**Queens Plaza Residential Development**
**Brownfield Cleanup Program (BCP) No. C241105**
**Long Island City, NY**

# REMEDIAL WORK PLAN

TST LIC Development LLC
c/o Tishman Speyer
45 Rockefeller Plaza
New York, New York 10111

**FLS Project Number: 10038-005**

Submitted to:
New York State Department of Environmental Conservation
Division of Environmental Remediation
625 Broadway, 12th Floor
Albany, New York 12233-7016

## August 2007

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# Professional Engineer's Certification

**REMEDIAL WORK PLAN**
**Queens Plaza Residential Development**
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**BCP No.**

**August 2007**

It is a violation of New York State Law for any person, unless acting under the direction of a licensed professional engineer or land surveyor, to alter any item in any way. If an item bearing the seal of an engineer or land surveyor is altered, the altering engineer or land surveyor shall affix to the item his seal and notation "altered by" followed by his signature and the date of such alteration, and a specific description of the alteration.

I, Arnold F. Fleming, hereby certify that the information presented in the report was prepared under my direct supervision.

_____ Date

_____
Arnold F. Fleming, P.E.
NYS Professional Engineer
License Number 050411

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## 1.0 INTRODUCTION & PURPOSE

The purpose of the Remedial Work Plan (RWP) for the Queens Plaza Residential Development is to present the remedial measures that meet the requirements of the Brownfield Cleanup Program (BCP) and the development project while addressing the specific conditions on the Brownfield Site. The proposed remediation contemplates excavation and disposal of all soils down to an approximate development depth of 10 ft to 3 ft Queens Borough Datum (QBD[1]) 1929 anticipated in the building plans, hereafter "development depth." Additional soil removal would occur where accessible grossly contaminated soils are found. Inaccessible materials would be addressed by institutional and engineering controls.

The site (the "Brownfield Site") is a portion of a larger site known as the Outlet City site currently in the New York State Department of Environmental Conservation Voluntary Cleanup Program (VCP), VCP No. V00081-2. Outlet City Inc. is the current owner of the larger VCP site and TST LIC Development LLC (the "BCP Volunteer") is a contract vendee and the BCP Applicant. The Brownfield Site consists of Area C, Area D, Area E, and the western portion of Building 10 and is also a New York City "E" Designated site. The Brownfield Site is currently abandoned and unused except for temporary storage/commercial purposes.

The Brownfield Site is in Long Island City, Queens County, New York and encompasses an irregularly shaped parcel bounded on the north by Jackson Avenue and two properties outside the larger Outlet City site, an unoccupied 5-story residential building with rear yard, and a New York City Transit Authority (NYCTA) substation. On the west, the Brownfield Site borders Orchard Street, a mapped and dedicated City street. The southern boundary of the Brownfield Site is Building 3A and the western portion of Building 2B on the Outlet City site. The eastern side of the Brownfield Site abuts the 5-story unoccupied residential building along Jackson Avenue, the southern portion of Building 6A, the western portion of Building 2B and a portion of Building 10. There is a NYCTA easement along the Brownfield Site's northern boundary on Jackson Avenue containing a subway tunnel. Figure 1 presents a Brownfield Site Location Map and Figure 2 presents a Brownfield Site Plan.

Brownfield Site topography slopes gently to the south where the surface elevation is approximately 4 feet lower than along Jackson Avenue. Surface soils consist of a fill layer approximately 5 feet thick. The fill is a mixture of fine to medium sand, with some silt and gravel and traces of brick, cinders, concrete, cobbles, and wood. Bedrock is variable beneath the Brownfield Site and influences contaminant movement. All soil has been capped with a building and/or asphalt parking lots.

Historically, chemical manufacturing/storage was the principal activity on the Brownfield Site. The former owner, West Chemical Company, manufactured soaps, disinfectants, floor waxes and other household and industrial cleaners and products. Creosote was used

[1] Site elevation decreases from approximately 16.5 ft QBD on the northern portion of the Site (by Jackson Ave.) to approximately 12.5 ft QBD on the southern portion of the Site. The original excavation was to approximately 0.5 to 4.5 QBD, but this was revised following building design changes.

in large quantities as a disinfectant and creosote spills represent the most significant contamination of the Brownfield Site's soil and groundwater. Creosote has impacted soils and formed a contaminated zone atop the bedrock and till layers at depth. Petroleum releases also have occurred and there is a limited area of free petroleum product beneath Building 10, a mix of #6 and #4 fuel oil. Chlorinated solvents appear in soils and groundwater at lower levels.

Building 10 and off-Site buildings bordering the Brownfield Site have served commercial purposes for at least 50 years. The structures are built of reinforced concrete frame and wood post-and-beam construction. All have concrete floors on their lowest level at or slightly below the surrounding sidewalk elevations. The buildings would be demolished prior to and/or concurrently with remediation and re-development, but their foundations would remain to be removed as appropriate under the remediation of the Brownfield Site, but ultimately this will be a field decision

The properties surrounding the Brownfield Site are primarily used for light manufacturing and/or commercial purposes, with sporadic residential use. To the south is part of the Outlet City site and beyond the Long Island Railroad (LIRR) Yard A. North, across Jackson Avenue, is a municipal parking garage that is a designated development site. West of the Brownfield Site are warehouse buildings with light manufacturing. East of the Brownfield Site, across Queens Boulevard, are a Covenant House residential facility and a gasoline filling station. The Brownfield Site was historically zoned as "M1-6/R10 Light Manufacturing," until the 2001 Long Island City rezoning changed the classification to M1-6/R10 under the special Long Island City Mixed Use District, allowing high density commercial, retail and residential development on the Brownfield Site.

The BCP Volunteer proposes to build a multi-tenant high-rise residential apartment building on the Brownfield Site. The footprint is approximately 220 feet by 75 feet, ~16,500 $ft^2$, which encompasses approximately 0.4 acres. The entire Brownfield Site encompasses 20,250 $ft^2$, 0.5 acres. Retail space would occupy the ground floor. The residential building would have a basement extending to elevations 0.5 ft to 4.5 ft QBD (groundwater elevation is approximately 7.5 ft to 10.5 ft QBD) over all or a portion of the building, depending upon restrictions imposed upon the Brownfield Site by the NYCTA easement and/or the final development design. The building would be supported by a combination of slab-on-grade, caissons, or piles. The basement would house only physical plant operations and ancillary uses (maintenance areas, storage and mechanical equipment) and exclude tenant occupancy. Because of limitations on access to portions of the Brownfield Site, the BCP Volunteer intends to pursue Track 2 Restricted Residential Soil Cleanup Objectives (SCOs)—meaning excavation to 15 feet below final grade or bedrock—with modified Restricted Residential Soil Cleanup criteria (Brownfield Cleanup Track 4) as the fall back soil cleanup goals if Track 2 cannot be attained.

The project schedule calls for the start of remediation of the Brownfield Site by August 1, 2007, with construction of the building foundations to follow. Construction will begin on

the remediated portions of the Brownfield Site while remediation continues on the remainder of the Site.

# 2.0 BROWNFIELD SITE DESCRIPTION

## 2.1 Brownfield Site Location

The Brownfield Site is located at the southeast corner of Jackson Avenue and Orchard Street and comprises tax Block 264, Lot 13. Figure 1 presents a Brownfield Site Location Map and Figure 2 presents a Brownfield Site Plan. A Brownfield Site survey is included in Appendix A.

## 2.2 Brownfield Site & Vicinity Characteristics

The Brownfield Site is in Long Island City, long a manufacturing district but rezoned by the City to allow a mixed residential commercial neighborhood. The Brownfield Site lies in an area containing a mixture of residential buildings, office buildings, municipal parking and commercial enterprises consisting of warehouses, light manufacturing, retail, and shipping terminals. The LIRR Yard A to the south of the Brownfield Site is a major transportation hub consisting of numerous tracks and train service equipment. Figure 3 presents an aerial view of the Brownfield Site and surrounding areas.

## 2.3 Nearby Public Areas of Concern

The nearest schools are St. Patrick's School and Public School No. 4, which are over 1,800 feet north of the Brownfield Site. Two churches are approximately 1,000 feet west of the Brownfield Site and the New York Foundling Hospital lies more than 2,000 feet southwest of the property. The New York City Subway Line No. 7 passes by the Brownfield Site 400 feet to the east over Queens Boulevard. A subway tunnel transects the northwest corner of the Brownfield Site twenty feet inside the Brownfield Site boundary (Figure 2), connecting to an active subway tunnel under Jackson Avenue. Figure 3 shows the location of sensitive land uses in the neighborhood.

## 2.4 Brownfield Site History

Prior to development, the Brownfield Site occupied an elevated area between two streams, an unnamed stream to the west and Dutch Kill to the east of the Brownfield Site (Beers, 1868), both discharging into Newtown Creek. Both streams were flanked by a marsh south of the Brownfield Site that now contains the LIRR Sunnyside Yard. The West Chemical Company (West Chemical) occupied the Brownfield Site from the early 1900s until 1977. During this time West Chemical manufactured a variety of commercial and household disinfectants, soaps, floor waxes, insecticides, and paper product dispensing machines. Prior to 1950, West Chemical manufactured a disinfectant that required storage of large quantities of creosote. Creosote use was discontinued after 1950 because of leaks and a fire that prompted the Fire Department of New York (FDNY) to

empty the entire contents of a creosote-filled above ground storage tank directly to the ground surface in order to prevent its combustion during the fire.

Reportedly, West Chemical stored a variety of other materials on-Site during its tenure including muriatic acid, alcohol, rosin, fats, and oils. These materials were used in the manufacture of hand creams, cleaning products (floor waxes and cleaners), and vending machine products. Storage tanks were principally located within the Brownfield Site for use in the adjacent buildings comprising the remainder of the Outlet City VCP site.

West Chemical divested the Brownfield Site and transferred ownership to Outlet City, Inc. in 1978. The Brownfield Site is currently abandoned and unused except for temporary storage/commercial purposes.

## 2.5 Off-Site History

A New York City Transit Authority (NYCTA) substation and a vacant, five-story residential building occupy the northeast adjacent lots. The area along Jackson Avenue was historically residential buildings with commercial/retail uses on the ground floor, similar to the one remaining structure of this type, the 5-story residential building abutting the northeast edge of the Brownfield Site. These buildings were demolished over time and are now used principally for parking and chemical storage

South of the Brownfield Site and the adjacent Outlet City site is the LIRR Yard A, a railroad facility since 1910. West of the Brownfield Site are warehouses, light manufacturing and product distribution centers of similar age to the Outlet City buildings. East of the Brownfield Site is the remainder of the Outlet City VCP site including West Street, a de-mapped City Street, and beyond that a major thoroughfare, Route 25 (Queens Boulevard) and the No. 7 Subway Line, warehouses, parking facilities, a gasoline filling station, and office and commercial buildings. North of the Brownfield Site is a municipal parking facility with ground floor retail space occupying a city block, historically a manufacturing site until development as a parking garage by the City of New York in 1968 (completed in 1975).

## 2.6 Description of Contemplated Use

The BCP Volunteer intends to build a multi-tenant high-rise residential apartment building on the Brownfield Site. Retail space will occupy the ground floor. The building will have a basement extending to elevation 2.7 ft QBD, (groundwater elevation is approximately 7.5 ft to 10.5 ft QBD) under the building footprint or a portion, depending upon the restrictions imposed by the NYCTA and/or the final development design on the northern portion of the Brownfield Site along Jackson Avenue. The residential building will be supported by a combination of slab-on-grade, caissons, or piles. The basement would house only physical plant operations, ancillary uses, and exclude tenant occupancy.

## 2.7 Brownfield Site Geology, Hydrogeology, and Subsurface Characteristics

The Brownfield Site is located on gently sloping land with the high point along Jackson Avenue sloping down approximately 4 feet to the Outlet City site to the south. The generalized subsurface profile consists of fill overlying silty sand and glacial till, with bedrock below the till. A lens of clay above the bedrock near the center of the Brownfield Site occurs in the area with the worst contamination. A bedrock elevation contour map and a geologic cross-section for the Brownfield Site are depicted in Figures 4 and 5.

Surface soils consist of a fill layer approximately 5 feet in thickness. This fill is a mixture of fine to medium sand, with some silt and gravel and traces of brick, cinders, concrete, cobbles, and wood. The fill is underlain by silty sand and glacial deposits followed by a layer of fine sand with intermittent seams of silt and clay. Thicker layers of varied silt and clay are present within this sand unit in some locations on the Brownfield Site. The sand layer varies in thickness from approximately 4.5 to 18 feet. Additionally, a till layer is present over most of the Brownfield Site beginning from approximately 4.5 ft to 7 ft QBD and extending to the top of bedrock at elevations of approximately -31 ft QBD.

Based on soil boring data from previous investigations, bedrock at the Brownfield Site is gneiss. Bedrock elevation varies from 6 to -31 ft QBD. Bedrock beneath the Brownfield Site rises to a conical peak beneath Building 10 at approximately 6 ft QBD. Bedrock plunges from the peak to the following elevations: -31 ft QBD to the north, -13 ft QBD to the west, and -6.5 ft QBD to the east. The plunge is steepest to the north, and relatively gentler in the other cardinal directions.

Groundwater occurs within the unconsolidated geologic materials covering the Brownfield Site. The upper surface of the groundwater reservoir is marked by the groundwater table, which fluctuates seasonally in response to precipitation. The groundwater table elevation ranges from 7.5 ft to 10.5 ft QBD over most of the Brownfield Site. Groundwater flow direction is predominantly to the south-southwest with local deflections around the bedrock mound to the south-southeast. Underground utilities such as sewer, water, subways, steam pipes and other subsurface manmade objects locally influence and redirect natural groundwater flow, or cause localized mounding of the groundwater table. Figure 6 shows the direction of groundwater flow on the Brownfield Site.

Groundwater elevation is approximately 7.5 ft QBD across the Brownfield Site. Groundwater elevation rises to a peak (approximately 10.5 ft QBD) at the location of the bedrock peak beneath Building 10. The rise is relatively abrupt and occurs within a radius of approximately 30 ft from the peak. FLS infers from this rise that leaks from sewer and/or water mains within a building foundation founded on bedrock are the cause of this abrupt rise. This localized mounding is the only exception to the relatively gentle decrease in groundwater elevation from north to south across the Brownfield Site and represents a unique, localized condition arising from the building foundation and elevated

bedrock at this location. Net groundwater flow across the Brownfield Site is to the south-southwest.

No surface water bodies exist on the Brownfield Site. The closest surface water body is the Dutch Kill coming from the Newtown Creek, located approximately 1,600 feet south of the Brownfield Site, and the East River approximately 4,200 to the west.

## 2.8 Nature & Extent of Contamination

### 2.8.1 Previous Investigations

Six previous environmental investigations beginning in 1988 consisted of varying levels of soil and groundwater investigation, non-aqueous phase liquid (NAPL) product level studies, and collection of soil gas data on the entire Outlet City VCP site. Previous investigations included the following studies:

1. *Queens Plaza Site Investigation*, AKRF, 1988
2. *Outlet City Soil and Groundwater Sampling Results*, AKRF, 1990
3. *Outlet City Property*, Supplemental Site Assessment/Remedial Investigation, AKRF, 1998
4. *Soil and Groundwater Sampling and Analysis*, ELM, 2001
5. *Site Investigation*, AKRF, 2002
6. *Additional Remedial Investigation Report (Draft),* Fleming-Lee Shue, Inc., February 2007

### 2.8.2 Soil Contamination

The six previous investigations found that soil contamination originated predominantly from creosote spills and to a lesser extent from petroleum-based spills. The sources of these spills are greatest near where the material was stored and processed on the Brownfield Site: Areas C, D and E. Creosote impacts predominantly occur within the former creosote storage and processing areas, but also extend into adjacent portions of the Outlet City VCP site to the south and east.

Creosote spills impacted both shallow soils in the form of a smear zone and the deeper soils in the form of residual DNAPL. The DNAPL rests within an approximate 1-foot-thick zone in soil atop the till or in soil/decomposed bedrock directly on top of the bedrock. Creosote DNAPL at the till/bedrock juncture occurs at elevations of 5.5 ft QBD to -13.5 ft QBD and is found at shallow depths where bedrock comes close to the surface; but most of the DNAPL occurs at elevations

lower than 1.5 ft QBD. Chlorinated solvent use accounts for a minor amount of soil contamination throughout the Brownfield Site.

Impacts from light non-aqueous phase liquid (LNAPL) occur in Areas D and E and to the south on the Outlet City VCP site. LNAPL impacts are in the form of free product and impacted soil in a smear zone on the Brownfield Site. Except for two samples with concentrations less than 0.5 ug/kg, PCB sample results were below detection levels in all Brownfield Site soil samples.

Figures 7 and 8 show the aerial extent of LNAPL and the vertical extent of the smear zone. Figure 9 shows the locations and depths of samples exceeding Technical Assistance Guidance Memorandum 4046 (TAGM) Residential Soil Cleanup Objectives (RSCOs). An electronic database including all soil samples collected on the Brownfield Site since 1988 is included as Attachment 1.

