liquid: Fl.P. below 73°F and BP at or above 100°F.

Incompatibilities & Reactivities Strong oxidizers**Exposure Routes** inhalation, skin absorption, ingestion, skin and/or eye contact**Symptoms** irritation eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia; dermatitis; liver, kidney damage**Target Organs** Eyes, skin, respiratory system, central nervous system, liver, kidneys**Personal Protection/Sanitation** (See [protection codes \(protect.html\)](http://protect.html))**Skin:** Prevent skin contact**First Aid** (See [procedures \(firstaid.html\)](http://firstaid.html))**Eye:** Irrigate immediately**Skin:** Soap wash promptly

Eyes: Prevent eye contact
Wash skin: When contaminated
Remove: When wet (flammable)
Change: No recommendation

Breathing: Respiratory support
Swallow: Medical attention immediately

Respirator Recommendations

NIOSH

Up to 500 ppm:

(APF = 10) Any chemical cartridge respirator with organic vapor cartridge(s)*

(APF = 25) Any powered, air-purifying respirator with organic vapor cartridge(s)*

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

(APF = 10) Any supplied-air respirator*

(APF = 50) Any self-contained breathing apparatus with a full facepiece

Emergency or planned entry into unknown concentrations or IDLH conditions:

(APF = 10,000) Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode

(APF = 10,000) Any supplied-air respirator that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained positive-pressure breathing apparatus

Escape:

(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister

Any appropriate escape-type, self-contained breathing apparatus

[Important additional information about respirator selection \(pgintrod.html#mustread\)](#)

See also: [INTRODUCTION \(/niosh/npg/pgintrod.html\)](#) See ICSC CARD: [0078](#)

[\(/niosh/ipcsneng/neng0078.html\)](#) See MEDICAL TESTS: [0232 \(/niosh/docs/2005-110/nmedo232.html\)](#)

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APPENDIX 5

Vapor Barrier Specifications

VAPORBLOCK® PLUS™ VBP20

Under-Slab Vapor / Gas Barrier



Product Description

VaporBlock® Plus™ 20 is a seven-layer co-extruded barrier made from state-of-the-art polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission. VaporBlock® Plus™ 20 is a highly resilient underslab / vertical wall barrier designed to restrict naturally occurring gases such as radon and/or methane from migrating through the ground and concrete slab. VaporBlock® Plus™ 20 is more than 100 times less permeable than typical high-performance polyethylene vapor retarders against Methane, Radon and other harmful VOCs.

VaporBlock® Plus™ 20 is one of the most effective underslab gas barriers in the building industry today far exceeding ASTM E-1745 (Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs) Class A, B and C requirements. Available in a 20 (Class A) mil thicknesses designed to meet the most stringent requirements. VaporBlock® Plus™ 20 is produced within the strict guidelines of our ISO 9001:2008 Certified Management System.

Product Use

VaporBlock® Plus™ 20 resists gas and moisture migration into the building envelop when properly installed to provide protection from toxic/harmful chemicals. It can be installed as part of a passive or active control system extending across the entire building including floors, walls and crawl spaces. When installed as a passive system it is recommended to also include a ventilated system with sump(s) that could be converted to an active control system with properly designed ventilation fans.

VaporBlock® Plus™ 20 works to protect your flooring and other moisture-sensitive furnishings in the building's interior from moisture and water vapor migration, greatly reducing condensation, mold and degradation.

Size & Packaging

VaporBlock® Plus™ 20 is available in 10' x 150' rolls to maximize coverage. All rolls are folded on heavy-duty cores for ease in handling and installation. Other custom sizes with factory welded seams are available based on minimum volume requirements. Installation instructions and ASTM E-1745 classifications accompany each roll.



Under-Slab Vapor/Gas Retarder

Product

Part

VaporBlock Plus 20 VBP 20

APPLICATIONS

- Radon Barrier Under-Slab Vapor Retarder
- Methane Barrier Foundation Wall Vapor Retarder
- VOC Barrier