**Volatile Organic Compounds (VOCs)**

The primary soil contaminants are the creosote-based and petroleum-based VOCs, benzene, toluene, ethylbenzene, and xylenes, (collectively BTEX). The elevated concentrations of these compounds correspond to observations of soil staining or NAPL on the Brownfield Site.

Other VOCs in soils include methylene chloride, tetrachloroethylene, and trichloroethylene. Table 1 summarizes the range of select Brownfield Site VOC concentrations using all the data collected to date (1988 to 2006) above and below 16 feet, the proposed development excavation elevation.

**Table 1 – VOCs in Soils**

Results in ug/kg

| | ≤16' | | | | >16' (<0.5 ft QBD) | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound** | **Samples, n** | **Min** | **Max** | **Median** | **Samples, n** | **Min** | **Max** | **Median** |
| Benzene | 48 | ND | 8,500 | ND | 12 | ND | 9,500 | ND |
| Toluene | 48 | ND | 100,000 | 3 | 12 | ND | 100,000 | ND |
| Ethylbenzene | 48 | ND | 63,000 | 17 | 12 | ND | 48,000 | 67 |
| Xylenes | 45 | ND | 220,000 | 570 | 12 | ND | 190,000 | 289 |
| Methylene Chloride* | 48 | ND | 13,000 | 2 | 12 | ND | 450 | ND |
| Tetrachloroethylene | 48 | ND | 27,000 | ND | 12 | ND | ND | ND |
| Trichloroethylene | 48 | ND | 1,400 | ND | 12 | ND | 350 | ND |
| Total VOCs | 29 | ND | 424,500 | 1,640 | 5 | 19 | 759,966 | 14,742 |

* Detected in some blanks

ND – Not detected

The basis for >16 (<0.5 ft QBD) feet is Part 375-3.8 (e) (2) iii, which indicates that the requirements to achieve contaminant-specific soil cleanup objectives do not apply below 15 feet, and the approximate development depth.

## Semi-Volatile Organic Compounds (SVOCs)

The location of elevated SVOCs mirrors that of elevated VOCs. The concentrations of SVOCs with the highest concentrations include naphthalene, 2-methylnaphthalene, acenaphthene, dibenzofuran, fluorene, and total SVOCs. As with the VOCs, the greatest concentration of SVOCs occurs on the Brownfield Site corresponding to the creosote DNAPL. Table 2 summarizes the range of select SVOC concentrations of these compounds using all the data collected to date above and below 16 feet (0.5 ft QBD).

**Table 2 – SVOCs in Soils**
Results in ug/kg

| | ≤16' | | | | >16' (<0.5 ft QBD) | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound** | **Samples, n** | **Min** | **Max** | **Median** | **Samples, n** | **Min** | **Max** | **Median** |
| Naphthalene | 45 | ND | 2,500,000 | 9,500 | 12 | ND | 2,300,000 | 7,440 |
| 2-methylnaphthalene | 46 | ND | 2,300,000 | 14,500 | 12 | ND | 2,700,000 | 10,955 |
| Benzo(a)Pyrene | 45 | ND | 12,000 | ND | 12 | ND | 303 | ND |
| Benzo(a)anthracene | 45 | ND | 13,000 | ND | 12 | ND | 650 | ND |
| Acenaphthene | 45 | ND | 460,000 | 5,100 | 12 | ND | 390,000 | 2,862 |
| Dibenzofuran | 45 | ND | 440,000 | 3,400 | 12 | ND | 380,000 | 3,935 |
| Fluorene | 45 | ND | 260,000 | 3200 | 12 | ND | 210,000 | 2,807 |
| Total SVOCs | 11 | 1,656 | 5,422,000 | 805,100 | 5 | 60 | 1,649,161 | 276 |

## Metals

The concentrations of metals in Brownfield Site soil were typical of urban areas and/or Eastern US Background Levels (TAGM 4046). However, relatively higher levels of arsenic, cadmium, lead, and mercury were identified in Areas C, E and Building 10 in soils above 16 feet below grade (ft-bg) (0.5 ft QBD). Below this depth the concentrations of these metals were either all below TAGM RSCOs or within Brownfield Site background levels. There was no discernable pattern in metal concentrations above 16 ft-bg, but lead was generally higher in Area E. Table 3 summarizes the range of select metals concentrations using all the data collected to date on the Brownfield Site above and below 16 feet (0.5 ft QBD).

**Table 3 – Metals in Soils**
Results in mg/kg

| | ≤16' | | | | >16' (<0.5 ft QBD) | | | |
|---|---|---|---|---|---|---|---|---|
| **Compound** | **Samples, n** | **Min** | **Max** | **Median** | **Samples, n** | **Min** | **Max** | **Median** |
| Arsenic | 33 | ND | 47 | 4 | 8 | ND | 1.7 | ND |
| Barium | 33 | 21 | 930 | 40 | 8 | 10 | 36.2 | 21.9 |
| Cadmium | 33 | ND | 15 | 0.69 | 8 | ND | ND | ND |
| Chromium | 33 | 7 | 64 | 25 | 8 | 4 | 12 | 8 |
| Lead | 33 | ND | 2,190 | 33 | 8 | 3 | 29 | 9 |
| Mercury | 33 | ND | 1.7 | ND | 8 | ND | 0.04 | ND |
| Nickel | 33 | 5 | 43 | 18 | 8 | 3 | 10 | 5 |
| Selenium | 33 | ND | 2.7 | ND | 8 | ND | ND | ND |
| Silver | 33 | ND | 1.1 | ND | 8 | ND | ND | ND |
| Zinc | 33 | 16 | 6,100 | 77 | 8 | 6 | 39 | 18 |

**Pesticides**

Pesticides were mostly below detection limits in samples collected on the Brownfield Site. Where pesticides were detected above 16 ft-bg, elevated concentrations of pesticides, ranged from 1.3 ug/kg to 1,800 mg/kg in Areas C, D, and E, as well as under Building 10. These pesticides included alpha benzene-hexachloride (BHC), gamma BHC, endrin, heptachlor, heptachlor epoxide. Below 16 feet nearly all pesticides were below detection limits and none exceeded any regulatory criteria. Pesticides occurred throughout the Brownfield Site.

### 2.8.3 Groundwater

Dissolved contamination appears in the lower and upper portions of the Brownfield Site groundwater flow regime. The dissolved plume exhibits the highest concentration of VOCs and SVOCs in the lower groundwater flow regime where the groundwater plume mirrors the distribution of DNAPL and where groundwater is in contact with the residual DNAPL. In contrast, VOCs and SVOCs were below detection limits for most compounds in the shallow wells. PCBs were below detection levels in all groundwater samples collected across the Brownfield Site. Figures 10 and 11 show the concentrations of VOCs and SVOCs on the Brownfield Site during the latest round of groundwater sampling.

**Volatile Organic Compounds (VOCs)**

Groundwater sampling throughout the Brownfield Site identified elevated levels of VOCs. In general, elevated concentrations of chlorinated VOCs, BTEX, 1,2-dichloroethane, 1,2,4-trimethylbenzene, 2-butanone, styrene, isopropyltoluene, and, n-propylbenzene were identified above NYSDEC's Division of Water Technical Operational Guidance Series (TOGS) 1.1.1 Class GA Ambient Water Quality Standards (AWQS).

Groundwater samples collected from monitoring wells at the Brownfield Site, in Areas C, D, E, and along Orchard Street (OS-7D), had total concentrations of VOCs at levels equal to or greater than 1,000 ug/L.

Total BTEX concentrations in monitoring wells along Orchard Street (OS-7D) measured 10,130 ug/L. Additionally, significant levels (>1,000 ug/L) of 1,1,2-trichloroethane and/or 1,2-dichloroethane concentrations, acetone, and methylene chloride were detected in groundwater samples from monitoring wells in Area E and along Orchard Street (OS-7D).

**Semi-Volatile Organic Compounds (SVOCs)**

Groundwater sampling from the monitoring wells throughout the Brownfield Site identified the highest concentrations of SVOCs in the western and southwestern portion of the Brownfield Site with SVOCs exceeded 1 mg/L in Areas C, E, and Building 10, and along Orchard Street. The SVOCs exceeding 1,000 ug/L in these areas consisted primarily of phenolic compounds (phenol, 2-methylphenol, and phenanthrene) and low concentrations of PAHs (acenaphthene, anthracene, fluoranthene, fluorine, and pyrene). Chlorobenzenes, dibenzofuran, and phthalates were also identified in these areas at a much lower concentration. Other SVOCs include carbozole, 2,6-dinitrotoluene, dibenzofuran, dichlorobenzene, diethylphthalate, 4-nitroaniline, and nitrobenzene.

Total SVOCs at concentrations between 100 ug/L and approximately 60 mg/L were detected in groundwater along Orchard Street.

**Metals**

Groundwater throughout the Brownfield Site was found to contain a variety of dissolved metals, most of which exceeded TOGS GA AWQS, including: aluminum, arsenic, iron, lead, magnesium, manganese, nickel, and sodium. Barium, beryllium, cadmium, chromium, copper, selenium, and zinc were identified above their respective TOGS AWQS in Area E (E-2).

The source of metals in the groundwater cannot be explained by Brownfield Site manufacturing activities. Since the Brownfield Site used coal until #6 fuel oil tanks were installed in 1946, significant quantities of coal ash from historic operations may account for these metals.

**Pesticides**

Pesticide concentrations in groundwater samples collected from Areas C, E, and under Building 10, and along Orchard Street were largely below detection levels or at very low concentrations. The exception is in the sample collected from E-2 identified with pesticide levels exceeding TOGS GA AWQS; however, all

concentrations were where the total pesticide concentration measured 38 mg/L. In Area C (C-5), endrin was found to exceed the GA AWQS of "non-detect."

## 2.9 Alkalinity, BOD, COD, and Hardness

Groundwater samples collected from monitoring wells E-3 and OS-6 were analyzed for total alkalinity as $CaCO_3$, biological oxygen demand (BOD), chemical oxygen demand (COD), and total hardness as $CaCO_3$. The ranges of detected parameters, in mg/L, are as follows: alkalinity as $CaCO_3$, 183 – 459; BOD, ND – 542; COD, 22 – 1,820; and hardness as $CaCO_3$, 141 – 301.

## 2.10 Other Environmental Conditions

This section describes other environmental conditions that will be addressed during remediation.

### 2.10.1 Underground Storage Tanks

Four large USTs remain on the Brownfield Site. The USTs contained #6 and later #4 fuel oil, but have been empty and closed in place since 1991. Unknown USTs may be encountered as the Brownfield Site is excavated for remediation and development.

### 2.10.2 Sub-Slab Vapor and Indoor Air Findings

VOCs were detected in air and sub-slab soil vapor on the Brownfield Site and in the adjacent buildings on the Outlet City VCP site. The compounds included acetone, benzene, 2-butanone, carbon tetrachloride, chloromethane, dichlorodifluoromethane, ethylbenzene, toluene, xylenes, tetrachloroethylene, trichloroethene, and trichlorofluoromethane.

With exception of carbon tetrachloride, which was detected in only one out of 12 indoor air samples (AA-10) at a concentration of 1.4 $ug/m^3$, all VOCs in indoor air were detected at concentrations within the ranges published in the NYSDOH study of air in homes (1997-2003) and the USEPA study of air in offices (1994-1998).

Comparison of indoor air results with VOC concentrations detected in outdoor air and sub-slab soil vapor suggests that indoor air is impacted by VOCs in sub-slab soil vapor on the Outlet City site adjacent to the south and east of the Brownfield Site (Buildings 2A, 3B, 5, 6, and the southwest portion of Building 9), and on the Brownfield Site in Building 10. The VOCs include benzene, toluene, ethylbenzene, xylene, and 2-butanone (MEK). Soil gas VOC concentrations were greatest on the Brownfield Site near contaminant source Areas D and E, and on the adjacent Outlet City site near Building 3A/B and Building 1. Some of the compounds found in the soil gas differ from the

constituents found in analysis DNAPL on the Brownfield Site, meaning they are from another off-Site source.

# 3.0 ALTERNATIVES ANALYSIS

## 3.1 Exposure Assessment

An Exposure Assessment qualitatively evaluates the potential for populations to be exposed to Brownfield Site contaminants. Five criteria must be met to create a pathway for potential exposure to contaminants. If any one or more of the criteria are not met, then the chain is incomplete and exposure cannot occur. The five exposure pathway criteria are 1) contaminant source, 2) contaminant release and transport mechanism, 3) exposure point, 4) exposure route, and 5) receptor population. On-Site contaminated media include soil, groundwater, soil vapor, LNAPL, and DNAPL. Potential Brownfield Site receptors include the following populations:

- On-Site environmental and construction workers
- Future residents
- Future Brownfield Site maintenance workers
- Off-Site residents/ building occupants
- Off-Site maintenance workers

The following potential exposure routes are considered incomplete:

- **Groundwater Ingestion**

  This pathway is incomplete because New York City code prohibits the use of groundwater for potable purposes. Additionally, Restricted Residential use will include a Brownfield Site-specific groundwater prohibition within the Environmental Easement.

- **Soil Dermal Contact by Future Residents and Future Maintenance Workers**

  When complete, re-development will have removed all contaminated soil to development depth and the Brownfield Site will be covered by the structure or hardened surfaces, eliminating this exposure pathway. No open areas are proposed for the developed Brownfield Site.

- **Inhalation of Vapors by Future Residents and Maintenance Workers**

  Remediation will include removal of contaminated soil to development depth as well as any smear zone accessible below development depth. The proposed residential building will include a vapor barrier that will eliminate this pathway by means of engineering controls that will be included in the Brownfield Site's Environmental Easement.

The following exposure pathways are considered potentially complete:

- **Soil Dermal Contact by On-Site Environmental and Construction Workers**

  Remedial Excavation of contaminated soil poses a possible direct contact pathway for those working on the Brownfield Site during remediation.

- **Groundwater Dermal Contact by On-Site Environmental and Construction Workers**

  Remedial excavation of contaminated soil below the groundwater table and construction de-watering activities poses a possible direct contact pathway to Brownfield Site workers and construction personnel.

- **Inhalation of Vapors and Particulates by On-Site Environmental and Construction Workers**

  Excavation and removal of contaminated soil may generate dust and vapors that could be inhaled by Brownfield Site workers and off-Site visiting personnel.

- **Inhalation of Vapors and Particulates by Off-Site Residents/Building Occupants**

  Excavation and removal of contaminated soil may generate dust and vapors that could be inhaled by off-Site residents/ building occupants and maintenance personnel.

## 3.2 Remedial Action Goals

The goals of remediation are to remove source contamination by excavating and removing the bulk of the contaminated material over the entire Brownfield Site where accessible. If inaccessible contaminants remain on the Brownfield Site they will be addressed by the application of institutional and engineering controls in an Environmental Easement to minimize the potential for risks to future residents, workers, and the environment. Another goal is to ensure that no DNAPL, LNAPL or contaminated groundwater leaves the Brownfield Site or re-contaminates the Brownfield Site from off-Site sources.

## 3.3 Remedial Action Objectives

The remedial action objectives are as follows:

1. Achieve a cleanup that eliminates and/or mitigates all significant threats from Brownfield Site contaminants to public health and the environment consistent with the contemplated end use of restricted residential.

2. Significantly reduce the contaminant mass and/or eliminate exposure pathways to any remaining contaminant, and ensure that all potential receptors are protected.

3. Eliminate and/or minimize the potential movement of any remaining contaminant on or off the Brownfield Site.

4. Protect workers and the community from Brownfield Site contaminants during remediation and re-development.

### 3.4 Standards, Criteria, & Guidance

Given the intended multi-story residential use with no open soil areas and anticipated institutional and engineering controls, the BCP Volunteer intends to pursue Track 2 Restricted Residential Soil Cleanup Objectives (SCOs)—meaning excavation to 15 feet or bedrock—with modified Restricted Residential Soil Cleanup criteria (Brownfield Cleanup Track 4) as the fall back soil cleanup goals if Track 2 cannot be attained.

The BCP Volunteer proposes using the soil cleanup goals previously approved by the Department and used for BCP sites with similar contamination (Avalon Site 9, Queens West Development, BCP No. C241087), geology and use as the fall back cleanup goals; the Department has determined that these soil cleanup goals are protective of human health and the environment. The BCP Volunteer proposes the following fall back Brownfield Site-specific soil cleanup objectives (SSSCOs) as presented in Table 3. The fall back soil cleanup goals would apply to soil below the final cover material.

**Table 3 - Proposed Soil Cleanup Objectives**

| Compound | SSSCOs (mg/kg) |
|---|---|
| Benzene | 0.06 |
| Toluene | 1.5 |
| Ethylbenzene | 5.5 |
| o-Xylene | 1.2 |
| M/P-Xylene | 0.6 |
| Naphthalene | 13 |
| Total VOCs | 10 |
| Total SVOCs | 500 |
| Lead | 1,000 |
| Mercury | 2 |
| Arsenic | 25 |
| Grossly Contaminated Soil | Grossly Contaminated Soil as defined by DER-10: "Soil which contains visibly identifiable free or otherwise readily detectable free or residual product." The objective is to remove grossly contaminated soil where feasible; refer to Section 4.2.1. |
| Unspecified Compounds, if applicable | Default to 6 NYCRR Part 375 Part 6, Table 375-6.8 (b) Restricted Residential Cleanup Objectives protection of public health or Groundwater whichever is more restrictive |

The proposed SSSCOs will be achieved through excavation of contaminated soils to the extent that they are accessible. Refer to Section 4.2.1 for the excavation description.

## 3.5 Development of Remedial Alternatives

There are two remedial alternatives for the Brownfield Site that are practicable considering the intended use, setting, the economic factors driving re-development, and the New York City regulations promoting re-vitalization.

**Alternative 1: Removal of All Contaminants to Achieve Unrestricted Residential Use**

Alternative 1 consists of excavating down to bedrock over the entire area containing DNAPL and backfilling to development grade with clean soil. Alternative 1 entails deep excavation through the very dense, tight till and scraping the decomposed bedrock surface, resulting in a long remediation period. Off-site contamination would be blocked by a combination of sheeting, underpinning or existing building foundation walls to prevent re-contamination of the Brownfield Site. Groundwater would be remediated by the construction de-watering/treatment system. No engineering or institutional controls would be necessary under Alternative 1.

**Alternative 2: Soil and NAPL Removal with Engineering and Institutional Controls**

Alternative 2 is excavation and off-site removal of the source contaminant and contaminated soil beneath the Brownfield Site to development depth and to below development depth where practicable. Figure 12 shows the Brownfield Site and the excavation area. Alternative 2 includes excavation to the Brownfield Site boundaries using sheeting, underpinning or existing building foundations (refer to Attachment 2 for a complete list of options) to isolate the Brownfield Site edges from off-Site contamination remaining on the adjacent Outlet City VCP site or adjacent streets and properties. A vapor barrier between the building foundation and the surrounding soil will be installed to isolate the interior from vapor intrusion. In addition to the vapor barrier, a combination perimeter and sub-slab depressurization system (DPS) will be installed as an additional vapor protection measure. The depressurization system will be installed around the BCP Site perimeter above the maximum groundwater elevation. The northern quarter of the building, because it will not have a basement, will have sub-slab depressurization. The perimeter component will have a 10-foot stand-off along the southern boundary to accommodate future development of the adjacent site. In the beginning, the DPS will actively remove vapors, but if testing demonstrates that vapor levels during a passive condition pose no adverse impacts, then the Volunteer will petition to change to a passive vapor removal system only, with the active DPS as a backup. The vent will be 6 to 8 feet above the top of the adjacent 5-story building per New York City code.

A groundwater interception/treatment system would be installed along a portion of Orchard Street to create hydraulic control and prevent migration of contaminated groundwater from the Brownfield Site. All excavation of grossly contaminated portions of the Brownfield Site would be performed under a containment structure with negative

air pressure and/or by direct air flow to prevent odors or vapors from leaving the Brownfield Site.

The building and cover soil would serve as a protective cover from soils at depth containing residual DNAPL to eliminate exposure. The vapor barrier would prevent the potential for vapor intrusion into the building from residual DNAPL that is inaccessible.

Underground storage tank removal will take place concurrently with excavation. Institutional and engineering controls will be instituted to prevent future exposure potential. Groundwater use restriction will be instituted in the Environmental Easement.

**Analysis of Remedial Alternatives**

Table 4 presents a side-by-side analysis and comparison of each alternative.

**Table 4 – Alternatives Analysis**

| Evaluation Criteria | Alternative 1<br>Unrestricted Use | Alternative 2<br>Source Removal w/ Controls |
|---|---|---|
| Overall Protectiveness of Public Health & Environment | Removes all soil contamination, DNAPL and LNAPL from grade to top of rock up to 45+ ft below grade. Requires penetration of dense, compact till and removal of decomposed bedrock. Long remedial duration. Requires massive volume removal and lengthy excavation. | Removes all contamination to development depth plus smear zone. Exposure eliminated with engineering and institutional controls. Hydraulic control prevents impacted groundwater from leaving the Brownfield Site. |
| Standards, Criteria, & Guidance | Conform to standards and criteria via full removal to development depth and control of migration by groundwater interception | Will conform to standards and criteria via full removal to development depth and control of migration by groundwater interception |
| Long-Term Effectiveness & Performance | Completely effective, permanent remedy for mobile contaminants. | Completely effective, permanent remedy for mobile contaminants. |
| Reduction in Toxicity, Mobility, or Volume | Completely effective, permanent remedy. Removes mobile source mass and most contaminant volume. Blocks migration of remaining non-mobile contaminants with groundwater interception. | Completely effective, permanent remedy. Removes mobile source mass and most contaminant volume. Blocks migration of remaining non-mobile contaminants with groundwater interception. |
| Short-Term Impacts and Effectiveness | Effective in short term, but may require excavation under tent, trucks for removal, community monitoring, increased traffic, and soil stockpiling | Effective in short term, but may require excavation under tent, trucks for removal, community monitoring, increased traffic, and soil stockpiling |

**Table 4 – Alternatives Analysis**

| Evaluation Criteria | Alternative 1<br>Unrestricted Use | Alternative 2<br>Source Removal w/ Controls |
|---|---|---|
| Implementability | Very difficult to implement because of excavation depth to bedrock, feasibility of excavation and equipment limitations.<br><br>The costs and delays associated with this alternative would make the redevelopment economically unfeasible. | Easily and readily implemented. Existing structures to be razed making excavation on the Brownfield Site complete. |
| Cost-Effectiveness | Will dramatically increase cost of remediation to the point where it will off set advantages of construction and development. Cost has a high probability of terminating project. | Much more cost effective because most of the Brownfield Site must be excavated for construction purposes. Excavation serves a dual purpose. |
| Community Acceptance | Community is largely commercial and most residences are at some distance from Brownfield Site. Not expected to cause concern as long as effective short-term controls are in place and followed. Will increase duration and disruption to community because of traffic. | Community is largely commercial and most residences are at some distance from the Brownfield Site. Not expected to cause concern as long as effective short-term controls are in place and followed. |
| Land Use | Remedy is consistent with contemplated residential use | Remedy is consistent with contemplated residential use |

The preferred remedial alternative is Alternative 2. Alternative 1 is not feasible because the time to implement the additional deep excavation precludes development within an economically feasible time frame, because of the sheeting and shoring requirements for the deep excavation. Alternative 1 will result in a very long remediation period because of the depth of excavation and the difficulty of excavating through the dense till layer and scraping the bedrock surface at depth. The BCP Volunteer needs to begin remediation by August 1, 2007.

Alternative 2 is selected because it is a completely effective permanent Brownfield Site remedy that fulfills all of the BCP remedial goals and objectives and leaves the Brownfield Site in a condition that poses no adverse conditions affecting public health or the environment. Alternative 2 isolates any remaining contamination thus eliminating any potential direct exposure pathways and controls and treats any potential off-Site plume of residual contamination. Only Alternative 2 can accomplish the goals within the critical time frame necessary to make the building feasible and economically viable for the intended use and location.

# 4.0 REMEDIAL WORK PLAN

The RWP describes the details of Alternative 2 to remediate the Brownfield Site. The remedial plan is to excavate the entire Brownfield Site down to the development depth, anticipated to be a maximum of 12 feet (approximately elevation 3 ft QBD) beneath the building or to rock. Where excavation does not extend to 15 feet below grade, endpoint samples will be collected to determine whether Track 2 SCOs have been attained. If endpoint samples fail the Track 2 Soil SCOs, then either Track 4 SCOs will apply by default or additional excavation and endpoint sampling may take place. Outside the building, excavation will extend to a maximum of 15 feet or to rock.

The building on the Brownfield Site and buildings near the Brownfield Site will be demolished to grade before remediation begins or concurrently with remediation, but their foundations will remain, although the disposition of foundations will be a field determination. The foundations will be removed during remediation because of potential contamination and/or used as barriers to contamination re-entering the Brownfield Site, depending on field conditions. Beyond excavation, another goal is to add hydraulic control to prevent contaminated groundwater from leaving the Brownfield Site.

## 4.1 Brownfield Site Preparation

### *4.1.1 Sediment and Erosion Control Measures*

Sediment and erosion control measures will be installed prior to any ground-intrusive work. They will be installed according to the requirements of the Stormwater Pollution Prevention Plan (SPPP), Appendix B. SPPP measures will provide for control of environmental pollution arising from stormwater during remediation and construction. The control measures will include a berm, or hay bales around the Brownfield Site perimeter, drainage inlet protection, stabilized construction pads at each construction entrance and routine maintenance and street cleaning. Appendix B describes the specific measures in detail.

### *4.1.2 Grading*

The Brownfield Site is an excavation with no anticipated significant fill import. Structural materials will be brought on the Brownfield Site for building and remediation construction. The Brownfield Site is currently paved and has a building that will be demolished to allow access to the soils beneath the structure. Demolition of the building and removal of the paving will lower the Brownfield Site below the sidewalk before remediation begins.

In keeping with the requirements of a New York City “E” Designated Brownfield Site, any imported backfill required for grading will either be certified virgin material or non-virgin material that has been tested and meets the stated reuse criteria as noted in the Soil Management Plan (SMP) in Appendix C.

### *4.1.3 Permanent Sheeting*

The Area E alleyway and adjacent parts of Area D contain source contamination in the form of LNAPL and DNAPL. Some of the NAPL migrated to other portions of the Brownfield Site along bedrock (DNAPL) and around building foundations and walls (LNAPL) onto the adjacent Outlet City site. It is possible that the remedial excavation will encounter NAPL at these locations, and it is possible that the NAPL could migrate back onto the remediated area. A means of preventing re-contamination of the remediated areas is therefore necessary.

A number of methods of preventing re-contamination may be used depending on the structures and nature of the contamination near them. Sheeting will be used where there is sufficient space to drive the sheet piles and where the structures can sustain the vibration. Where these conditions cannot be met, the approach will be to use underpinning of structures to below the smear layer. If foundation walls extend to bedrock, then these may be left in place to control migration, if conditions warrant; this will be a field determination. Figure 12 shows the anticipated location of the excavation support system. At some locations field conditions will dictate what method is used; and this will only be known upon excavation. Details of each of the possible means to prevent re-contamination appear in Attachment 2.

Waste characterization and additional geotechnical soil sampling are planned for the Brownfield Site in which numerous borings within the footprint and along the Site perimeter will be advanced. The information obtained from these borings will influence the means to control NAPL. The information may also indicate what means of NAPL control presented in Attachment 2 are unnecessary.

The unoccupied 5-story residential building will be underpinned along its western edge if it is still present and the MTA building is anticipated to require excavation support along its southern edge along the Brownfield Site boundary to provide support to the buildings while excavating (Figure 12) and isolate any contamination beneath this building from re-entering the Brownfield Site after completion of remediation. Underpinning will be installed by excavating narrow pits with local dewatering and placing the supports inside the pits and beneath the structures. Foundation depths of the buildings along the southern and southeastern Brownfield Site boundaries are also not known. If the foundations of these buildings do not reach the bedrock, underpinning of these buildings along the adjacent Brownfield Site boundaries might be necessary, or demolition of the buildings and foundations and replacing them with sheeting. The decision to underpin will be taken based on the Brownfield Site conditions and further coordination with the NYCTA. Alternative methods of isolating contamination and supporting the buildings may be necessary depending on field conditions. These will be coordinated with the agency as necessary.

Permanent interlocking sheeting will be installed around other segments of the remedial excavation to isolate it from re-contamination; the exact location and extent

of sheeting will be based on site conditions. The sheeting will be driven into the low-permeability till layer (or 2 to 3 feet lower than the smear zone). Sheeting will include all necessary walling, bracing, and/or tiebacks. The sheet piling will be new and unused, conforming to the requirements of ASTM A328-07, unless otherwise indicated.

The sheet piling must conform to all applicable codes and standards. The seams in the sheeting will be sealed with hydrocarbon-resistant Adeka gaskets, or equivalent, to prevent infiltration of contaminants back onto the Brownfield Site. Steam, vibratory, pneumatic or diesel powered hammers will be used to drive all sheeting. Any material that obstructs the driving of sheeting will be removed by excavation.

#### *4.1.4 Permits/Notifications*

All necessary permits will be obtained prior to commencing the remediation work. The permits that may be required include:

- New York City Department of Sanitation (DPS) landfill permit (16 RCNY Chapter 3) for placement of clean fill – Not anticipated.
- A New York City Department of Environmental Protection (NYCDEP) sewer connection permit (15 RCNY Chapter 19) for discharge of the groundwater from dewatering operations to the City sanitary sewer and remediated groundwater after dewatering ceases.
- Filing of a Notice of Intent (NOI) with the NYSDEC to obtain coverage under New York State Pollution Discharge Elimination System (SPDES) General Stormwater Permit for Construction Activity – Not anticipated as the Brownfield Site is less that 1 acre.
- A copy of the NYSDEC Air Facility Registration form and manufacturer cut sheets for the blowers and the granular activated carbon vessels associated with the air handling/vapor treatment system will be provided to NYSDEC
- Building permit for excavation enclosure
- Part 375.1.12 waiver for local permits. Not anticipated, but could be required.

## 4.2 Soil Removal

The following sections describe the remedial excavation methods and procedures.

### 4.2.1 Extent of Soil Removal

Excavation will extend to the boundary of the Brownfield Site. Soldier beams and lagging are anticipated to be constructed approximately three feet beyond the property line along Orchard Street and Jackson Avenue subject to NYCTA requirements. Within the Brownfield Site a combination of sheeting, shoring, and underpinning will stabilize the excavation sides where there are building foundations

or walls (Attachment 2). The Brownfield Site will have been previously divided into grid cells for the purpose of pre-characterizing soil for disposal (refer to the Soil Management Plan in Appendix C).

Soil within the Brownfield Site will be excavated to development depth. Where the soil is shallower than these elevations, the soil will be excavated to the top of bedrock and all contamination removed. Where the soil is deeper than the development depth and where a smear zone exists, soil with free or residual LNAPL and/or DNAPL will be excavated to the bedrock or as far as practicable and accessible within the till. If the bedrock and/or till is much deeper than development depth, then the smear zone or other visible contamination will be excavated to two feet below the bottom of the stained soil, if possible, or until the bulk of the stained soil is removed, to the point where any remaining stained soil plus development plans will no longer pose a plausible risk and/or pathway to potential receptors. All accessible contaminant of concern—creosote and petroleum—will be removed.

Post-excavation bottom samples will be collected at endpoints to document conditions at a sampling rate of one endpoint sample/900 $ft^2$ (DER-10, 5.4 (a) 2 ii). Post-excavation sidewall samples will be collected around the excavation perimeter at a rate of one sample/30 linear feet (DER-10, 5.4 (a) 2 ii). Since these samples will be outside the Brownfield Site boundary, they are for documentation and record keeping purposes only. It is estimated that up to approximately 20,000± tons of soil will be excavated as part of the remediation. Large pieces of debris such as wood and concrete will be segregated from the soils and set aside as construction and debris (C & D) for disposal.

### 4.2.2 Excavation

The preferred method is to excavate and load soil (and debris) directly into trucks for disposal at off-Site facilities without stockpiling; however, some temporary stockpiling within the excavation may be necessary based on the availability of transport vehicles. There is insufficient space to routinely stockpile and segregate large volumes of soil and direct loading is the most effective means to meet the development schedule and control potential odors. Soil will be removed using appropriate or otherwise suitable excavation equipment. The excavation of areas where creosote or petroleum contamination is anticipated will be performed within a containment structure designed to allow a negative pressure to be maintained.

Excavation entails removal of all soil to development depth, including any smear zone below the development depth that is accessible. Soil will be excavated over the entire Brownfield Site area as required by the final foundation design and loaded directly into trucks for off-site disposal whenever possible. Soils not anticipated to be contaminated by petroleum or creosote will be excavated outside of a containment structure. Any soil stockpiled outside a containment structure will be placed upon plastic sheeting and covered with plastic sheeting at the end of each day. Soils

stockpiled within the containment structure will be placed on plastic sheeting but not covered.

Trucks transporting petroleum or creosote contaminated soils will be placed in gasketed trucks to prevent leakage of any liquids from the truck. The top of the truck will be covered with a tightly sealing cover to prevent odor or vapor release during transport.

DNAPL was not identified in the borings along Orchard Street and no migration of product back into the Brownfield Site from this direction is anticipated. On the north side of the Brownfield Site along Jackson Avenue, DNAPL was observed in borings collected at an elevation of approximately -17.5 ft QBD. DNAPL at this location is residual (not mobile) and therefore poses no material threat of migration. DNAPL along Jackson Avenue followed a release decades ago where the DNAPL source has long since been eliminated. Under these conditions, water is expected to have re-occupied the smaller pore spaces, making the DNAPL discontinuous and under negative capillary pressure, rendering it immobile. This is confirmed by serial well measurements that found no DNAPL inside any of the monitoring wells.