VAPORBLOCK® PLUS™ VBP20



Under-Slab Vapor / Gas Barrier

PROPERTIES	TEST METHOD	VAPORBLOCK PLUS 20	
		IMPERIAL	METRIC
APPEARANCE		White/Gold	
THICKNESS, NOMINAL		20 mil	0.51 mm
WEIGHT		102 lbs/MSF	498 g/m ²
CLASSIFICATION	ASTM E 1745	CLASS A, B & C	
TENSILE STRENGTH LBF/IN (N/CM) AVERAGE MD & TD (NEW MATERIAL)	ASTM E 154 Section 9 (D-882)	58 lbf	102 N
IMPACT RESISTANCE	ASTM D 1709	2600 g	
MAXIMUM USE TEMPERATURE		180° F	82° C
MINIMUM USE TEMPERATURE		-70° F	-57° C
PERMEANCE (NEW MATERIAL)	ASTM E 154 Section 7 ASTM E 96 Procedure B	0.0098 Perms grains/(ft ² ·hr·in·Hg)	0.0064 Perms g/(24hr·m ² ·mm Hg)
(AFTER CONDITIONING) PERMS (SAME MEASUREMENT AS ABOVE PERMEANCE)	ASTM E 154 Section 8, E96 Section 11, E96 Section 12, E96 Section 13, E96	0.0079 0.0079 0.0097 0.0113	0.0052 0.0052 0.0064 0.0074
WVTR	ASTM E 96 Procedure B	0.0040 grains/hr-ft ²	0.0028 gm/hr-m ²
RADON DIFFUSION COEFFICIENT	K124/02/95	< 1.1 x 10 ⁻¹³ m ² /s	
METHANE PERMEANCE	ASTM D 1434	< 1.7 x 10 ⁻¹⁰ m ² /d·atm 0.32 GTR (Gas Transmission Rate) ml/m ² ·D·ATM	

VaporBlock® Plus™ Placement

All instructions on architectural or structural drawings should be reviewed and followed.
Detailed installation instructions accompany each roll of VaporBlock® Plus™ and can also be located on our website.
ASTM E-1643 also provides general installation information for vapor retarders.



VaporBlock® Plus™ is a seven-layer co-extruded barrier made using high quality virgin-grade polyethylene and EVOH resins to provide unmatched impact strength as well as superior resistance to gas and moisture transmission.

Note: To the best of our knowledge, unless otherwise stated, these are typical property values and are intended as guides only, not as specification limits. Chemical resistance, odor transmission, longevity as well as other performance criteria is not implied or given and actual testing must be performed for applicability in specific applications and/or conditions. RAVEN INDUSTRIES MAKES NO WARRANTIES AS TO THE FITNESS FOR A SPECIFIC USE OR MERCHANTABILITY OF PRODUCTS REFERRED TO, no guarantee of satisfactory results from reliance upon contained information or recommendations and disclaims all liability for resulting loss or damage. Limited Warranty available at www.RavenEFD.com



Scan QR Code to download current technical data sheets via the Raven website.



Engineered Films Division
P.O. Box 5107
Sioux Falls, SD 57117-5107
Ph: (605) 335-0174 • Fx: (605) 331-0333

Toll Free: 800-635-3456
Email: efdsales@ravenind.com
www.ravenefd.com
1/11 EFD 1125

APPENDIX 6

Development Plans

BUILDING INFORMATION	
OCCUPANCY	R-2
CONST. CLASS	1B

THE MEEKERMAN

406 MANHATTAN AVENUE
BROOKLYN, NY 11211

Applicant
MEEKERMAN LLC
316 Douglass Street, 2nd Floor
Brooklyn, New York 11217

Architect
CURTIS + GINSBERG ARCHITECTS LLP

299 Broadway, Suite 1107
New York, New York 10007

Structural Engineer
DE NARDIS ENGINEERING LLC
15 Reservoir Road
White Plains, New York 10603

MEP
RODKIN CARDINALE CONSULTING ENG.
224 West 29th Street, 4th Floor
New York, New York 10001