Potential areas for DNAPL migration from off-Site occur along a portion of the west wall of the 5-story unoccupied residential building, the south yard of the residential building, along the south wall of the NYCTA Substation buildings, along the western wall of the 1-story brick building 6A and northern wall of buildings 2C and a portion of building 2B, along the west wall of building 2C and the north wall of building 3A. Building details are unknown at these locations and it is possible that the building walls extend to the top of bedrock. Their exact condition will only become known when the buildings are demolished and excavation begins. Depending on the uncovered conditions, several alternatives may be used to control DNAPL from migrating on or off Site. Measures may include underpinning of the building foundations or installing sheeting that will be keyed into the till or extend to bedrock.

### 4.2.3 Containment Structure—Petroleum and Creosote-Contaminated Areas of the Brownfield Site - Area E Alleyway and Adjacent Area D

The Area E alleyway and adjacent portion of Area D are the most heavily impacted part of the Brownfield Site. Creosote is responsible for most of the impacts and generates strong odors. Consequently, soil in this area must be excavated beneath a containment structure so that odors and vapors can be controlled. The enclosure(s) may be a sprung structure, scaffolding, or an enclosure formed by tarps or plastic coverings attached to adjacent buildings, or a hybrid. The enclosure will be sufficiently large to accommodate excavation equipment and accommodate truck loading. Negative pressure will be maintained by a continuous ventilation system consisting of ventilation fans and activated charcoal filters. Other areas may require excavation within an enclosure if warranted by excessive odors or VOC levels or

controlled with the use of odor suppressing foam and tarp covers. This decision will be made based on field conditions.

A containment structure will be installed, operated and maintained over the excavation areas to prevent off-Site migration of odors and vapors. The structure will be erected and maintained for as long as necessary during excavation. The structure will be designed and engineered to be self-supporting, constructed of a material that is compatible with the proposed environment, impermeable to the anticipated contaminant vapors, adequately lighted, large enough to encompass the excavation operations and able to be moved to encompass other areas, if necessary. The enclosure will comply with local building codes with regard to loading and structural considerations.

The containment structure will be fully enclosed and include an air handling/vapor treatment system. The enclosure will have a vapor management system capable of maintaining a negative air pressure and capturing and treating emissions from the excavation prior to discharge into the atmosphere and/or capable of controlling air emissions by means of direct air flow. Air changes will be sufficient to allow work within the structure at Level C, as defined in the Health & Safety Plan (HASP) (provided in Appendix D).

The air handling system will consist of at least two blowers that will draw air out of the structure to maintain a negative air pressure and/or by direct air flow so that vapors and odors are contained. The blowers will be sized to include a minimum of six air exchanges/hour, inclusive of the open excavation volume. Selection of the vapor control measures is subject to acceptance by the Department. The levels should be as such to meet the community air monitoring requirements as given in the Community Air Monitoring Plan (Appendix E). Exhaust air will be treated by an air treatment system designed to assure compliance of the discharged air with relevant emissions standards in accordance with the NYSDEC publication "Air Guide I." The vapor treatment system will likely consist of at least two vapor phase granular activated carbon (GAC) units to reduce VOC concentrations in the discharged air. Supplemental emission control (e.g., synthetic foam, "Biosolve", and/or soil liners) will be available for localized contaminant areas discovered outside the containment structure.

During operation of the air handling system, discharge emissions will be tested to confirm that they meet NYSDEC discharge criteria. Testing will consist of field screening the treated discharge on a daily basis using a photo-ionization detector (PID). Vapor samples will also be collected for laboratory analysis using Summa canisters at system activation and once again during contaminated soil removal activities to calibrate the PID measurements to actual containment concentrations.

At the conclusion of each work day, exposed contaminated soil within the containment structure will be covered with plastic and/or long-duration foam and then the air handling system will be turned off. Operation of the air handling system will

resume the next morning approximately one hour prior to any entry or excavation or loading, to evacuate and treat any vapors in the structure. If the covering of the exposed contaminated soil proves to be inadequate to control vapor/odors, as a contingency measure, at least one blower will be operated during non-working hours to maintain negative pressure within the structure. Contaminated soil containers and roll-off containers, if any, will be covered at the end of each day to prevent vapor emissions and the migration of odors and to prevent the infiltration of rainwater.

## 4.3 Endpoint Sampling

The goal of endpoint sampling is to verify that soil left on Brownfield Site meets the SSSCOs or that any remaining soil does not pose an adverse risk to end users. Another goal is to document final conditions both on the Brownfield Site and along the adjacent sites and streets.

Bottom post-excavation samples will be collected to document endpoints conditions at a sampling rate of one endpoint sample/900 $ft^2$ (approximate 30-foot center spacing). If end point sampling indicates that SSSCOs were not met, additional excavation will be performed where feasible and the end point sampling will be repeated. Post-excavation samples will not be collected where excavation is to bedrock.

If additional excavation becomes necessary for construction purposes after post-excavation sampling documents clean conditions, then, assuming the soil is free of visible staining other signs of contamination, or elevated PID readings, the excavation will not require further testing.

Sidewall post-excavation samples will be collected around the perimeter of the Brownfield Site excavation at a rate of one sample/30 linear feet, and will be collected in the approximate center of the contaminated interval. Since the sidewall samples along Orchard Street and Jackson Avenue will actually be collected in off-Site soils beneath the sidewalk, because excavation will reach to the Brownfield Site boundary, these sidewall samples are being collected for information purposes only. The sidewall samples will be more representative of conditions beneath the public streets and will serve to document conditions at the Brownfield Site boundary. Where the sidewall is inaccessible, the samples will be taken with a direct push sampling device at 30-foot intervals just outside the Brownfield Site boundary.

For the remaining perimeter, post-excavation samples will not be collected where there is sheeting or foundation walls, nor will sidewall samples be collected at the Brownfield Site perimeter where there is a common perimeter with the bordering Outlet City site.

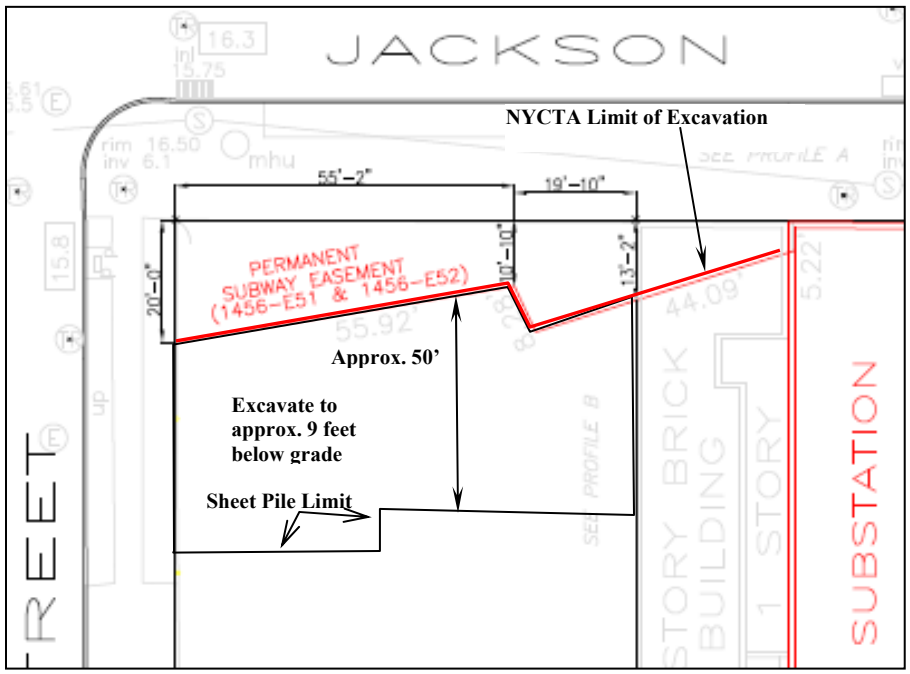
Post-excavation samples will be collected for Target Compound List (TCL)VOCs, TCL SVOCs, and TCL metals. The Quality Assurance/Quality Control (QA/QC) Plan in Appendix F presents the approximate number of samples, method numbers, and sample collection information.

## 4.4 Protective Wedge

Monitoring well/boring E-4 has a smear zone that extends below development depth to the till where it reaches the DNAPL layer above the bedrock. Following removal of all accessible smear zone and DNAPL at this location to approximately two feet below development depth or to bedrock, a concrete wedge will be installed by chipping out the edge of the contaminated till layer and filling the void with concrete up to the bottom of the proposed development grade. The purpose of this wedge is to prevent any DNAPL from ever moving toward the basement. It should be noted that this is a precautionary measure only. The DNAPL is immobile because of its discontinuous nature, and this is also at the highpoint of the DNAPL zone where its head, if there were any, is greatest. The wedge is an additional design component added as an additional measure of protection. Figure 8 shows the location and approximate placement of the wedge.

## 4.5 Subway Tunnel

Special conditions exist near the subway tunnel crossing the Brownfield Site along the northwest corner, and the BCP Volunteer is subject to constraints and conditions imposed by NYCTA. Excavation is limited near the tunnel because of safety and structural considerations, and details concerning sheeting, shoring, pile driving, dewatering, or underpinning along the tunnel must be approved by NYCTA.




The figure above shows the permanent tunnel easement provided by NYCTA, which also serves as NYCTA's excavation limits. In practice, the BCP excavation and caissons along the easement will extend to the Limit of Excavation or to within 3 feet of the face of the subway structure.

Excavations near the subway easement within 5 to 6 feet below grade carry relatively few restrictions. Below this depth NYCTA excavation and dewatering requirements become much more stringent. Excavation cannot extend closer than 1 foot to the top of the subway structure, and on the sides a minimum slope of 1 to 1.5 must be maintained.

NYCTA requires hand excavation close to the tunnel and excavation below the top of the subway requires bracing.

The foundation excavation will extend to approximately 10 feet QBD between the Sheet Pile Limit and the NYCTA Limit of Excavation (approximately 10 feet below the final sidewalk grade [19.8 QBD] along Jackson Avenue).

Other potential issues near the tunnel are vibration, access limitations, the potential delays attendant when working near major subsurface infrastructure, and ultra high voltage. There is an MTA substation near the subway tunnel and this is probably a source of high energy electrical power. Coordination of the construction has begun with the NYCTA. Requirements of the NYCTA will be presented to the Department to determine the appropriate measures in this area of the Brownfield Site to address contamination in a manner that is protective to the public health and the environment.

Contaminated soil may have to remain near the tunnel because of safety, structural, and access factors. As with the primary excavation, contaminated soil will be removed to the extent practicable where bulk source removal plus Brownfield Site conditions and end use result pose no risk and eliminate an exposure pathway. Post-excavation samples will be collected to document endpoint conditions on either side of the tunnel. Endpoint samples will be collected in soils above 15 feet below grade to see if they meet the SCOs, and endpoint soil samples will be collected from soil remaining atop the tunnel following excavation.

## 4.6 Construction Dewatering

Dewatering will be used as necessary to complete the work and excavate to the desired depths. Groundwater within the Brownfield Site will be lowered and removed from the excavation using wells placed so as to dewater for construction purposes and/or by local dewatering as necessary. The dewatering system will remove and treat the Brownfield Site groundwater as well as the surrounding area to well below development depth, to the bottom of the remediation zone.

The dewatering system will operate throughout the remediation phase of the project and during the initial building construction phase until foundation floatation is no longer an issue. The extracted groundwater will then be properly treated by being pumped through a treatment suite consisting of settling tanks to remove suspended solids, a separator to remove any free product, and granular activated charcoal (GAC) units to remove dissolved organic contaminants, as required. From there the water will be discharged to the New York City Combined Sewer system through a sewer connection to the existing sewer line on Orchard Street. Discharge will be performed under a NYCDEP groundwater discharge permit meeting the NYCDEP requirements for treatment. No dewatering liquids will be discharged back into the excavation. See Appendix B for the Stormwater Pollution Prevention Plan. A dewatering plan will be forwarded to NYSDEC once it has been developed.

## 4.7 Trucking and Disposal

All trucks used for disposal will be permitted as licensed waste transporters as required by NYCRR Part 364. Trucks will be covered with a tight fitting plastic cover to prevent vapor or odor release during transit. Petroleum or creosote-contaminated soils will be transported in trucks with gasketed rear gates to prevent any liquid discharge during transit.

A decontamination pad will be placed at the exit. Before exiting, soil will be brushed or washed off the trucks' exterior and undercarriage and the wash water collected and treated before disposal to the city sanitary sewer.
Details of truck movement and staging will not be complete until a contractor is selected. These will be presented to NYSDEC once they become known.

## 4.8 Air/Odor Monitoring

Air monitoring on-Site and in the work zone is described in the Brownfield Site-specific HASP in Appendix D. Air monitoring around the Brownfield Site perimeter and within the community is described in the Community Air Monitoring Plan (CAMP) described in Appendix E.

## 4.9 Groundwater Remediation

The ridge of rock under Building 10 blocks groundwater flow to the south diverting the flow to the southwest around the rock, then south toward Newtown Creek through the Dutch Kills.

Because of the obstruction caused by the till layer, a thin, approximately 1-foot-thick, layer of immobile residual DNAPL-contaminated soil will not be removed. The groundwater sampling in this layer suggests that there is little flow in this deep groundwater, probably due to the undulating characteristics of the underlying bedrock forming a basin at depth. To prevent the possibility of this groundwater moving off-Site, the remediation plan includes installing a series of scavenger (capture) wells for hydraulic control to pump and treat this groundwater at the western edge of the Brownfield Site (Figure 12). The groundwater would be treated separately (from construction dewatering) and discharged to the city combined sewer as long as it is in use. Quarterly testing of the discharge will be performed to determine if the deep groundwater meets the TOGS AWQS or has reached asymptotic conditions acceptable to the Department, allowing the pumping system to be discontinued.

The scavenger wells will be designed, installed, and operated following remedial excavation and after the foundation and engineering controls are in place and the Brownfield Site surface is complete. The reasoning behind this approach is threefold: (1) source removal will eliminate much of the contaminant mass, which in turn affects

groundwater contaminant levels, (2) direct observation of the excavation will greatly enhance understanding of Brownfield Site perimeter conditions and optimize placement of the scavenger wells, and (3) development may alter the groundwater flow and positioning the scavenger wells will be protective only after the groundwater flow changes are understood, which is after the foundation and engineering controls are installed and the surface drainage configuration is final.

Groundwater will be tested to determine if a treatment system is necessary or if the discharge will be suitable for discharge to the New York City sewer system.

**Groundwater Capture Well Remediation Design**

The layer of residual creosote DNAPL overlying the bedrock at depth will remain in place because it is inaccessible by excavation and below development depth. The DNAPL, while occupying a layer approximately 1 foot thick over competent bedrock, may continue to contaminate groundwater that must be controlled from leaving the site. Capture wells will be installed in the sidewalk along Orchard Street for this purpose.

The first step is to design a capture well network that yields adequate coverage, and the design entails collecting site-specific information through a pilot test in the contaminated water-bearing zone followed by an analysis of the capture zones formed by different wells and spacing. The pilot test, or pumping test, will obtain aquifer property information to determine the following design elements:

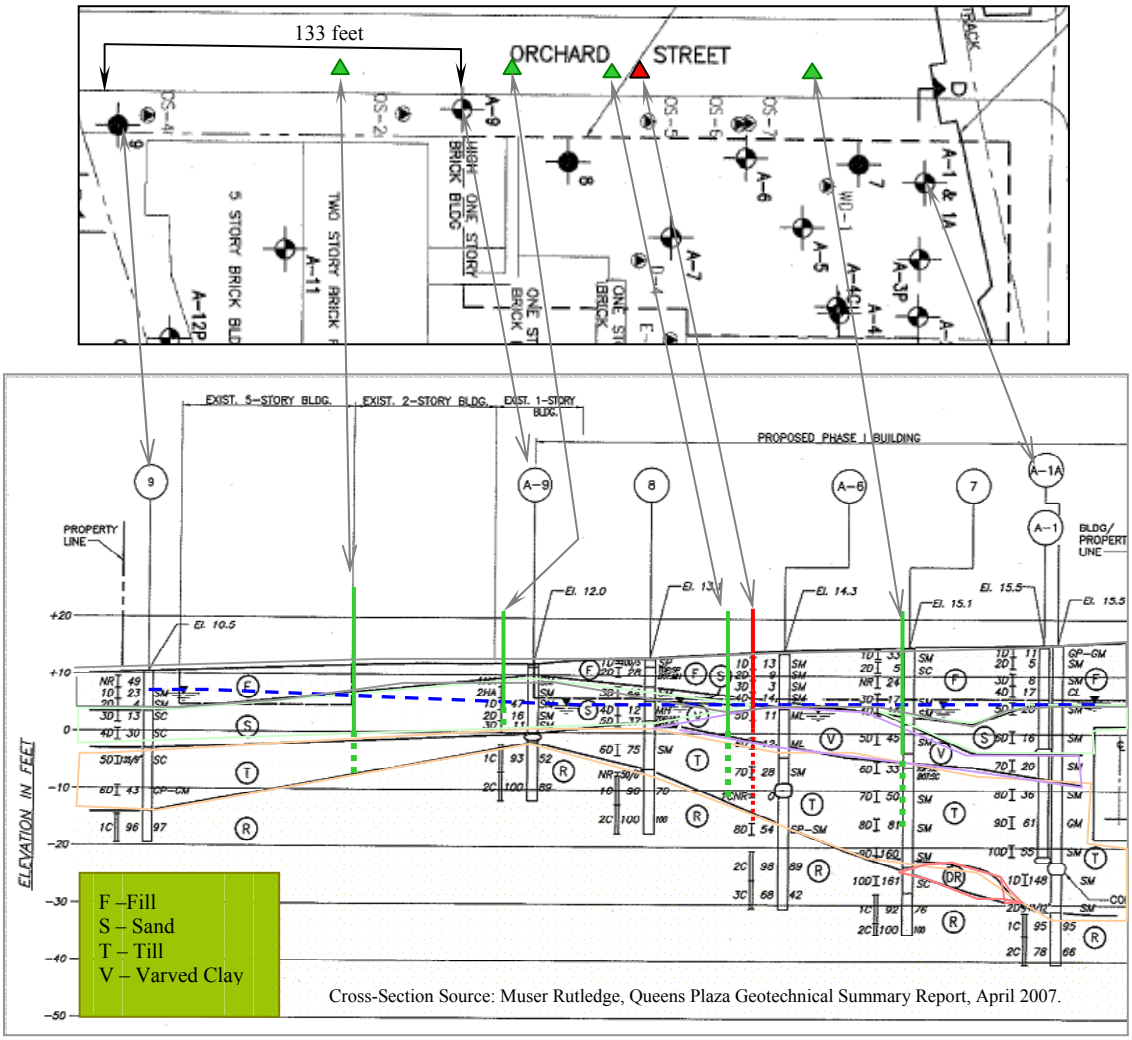
- Pumping rate
- Number of capture wells
- Diameter of capture wells
- Capture well spacing

The pilot test will consist of one 4-inch diameter stainless steel pilot well, screened through 80 – 100% of the thickness of the contaminated water-bearing zone. The pumping well will be screened from the top of the bedrock-till surface, but will have a 1-foot-long sump. A rock core will first be collected that extends five feet into competent rock. The rock core will be grouted before installing the well. The purpose of the core is to examine the character of the rock near the well and to position the screen so as to effectively remove dissolved contamination.

The position of the pilot pumping well depends on the stratigraphy, the bedrock-till profile, and contaminant source zone. The figure below depicts the stratigraphy along Orchard Street to be served by the capture wells and the position of the proposed capture wells relative to the Brownfield Site. The position of the pilot pumping well was selected because it encompass the most representative contaminated water bearing zone closest to the on-site source area, Areas E & D, and because its position takes advantage of a potential natural barrier to groundwater flow formed by the bedrock ridge (see figure below).

The unconsolidated contaminated water-bearing zone along Orchard Street is principally in the compact till and decomposed above the competent bedrock. Varved clay and sand overlie the till throughout much of the local area, but the varved clay is absent in places (see figure below). Transmissivity in the till/decomposed rock is expected to be low and the water-bearing zone is expected to behave predominantly as a confined or leaky unit.

The water-bearing zone response to pumping will be measured using 1.25-inch-diameter PVC piezometers in the water bearing zone as shown in the figure below.




Cross-Section Source: Muser Rutledge, Queens Plaza Geotechnical Summary Report, April 2007.

One piezometer will monitor water level changes above the varved clay aquitard. The piezometers will have 5-foot-long well screens. The pumping test will continue for 72 hours, or less if conditions warrant and insufficient water is produced. The water-bearing zone response will be measured using pressure transducers in the pumping well and in the piezometers. Recovery data will be collected after pumping stops. All discharge water will be discharged to the city sanitary sewer, for which it is currently permitted, although

as stated in Section 4.9, the groundwater will be retested to confirm that it meets NYCDEP sewer discharge requirements.

Where feasible, the existing monitoring wells on Orchard Street will be used as piezometers. Since construction details on these wells are not available, the wells will first be gauged to whether they are suitable as observation wells. If not suitable, then new piezometers will have to be installed.

Before the pumping test, antecedent water levels will be measured for one well to identify ground water level changes that could influence the pumping test. Slug tests and a one-day step drawn down test will be conducted before the pumping test to estimate the sustainable pumping rate for the aquifer test.

Once the pumping test has been completed, the water-bearing zone properties will be evaluated using AquaSolve® or equivalent software using the model(s) that most accurately depict the water-bearing zone response. A capture zone analysis will follow estimation of the water-bearing zone properties. The capture zone analysis will use the procedure presented in Grubb to determine the optimum number and spacing of capture wells. The specific reference is *Analytical Model for Estimation of Steady-State Capture Zones of Pumping Wells in Confined and Unconfined Aquifers,* Grubb, S., Ground Water, Vol. 31, No. 1, January-February 1993. A capture well design will follow testing and analysis and be presented to NYSDEC for review and approval prior to implementation.

The capture well testing and analysis will follow completion of the building foundation and stabilization of the cover. The reason is that excavation and construction of a subsurface foundation and re-grading and cover will materially alter local groundwater flow. And in order to test and design an effective capture well network, it is necessary that post-construction, stabilized, steady-state conditions be in place.

## 4.10 Restoration

### 4.10.1 Backfill Material

The Brownfield Site will be an excavated area, but no significant imported fill is anticipated. Soils that meet the SSSCOs will be stockpiled and used for fill in the areas of the Brownfield Site not occupied by the building basement. It is anticipated that the alley (Area E) and the eastern half of Building 10 will require backfilling. Either reusable soils or imported soils meeting the requirements of Restricted Residential use will be used for this purpose.

No exposed soils are anticipated to remain on the Brownfield Site after development, according to the current development plan. However, the possibility exists that future development may include some limited "green space." In the event that green space is eventually adopted into the final development plan for the Brownfield Site, a minimum 2-foot-thick continuous cap of imported clean soil, as described below, will be placed in these areas.

Any potential backfill brought onto the Brownfield Site must be either certified virgin soil or non-virgin material that fulfills the requirements specified in the Soil Management Plan (Appendix C). The backfill will be used to fill the soil excavations. All soil stockpiling, handling, and characterization will be conducted according to the requirements of the SPPP and Soil Management Plan, included in Appendix B and C, respectively.

### 4.10.2 Backfilling

Excavations will be backfilled to approximately two feet below street level with certified clean fill or reusable soils from the Brownfield Site to facilitate placement of pile caps, vapor barrier, foundations, basements and utility lines for the proposed redevelopment. Area E and middle portion of the Building 10 will be backfilled to existing grade. Backfill will be placed in loose lifts no thicker than 12 inches and compacted in accordance with the owner's requirements. Excavated and filled areas and adjacent transition areas shall be reasonably smooth, compacted, and free from irregular surface changes.

## 4.11 Engineering Controls

### 4.11.1 Water Proofing and Vapor Barrier

The building sub-grade will be below the groundwater table; consequently, water proofing will be necessary. Because the sub-grade will be below the groundwater table, a sub-slab depressurizing system is infeasible. The waterproofing system will thus simultaneously serve both a construction requirement and as a remediation engineering control.

Grace Preprufe® 300R water proofing system or equivalent will be used at the bottom of the sub-slab and on the walls of the basement. Grace Preprufe® 300R membranes are composite sheets of a thick HDPE film, an aggressive pressure sensitive adhesive and, weather-resistant protective coating. Water proofing of Grace Preprufe® 300R is equivalent to 46-mil vapor barrier. Preprufe 300R membranes or equivalent with a HDPE of not less than 20 mils will be applied horizontally to smooth prepared concrete, carton forms, well rolled and compacted sand or crushed stone substrate, and vertically to permanent formwork or adjoining structures. Concrete will then be cast directly against the adhesive side of the membranes.

The Preprufe adhesive layers work together to form a continuous and integral seal to surround the structure. Bituthene® self-adhesive membrane will be applied to walls after removal of formwork for a fully bonded system to all structural surfaces. The effect is to totally encapsulate the building substructure to grade. This yields a barrier to both moisture and vapors.

#### *4.11.2* Soil Cap

Following Brownfield Site remediation, a cap will be placed over the entire Brownfield Site footprint to prevent exposure to underlying soil that could contain contaminants concentrations exceeding NYSDEC RSCOs. The Brownfield Site cap will consist of the on-Site building; concrete/asphalt paving; and two feet of certified clean fill, meeting the unrestricted residential use cleanup objectives, in areas not covered by structure or pavement (none currently anticipated). A marker layer (e.g., orange construction fencing or other geotextile) will be installed under the cap in soil to mark the transition between the soil cap and the material below.

## 4.12 Nuisance Control

### 4.12.1 Rodent Control

The potential for rats and other rodents will be addressed by placing traps around the periphery of the Brownfield Site. No food will be stored on-Site for the duration of remedial activities, and all refuse generated by Brownfield Site activities will be promptly containerized in covered dumpsters or roll-offs. These measures will reduce the possibility of attracting rodents. Rodent traps will be inspected and replaced at a minimum of once every month. Additional traps will be placed, if warranted.

### 4.12.2 Noise Control

Appropriate measures will be taken to ensure that noise levels conform to New York City and local regulations, and to the latest OSHA standards for worker protection. Noise control measures will ensure that on-Site work does not pose a nuisance to surrounding businesses. Equipment and vehicles used on-Site will be outfitted with appropriate noise control devices.

## 4.13 Citizen Participation

Citizen participation will be performed throughout the project in accordance with the approved Citizen Participation Plan. Project fact sheets will be distributed to the public throughout the project, and will include the following:

- Brownfield Site description
- Remedial objectives and selected remedial alternative
- Project schedule
- Sources of additional information

The NYSDEC-approved fact sheet will be provided to persons on the project mailing list (included in Appendix G) prior to the start of remedial activities.

## 4.14 Notification and Reporting

### *4.14.1 Notification*

The following parties will be notified of significant events or developments during the course of the remedial program, and will be notified a minimum of one week in advance of the start of remediation. The listed individuals will receive copies of all reports, plans, and relevant specifications and correspondence.

| Name | Agency | Address | Phone | Role |
|---|---|---|---|---|
| Chris Milack | NYSDEC | Div. of Environmental Remediation<br>625 Broadway<br>Albany, New York<br>12233-7016 | 518/402-9768 | Project Manager |
| Chris Doroski | NYSDOH | Div. of Env. Health<br>River Street<br>Troy, New York 12180 | 518/402-7880 | Health Dept. Liaison |

### *4.14.2 Daily Reports*

Daily reports will be provided to the NYSDEC project manager during excavation activities (via e-mail or facsimile). The daily reports will provide a summary of daily activities, a Brownfield Site map, results of air monitoring, a discussion of any odor or dust problems, and any corrective actions implemented to counter noise, odor, or dust. Any time-sensitive information will be communicated directly to the NYSDEC project manager ahead of the daily reports.

### *4.14.3 Record Keeping*

A project logbook will be kept on-site during all remedial activities, and will be available for NYSDEC inspection. At a minimum, the following information will be recorded in the project logbook:

- Date, weather, and Brownfield Site conditions
- Names and affiliations of all on-Site personnel
- Calibration records for all monitoring equipment
- A record of trucks transporting excavated material from the Brownfield Site
- Daily summary of work, issues, decisions, delays, resolution of issues
- Safety incidents and their resolution
- Waste manifests for material removed from the Brownfield Site will be kept with the project file

#### *4.14.4 Final Remedial Report*

Upon completion of Brownfield Site remediation, FLS will submit a Final Engineers Report to the NYSDEC. The Final Engineers Report will include the following:

- Photographs of remedial activities
- As-built drawings for all constructed elements (e.g., vapor barrier, containment wall)
- Monitoring and post-excavation end-point sampling results
- Waste manifests and bills of lading for all material removed from the Brownfield Site
- A drawing depicting the source areas of contamination encountered during remedial activities
- Documentation of environmental quality for imported backfill
- A Brownfield Site Management Plan

The Final Remediation Report will be certified by the professional engineer of record.

## 4.15 Institutional Controls

#### *4.15.1 Brownfield Site Management Plan*

Upon completion of remediation, a Brownfield Site Management Plan will be prepared to specify any Brownfield Site use restrictions, operation and maintenance procedures, and future soil and groundwater handling requirements. The Brownfield Site Management Plan will also include the Operation and Maintenance (OM&M) Plan, which will contain the following:

- Operation and maintenance procedures for long-term remedial measures (e.g., soil cap and vapor barrier)
- As-built drawings and descriptions of all engineering controls
- A contingency plan describing emergency procedures

The operation and maintenance procedures will be updated periodically to reflect changes in Brownfield Site conditions or the remedy.

#### *4.15.2 Environmental Easement*

An environmental easement will be recorded for the Brownfield Site to enforce the following use restrictions:

- Installation of groundwater wells for potable and non-potable purposes (e.g., car washing, non-contact cooling water) will be prohibited
- Any future excavation activities must be conducted in accordance with the Brownfield Site Management Plan
- The soil cap and permanent containment wall must be operated and maintained according to the Brownfield Site OM&M Plan

The environmental easement will be recorded in the Queens County Clerk's office and will include: a description of the use restriction; a map showing the area of the restriction; a written agreement by the property owner to establish and maintain the institutional and engineering controls; and a copy of the Brownfield Site Management Plan. Prior to the recording of the environmental easement, notification of the intent to establish the institutional controls will be sent to all adjacent property owners; NYSDOH; New York City Department of Health and Mental Hygiene; and the Queens County Clerk's office.

#### *4.15.3 Annual Certification*

An Annual Certification signed by a professional engineer will be submitted to NYSDEC to document the efficacy of the long-term remedial measures. The Annual Certification will certify that no changes to institutional and engineering controls have occurred since the previous certification, and that no deviations from the Brownfield Site management plan have taken place.

## 4.16 Schedule

Remedial actions will be performed during regular construction work hours on weekdays. The current estimate for the duration of the remedial part of construction is eight months starting on August 1, 2007. An approximate schedule is as follows:

**Brownfield Site Remediation Schedule**

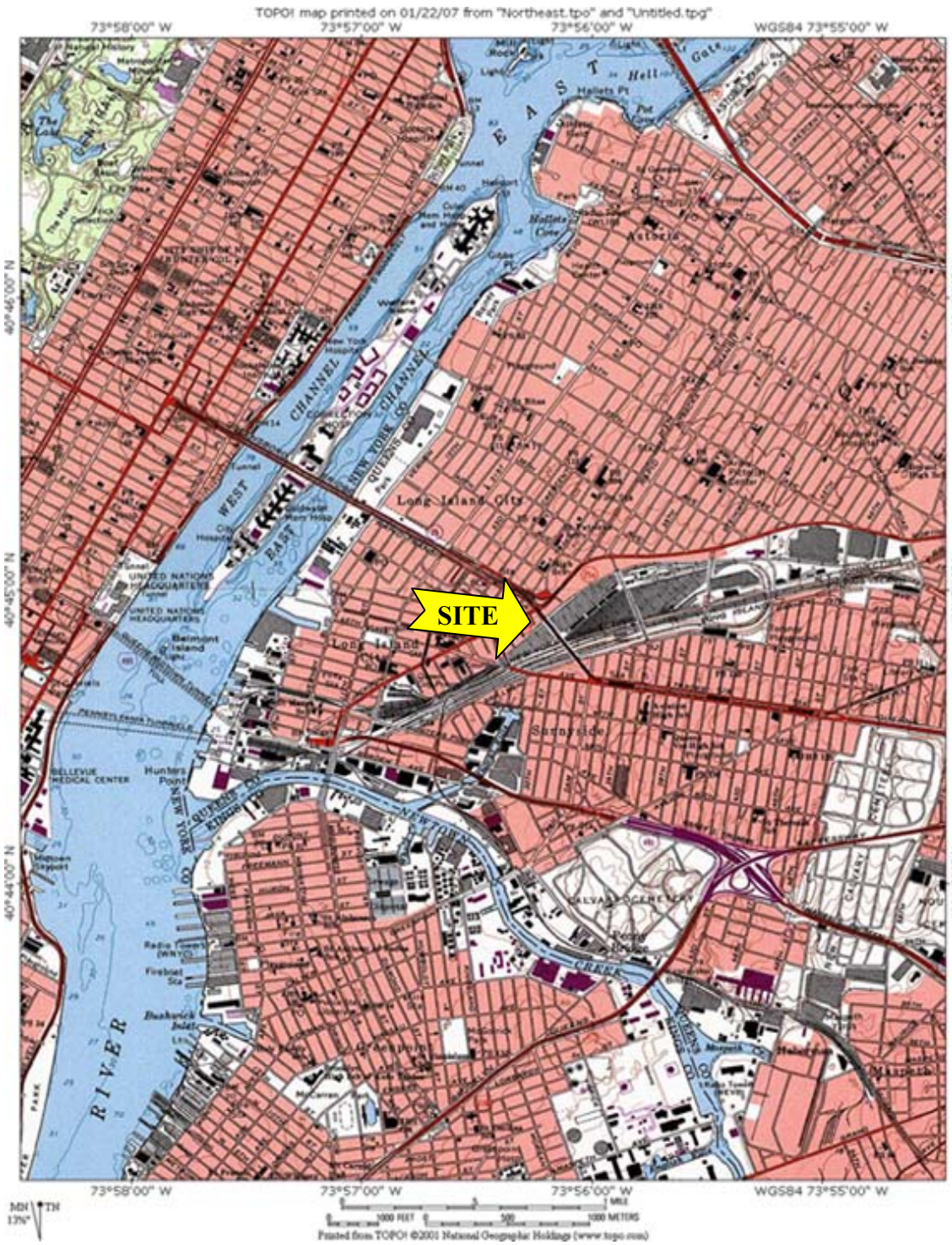
| Item | Duration/Date |
|---|---|
| Submit Proposed RWP | April 4, 2007 |
| NYSDEC Reviews RWP | 10 Days |
| Public Comment Period | 45 Days |
| NYSDEC Finalizes RWP | 10 Days |
| NYSDEC Issues Notice to Proceed | 2 Days |
| **Begin In-Ground Remediation/Construction** | **September 1, 2007—Remediation Begins** |

| | |
|---|---|
| Complete Remedial Excavation | 6 months |
| Remediation Complete | 2 months |