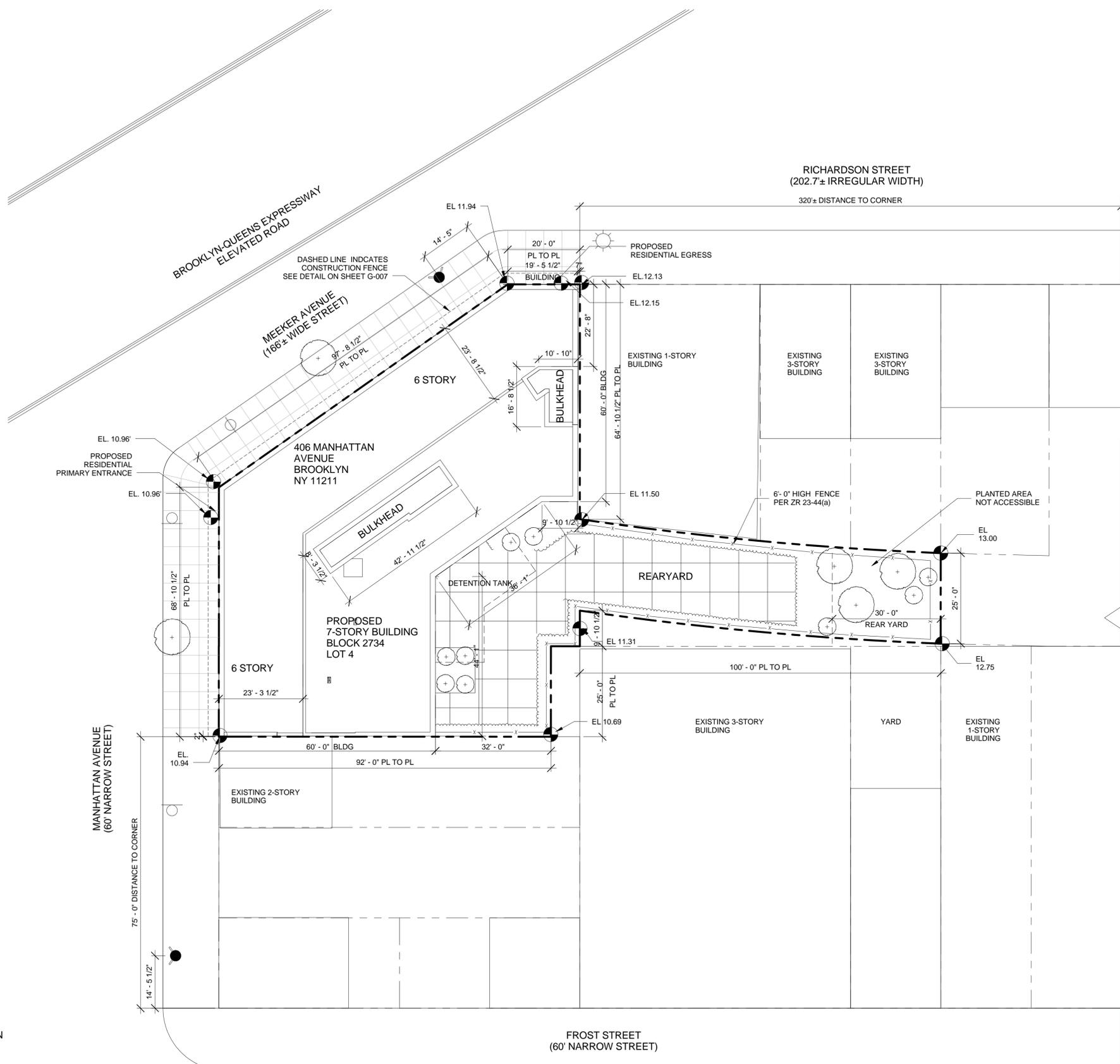
Builders Pavement Plan / Civil / Landscape
THE RBA GROUP INC.
27 Union Square West, 4th Floor
New York, New York 10003

LEGEND:

	TAX LOT BOUNDARY
	ZONING LOT BOUNDARY
	PROPOSED TREE
	LIGHT POLE
	TRAFFIC LIGHT
	TRAFFIC SIGN
	FIRE HYDRANT

- NOTES:
- SEE SHEET Z-001.00 FOR FLOOD ZONE MAP.
 - ZONING CLASSIFICATION Mx8 (M1-2/R6)
SEE SHEET Z-004 FOR ANALYSIS.
 - SEE SHEET Z-001.00 FOR LITTLE E DESIGNATIONS.
 - SEE MEP DRAWINGS SHEET P-101.00 FOR BUILDING SERVICES INFRASTRUCTURE.
 - NEAREST TRANSIT AUTHORITY OR RAILROAD INFRASTRUCTURE IS GREATER THAN 200'-0".
 - LANDMARK OR HISTORIC DISTRICT DESIGNATION = N/A.
 - RIGHTS-OF-WAY AND EASEMENTS = N/A.
 - NO ADJACENT WETLAND AREAS OR COSTAL EROSION HAZARD AREAS.
 - ELEVATIONS REFER TO NAVD 1988 DATUM.
 - SEE SHEET V-001 FOR SURVEY.

C1 SITE PLAN
1/16" = 1'-0"



No.	Date	Revision

12/30/14 HPD / BLDS SUBMISSION
12/15/14 DOB SUBMISSION

No.	Date	Submission

Title:
SITE PLAN

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Job No.: 1420
Date: 12/30/14
Scale: As indicated
Drawn By: NW
Checked By: MBM

Sheet No.:

of **G-001.00**