## 5.0 REFERENCES


1. *Queens Plaza Site Investigation*, AKRF, 1988.
2. *Outlet City Soil and Groundwater Sampling Results*, AKRF, 1990.
3. *Outlet City Property*, Supplemental Site Assessment/Remedial Investigation, AKRF, 1998.
4. *Site Investigation*, AKRF, 2002.
5. *Soil and Groundwater Sampling and Analysis*, ELM, 2001.
6. *Remedial Investigation Report,* Fleming-Lee Shue, Inc., March 2007.
7. *Geotechnical Summary Report, Queens Plaza Project – Site A, Long Island City, Queens, New York, Muser Rutledge, April 20, 2007*

# FIGURES



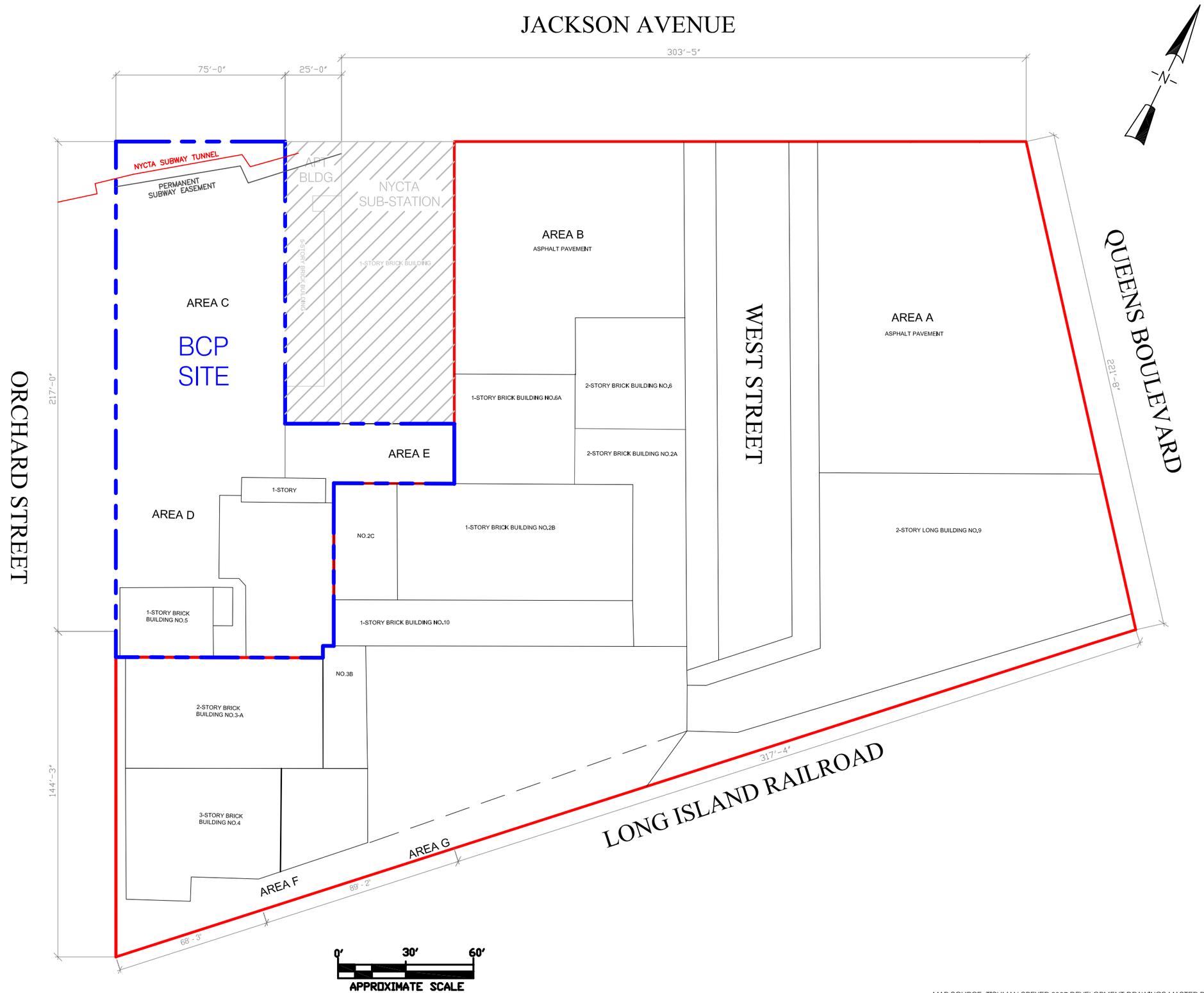

*40074-G1 Weehawken, NJ NY Quadrant 7.5 Minute Topographic Map, published by the USGS, and obtained from TOPO! ©2001*

Fleming Lee Shue

# FIGURE 1: SITE LOCATION MAP

SITE: Queens Plaza Residential Development
Brownfield Cleanup Site
Long Island City, NY

CLIENT: TST LIC Development LLC




MAP SOURCE: TISHMAN SPEYER 2007 DEVELOPMENT DRAWINGS MASTER PLAN

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*Environmental Management & Consulting*

158 West 29th Street, 9th Fl.
New York, NY 10001

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

# FIGURE 2

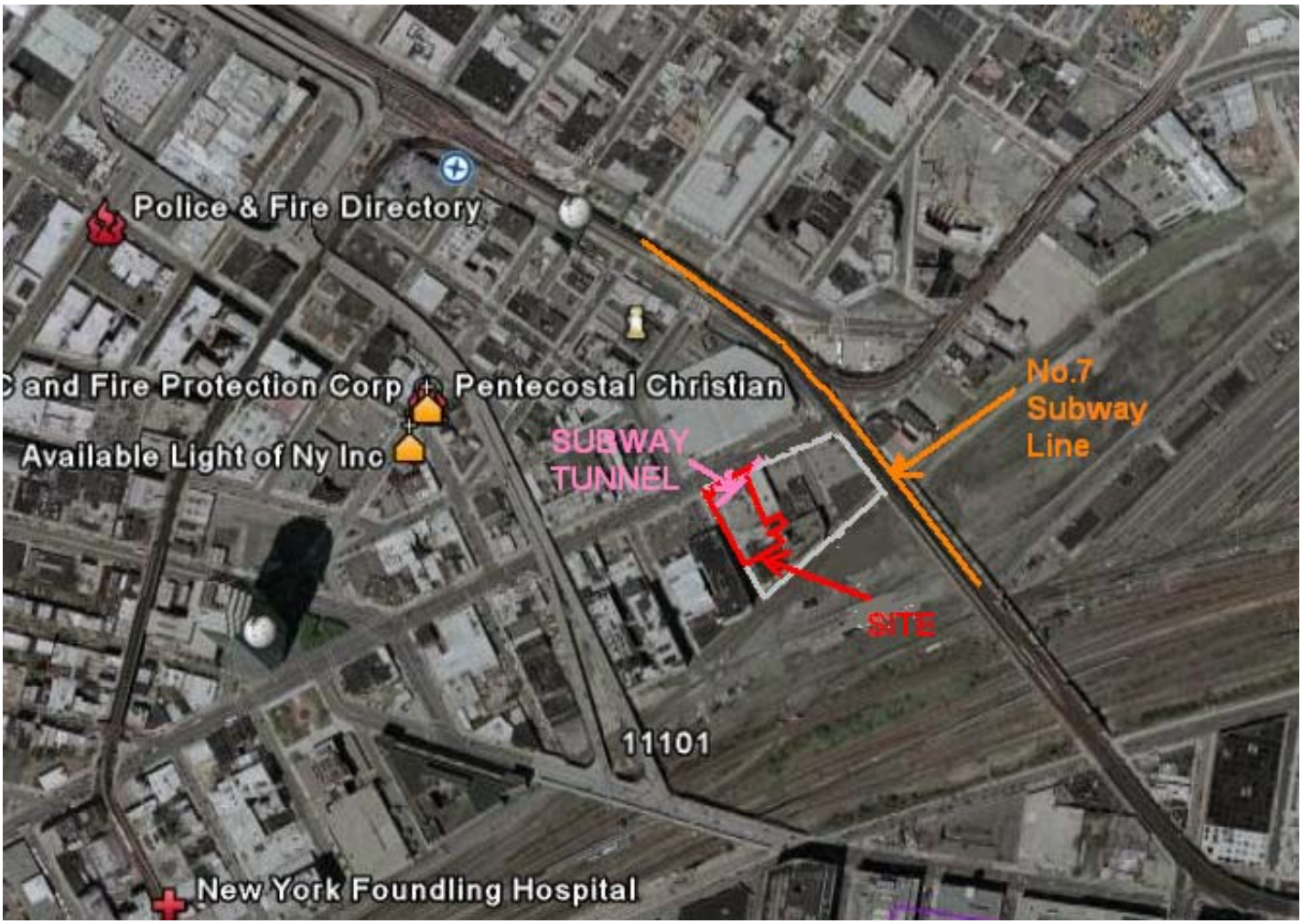
# SITE PLAN

**Date**
**March 2007**

**Project Number**
**10038-005**

## LEGEND

- BCP BOUNDARY AND EXCAVATION FOOTPRINT
- BOUNDARY OF OUTLET CITY VCP SITE
- NOT PART OF SITE




Source: Google Earth 2007

***Not to Scale***

**FIGURE 3: Aerial View of Site and Nearby Sensitive Land Uses**

Fleming Lee Shue

SITE: Queens Plaza Residential Development
Long Island City, New York

CLIENT: TST LIC Development LLC.

# JACKSON AVENUE

ORCHARD STREET

LONG ISLAND RAILROAD

A

C-9
(-26)

A-1/1A

AREA C

C-5

-25

A-5

C-8S
(-22.5)

C-8D

-20

OS-6

D-2D

OS-7D

-15

A-7

D-5
(-12.4)

-10

OS-5

RW-3

D-4

E-3

RW-1

E-2

E-4
(-5.38)

AREA E

RW-2

E-1D

S-4

1-STORY

10-6

AREA D

-5

8
(-6.4)

D-6

A'

NO.2C

1-STORY BRICK BUILDING NO.5

0

10-7

A-10

(+3.0)

NO.3B

2-STORY BRICK
BUILDING NO.3-A

3-STORY BRICK
BUILDING NO.4

1-3

F-3

AREA F

AREA G

5-STORY BRICK BUILDING

1-STORY BRICK BUILDING

ASPHALT PAVEMENT

AREA B

1-STORY BRICK BUILDING NO.6A

2-STORY BRICK BUILDING NO.6

NYCTA SUBSTATION

2-STORY BRICK BUILDING NO.2A

1-STORY BRICK BUILDING NO.2B

1-STORY BRICK BUILDING NO.10

0' 30' 60'

APPROXIMATE SCALE

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New York, NY 10001

Project Number
**10038-005**

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

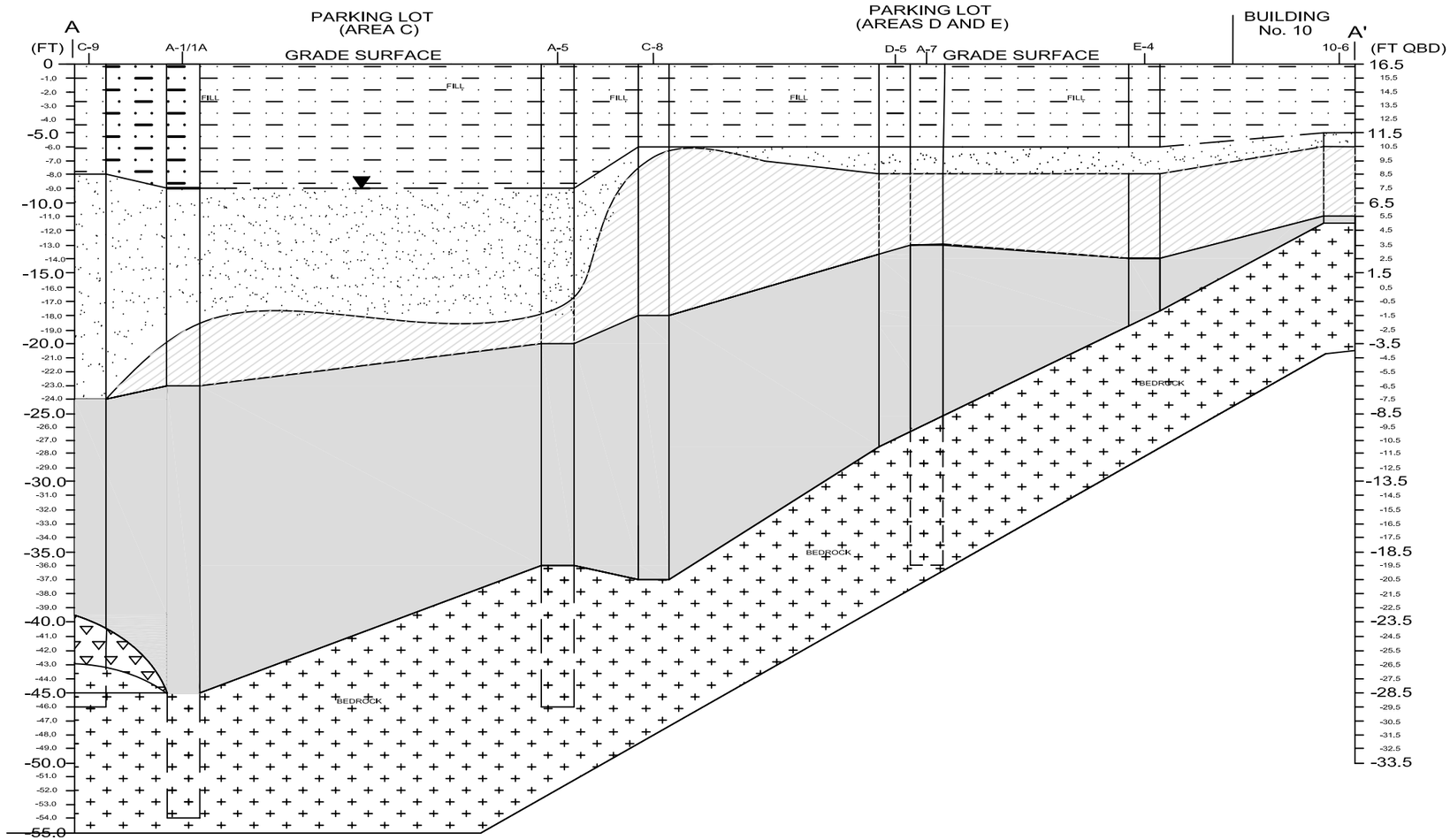
Date
**Revised July 2007**

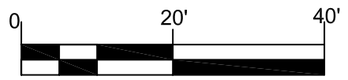
# FIGURE 4

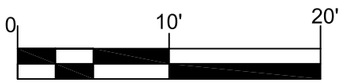
## BEDROCK ELEVATION CONTOUR MAP

## LEGEND

- 10-7 — Soil Sample and Monitoring Well Location
- Geotechnical Boring by Mueser Rutledge Consulting Engineers (April 2007)
- (11) — Bedrock Elevation in Feet (Queens Borough Datum)
- -10 — Bedrock Elevation Contour (Queens Borough Datum)
- BCP Site Boundary and Excavation Footprint
- Boundary of Outlet City VCP Site




NOTE:

GRADE OF SITE PRESUMED FLAT FOR ILLUSTRATION PURPOSES. ACTUAL GRADE OF SITE DECREASES APPROXIMATELY 2 FT FROM C-9 TO 10-6.

STRATIGRAPHIC CONTACTS ARE DASHED WHERE INFERRED.


Fleming Lee Shue

*Environmental Management & Consulting*

**158 West 29th Street, 9th Fl.**
**New York, NY 10001**


QUEENS PLAZA
RESIDENTIAL DEVELOPMENT
LONG ISLAND CITY, NY

# FIGURE 5

## BEDROCK PROFILE CROSS-SECTION A-A'

**Date**
**Revised July 2007**

**Project Number**
**10038-005**

## LEGEND

- Fill, ash, cinders, wood, concrete fragments, fine to medium sand with some silt and gravel
- Dense SAND, Silty Sand with clay seams
- Depth to groundwater
- Interlayered stiff Gray Silty CLAY with trace Sand
- Dense glacial TILL, fine to medium Sand with Gravel
- Weathered Rock
- Bedrock

FT-BG: Feet below grade

FT QBD: Elevation in feet relative to Queens Borough Datum (QBD), 1929

Bedrock Coring Location

# JACKSON AVENUE

N

5.5

C-9
(5.44)

AREA C

C-5
(5.19)

5.0

4.75

C-8S C-8D

OS-6

D-2D

OS-7D

4.5

D-5
(4.49)

(4.82)

OS-5

Net Groundwater Flow Direction

E-3

E-4
(4.57)

AREA E

RW-3
(4.03)

RW-1
(4.73)

E-2

RW-2

D-4
(4.36)

1-STORY

4.5

4.75

AREA D

10-6

D-6

5-STORY BRICK BUILDING

1-STORY BRICK BUILDING

ASPHALT PAVEMENT

AREA B

NYCTA SUBSTATION

1-STORY BRICK BUILDING NO.6A

2-STORY BRICK BUILDING NO.6

2-STORY BRICK BUILDING NO.2A

NO.2C

1-STORY BRICK BUILDING NO.2B

1-STORY BRICK BUILDING NO.5

1-STORY BRICK BUILDING NO.10

10-7

NO.3B

2-STORY BRICK BUILDING NO.3-A

1-3

3-STORY BRICK BUILDING NO.4

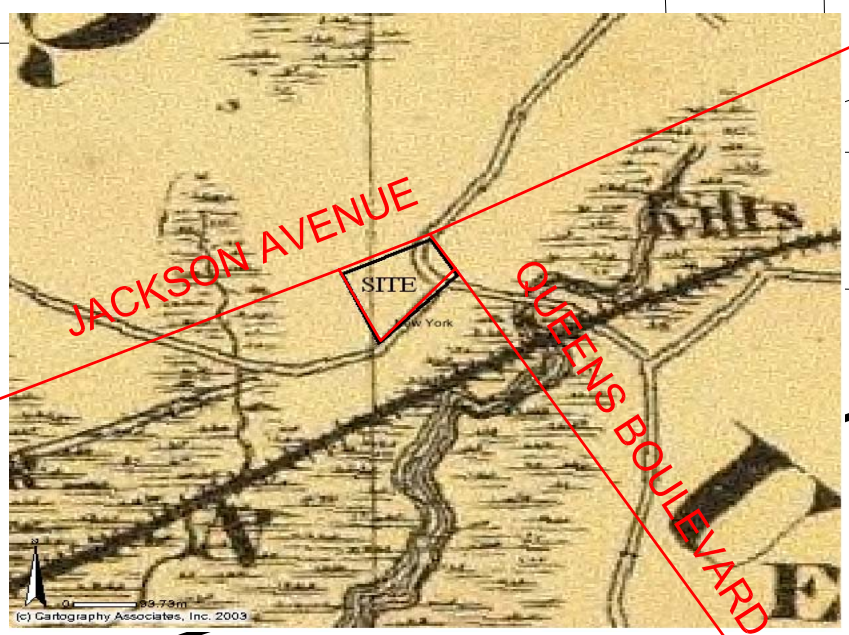
AREA G

AREA F

F-3

ORCHARD STREET

LONG ISLAND RAILROAD




1868 Beers Historical Topographic Map (not to scale)

0' 30' 60'

Fleming Lee Shue
Environmental Management & Consulting
158 West 29th Street, 9th Fl.
New York, NY 10001

Project Number
**10038-005**

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

Date
**March 2007**

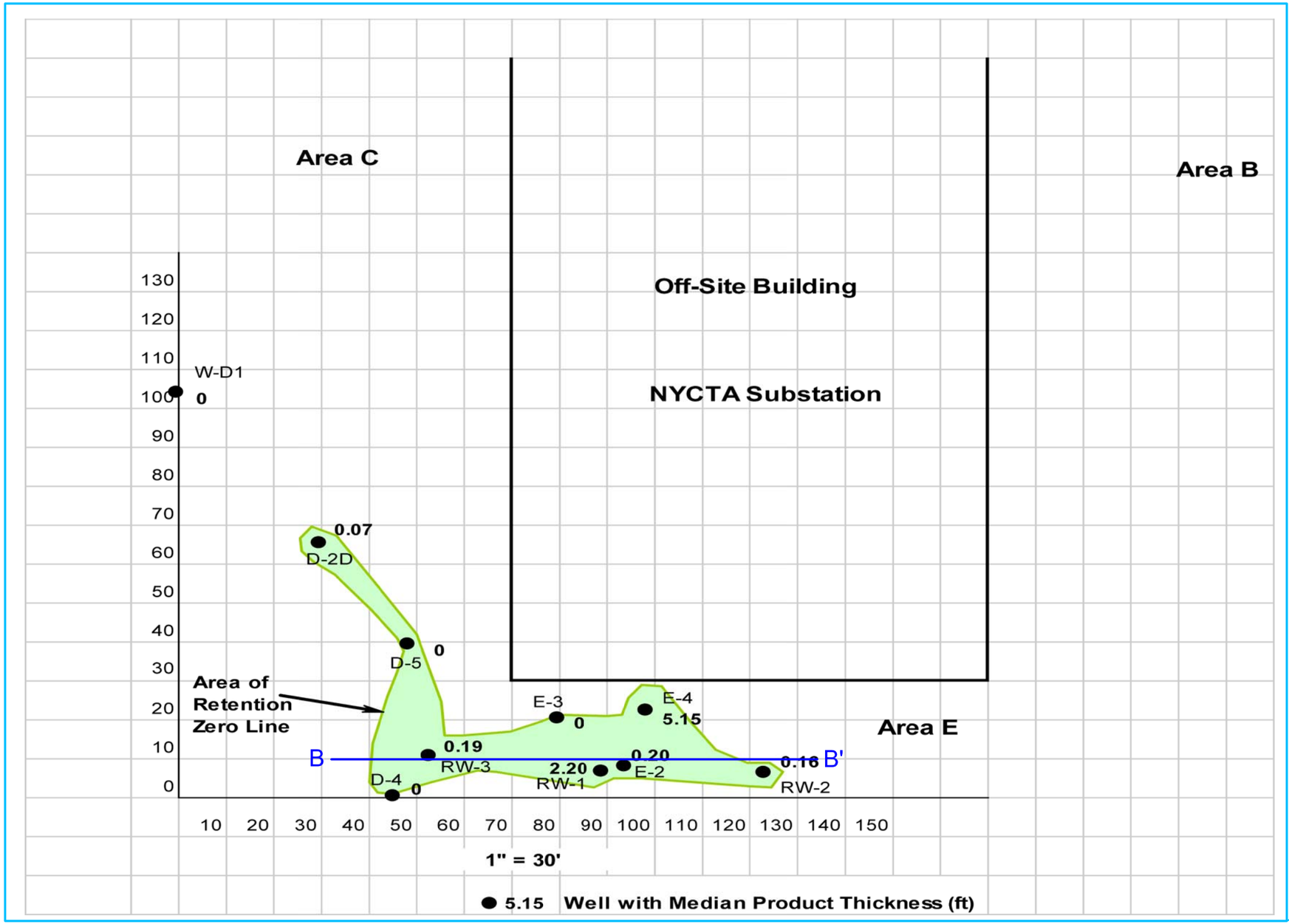
**FIGURE 6**

**GROUNDWATER ELEVATION CONTOUR MAP**

**August 7, 2006 Measurements**

## LEGEND

| | |
|---|---|
| 10-7 | Soil Sample and Monitoring Well Location |
| (11) | Groundwater elevation in feet (Queens Borough Datum) |
| —-10— | Groundwater elevation contour |
| | Groundwater flow direction |
| —·— | BCP Site Boundary and Excavation Footprint |

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**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

# FIGURE 7

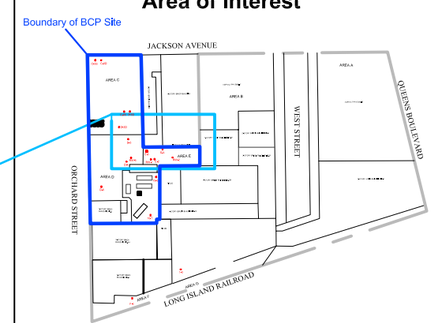
# EXTENT OF MEASURABLE LNAPL IN WELLS

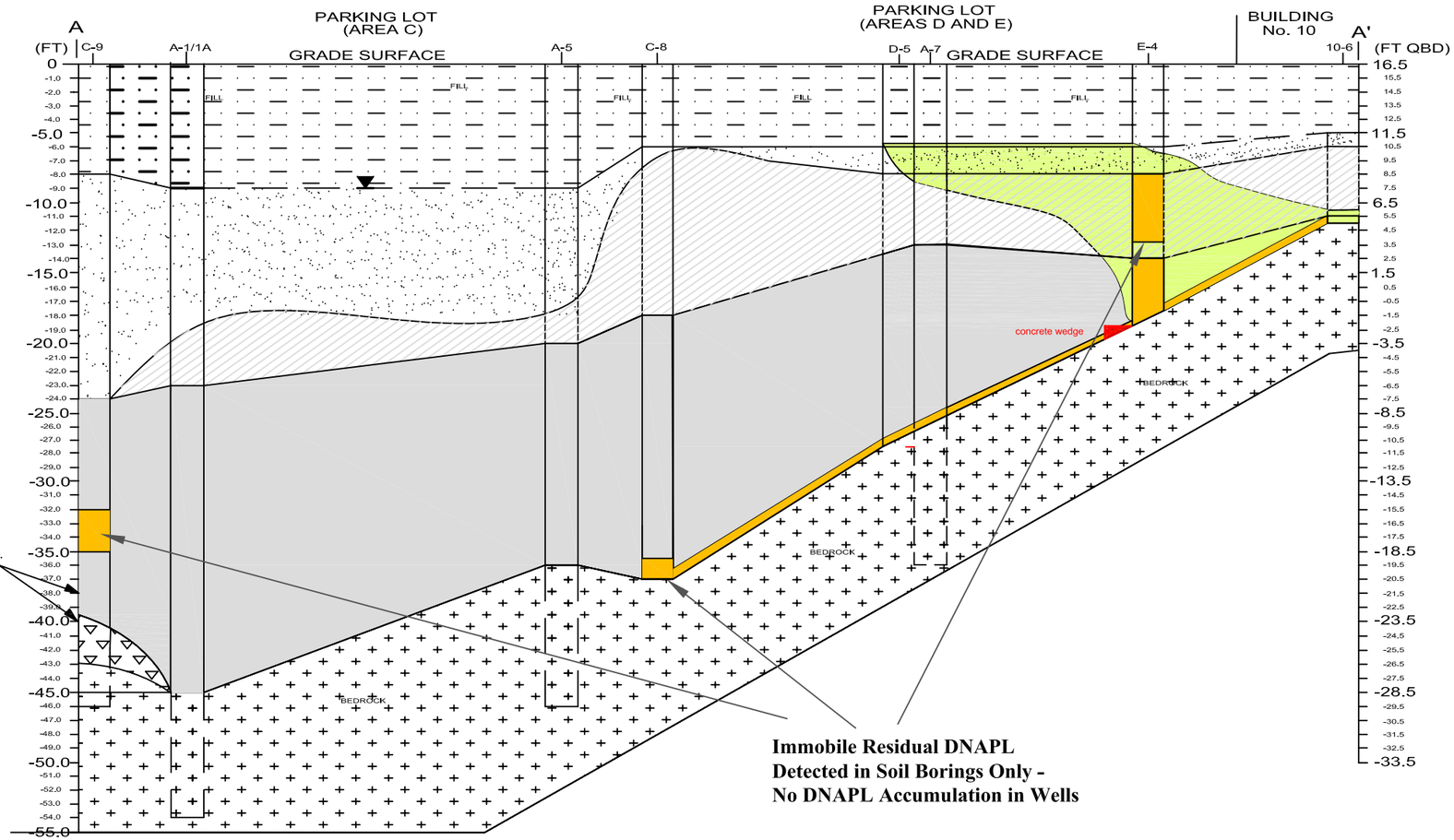
Date
**March 2007**

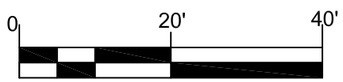
Project Number
**10038-005**

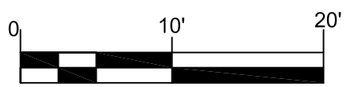
## LEGEND

**Area of Interest**






NOTE:

GRADE OF SITE PRESUMED FLAT FOR ILLUSTRATION PURPOSES. ACTUAL GRADE OF SITE DECREASES APPROXIMATELY 2 FT FROM C-9 TO 10-6.

STRATIGRAPHIC CONTACTS ARE DASHED WHERE INFERRED.

SCO - BROWNFIELD CLEANUP PROGRAM SOIL CLEANUP OBECTIVE


Fleming Lee Shue

*Environmental Management & Consulting*

**158 West 29th Street, 9th Fl.**
**New York, NY 10001**


QUEENS PLAZA
RESIDENTIAL DEVELOPMENT
LONG ISLAND CITY, NY

# FIGURE 8

## SMEAR ZONE

**Date**
**Revised July 2007**

**Project Number**
**10038-005**

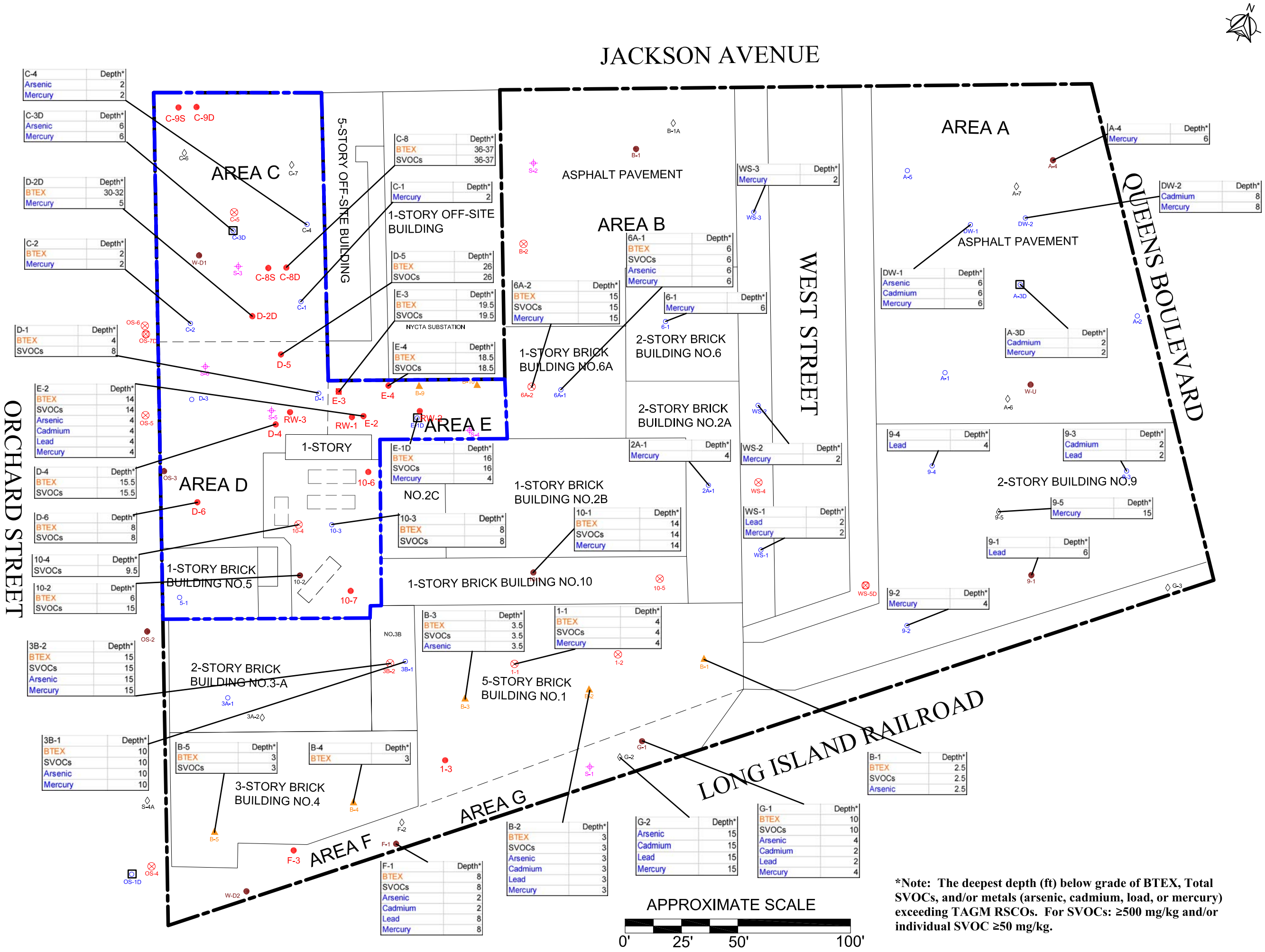
## LEGEND

- Fill, ash, cinders, wood, concrete fragments, fine to medium sand with some silt and gravel
- Dense SAND, Silty Sand with clay seams
- Depth to groundwater
- Interlayered stiff Gray Silty CLAY with trace Sand
- Dense glacial TILL, fine to medium Sand with Gravel
- Weathered Rock
- Bedrock

FT-BG: Feet below grade

FT QBD: Elevation in feet relative to Queens Borough Datum (QBD), 1929

- Bedrock Coring Location
- Immobile residual DNAPL, Creosote (DNAPL shown in soil borings was observed during soil boring installation)
- Smear Zone




*Note: The deepest depth (ft) below grade of BTEX, Total SVOCs, and/or metals (arsenic, cadmium, load, or mercury) exceeding TAGM RSCOs. For SVOCs: ≥500 mg/kg and/or individual SVOC ≥50 mg/kg.


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**FIGURE 9**

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

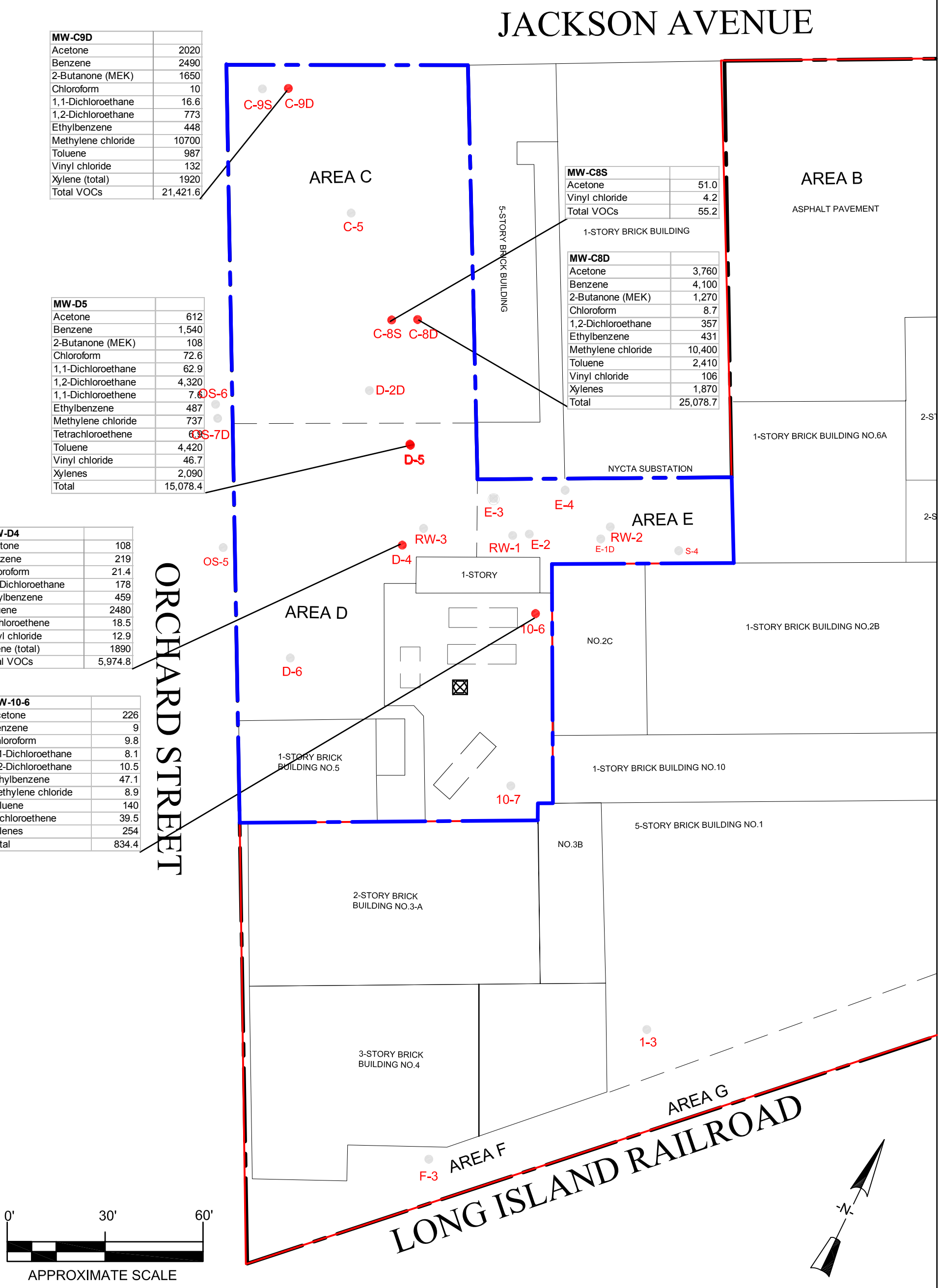
# BTEX, SVOCs, AND METALS IN SOIL EXCEEDING TAGM RSCOs

Date
**March 2007**

Project Number
**10038-005**

## LEGEND

- BCP Site Remediation Boundary
- Boundary of Remainder of Outlet City Site
- Gasoline USTs
- Fuel Oil USTs
- ELM SB/MW 2001 - Shallow
- ELM SB/MW 2001 - Deep
- ELM SB 2001
- Bedrock Borings
- AKRF SB 1988
- AKRF SB 1990
- AKRF SB 1998
- Recovery Well
- Monitoring Well
- FLS SB/MW 2006

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Project Number
**10038-005**

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

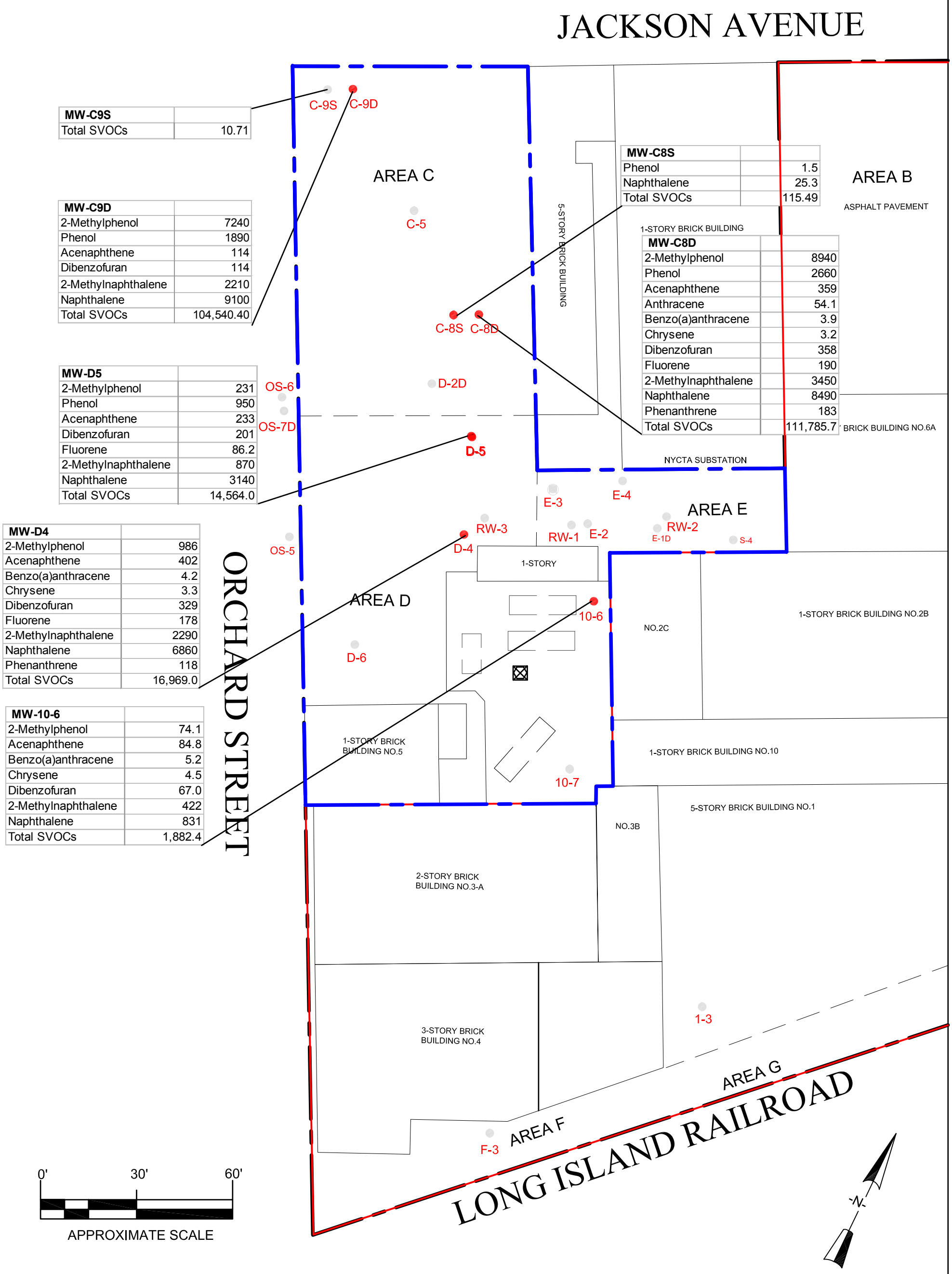
Date
**March 2007**

# FIGURE 10

**VOCS DETECTED IN GROUNDWATER, ug/l**

## LEGEND

- Recently Sampled Monitoring Well Location
- Soil Sample and Monitoring Well Location
- BCP Site Boundary and Excavation Footprint
- Boundary of Outlet City VCP Site

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**10038-005**

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

Date
**March 2007**

# FIGURE 11

**SVOCS DETECTED IN GROUNDWATER, ug/l**

## LEGEND

- Recently Sampled Monitoring Well Location
- Soil Sample and Monitoring Well Location
- BCP Site Boundary and Excavation Footprint
- Boundary of Outlet City VCP Site

# JACKSON AVENUE

75′-0″

25′-0″

217′-0″

ORCHARD STREET

NYCTA SUBWAY TUNNEL

PERMANENT SUBWAY EASEMENT

APT BLDG

NYCTA SUB-STATION

5-STORY BRICK BUILDING

1-STORY BRICK BUILDING

AREA C

BCP SITE

1-STORY B

AREA E

1-STORY

AREA D

NO.2C

1-STORY BR

1-STORY BRICK BUILDING NO.5

1-STORY BRICK BUILDING NO.10

NO.3B

0′ 15′ 30′

APPROXIMATE SCALE

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Project Number
**10038-005**

**QUEENS PLAZA RESIDENTIAL DEVELOPMENT LONG ISLAND CITY, NY**

Date
March 2007

**FIGURE 12**

**BCP SITE REMEDIATION AREA**

## LEGEND

- BCP SITE BOUNDARY AND EXCAVATION FOOTPRINT
- BOUNDARY OF OUTLET CITY VCP SITE
- EXCAVATION SUPPORT SYSTEM
- NOT PART OF SITE
- APPROXIMATE SCAVENGER WELL LOCATION (NUMBER OF WELLS APPROXIMATE)

MAP SOURCE: TISHMAN SPEYER 2007 DEVELOPMENT DRAWINGS MASTER PLAN

# APPENDIX A

## Brownfield Site Survey

# APPENDIX B

## Stormwater Pollution Prevention Plan

# APPENDIX C
## Soil Management Plan

# APPENDIX D
## Health & Safety Plan

# APPENDIX E
## Community Air Monitoring Plan

# APPENDIX F

## Quality Assurance/ Quality Control Plan

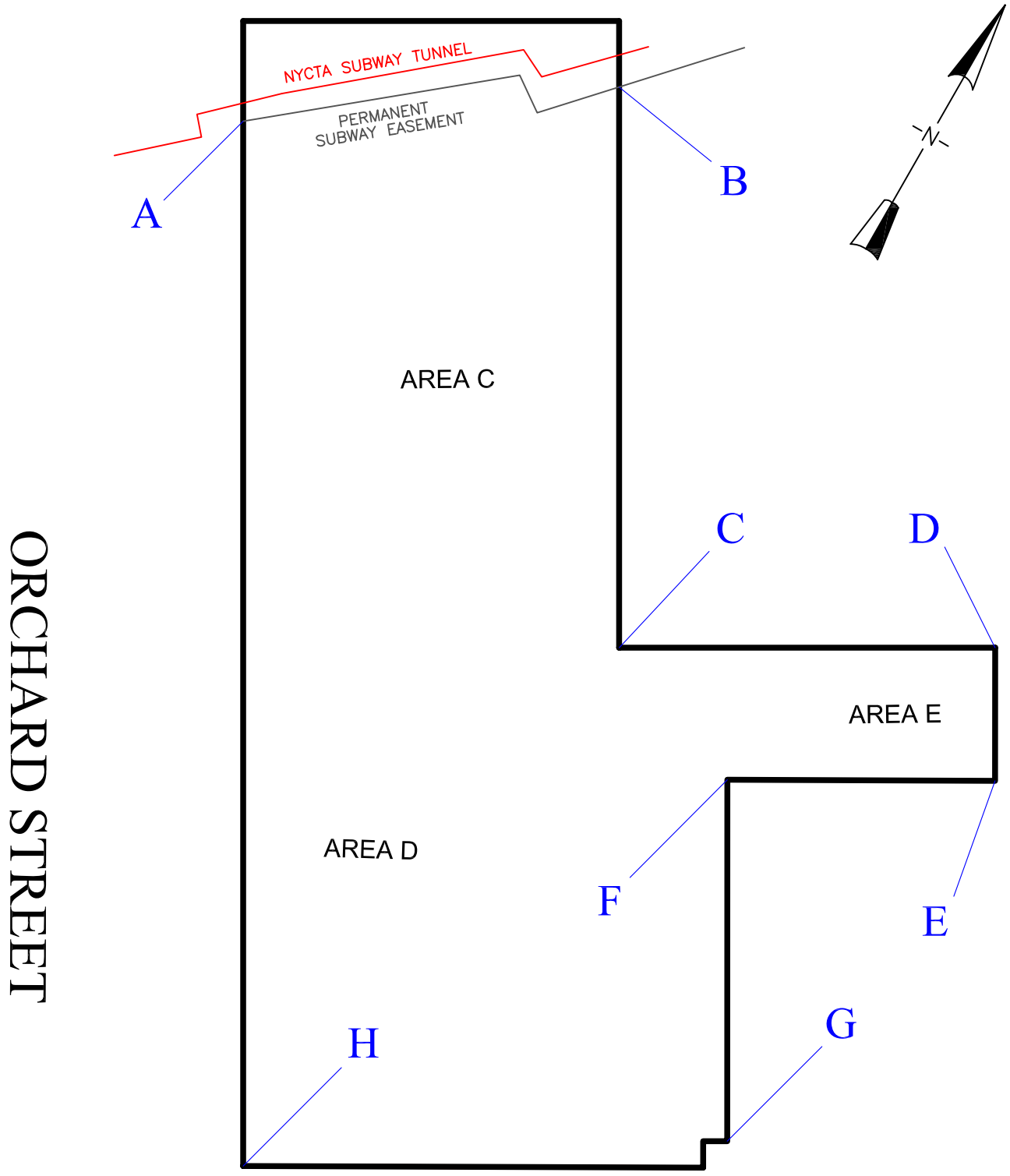
# APPENDIX G
## Citizen Participation Plan

# ATTACHMENT 1

## Soils Database 1988 to 2006 (CD)

# ATTACHMENT 2

## Construction Details – Means for Preventing Re-Contamination

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Queens Plaza Residential Development

FIGURE 1

July 2007

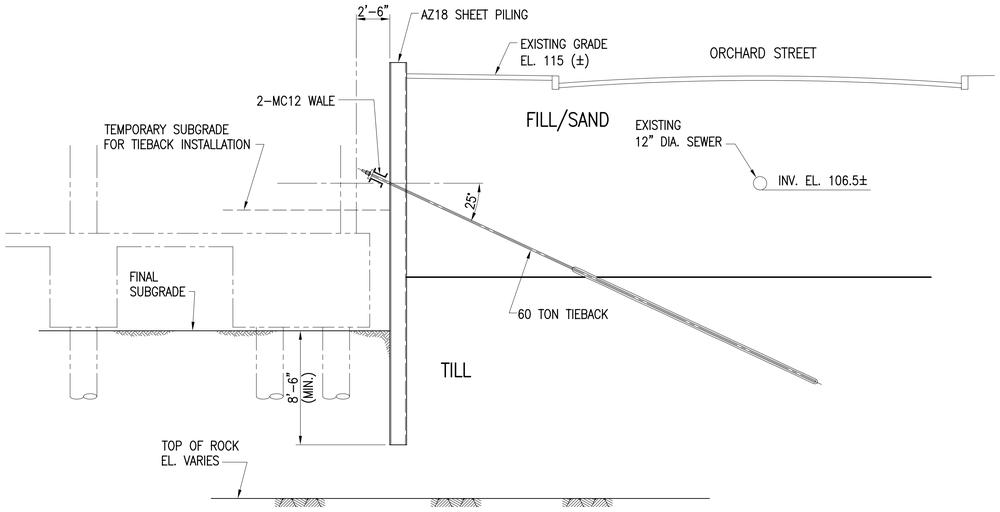
Project Number 10112-001

# BCP SITE PERIMETER SEGMENTS

LEGEND

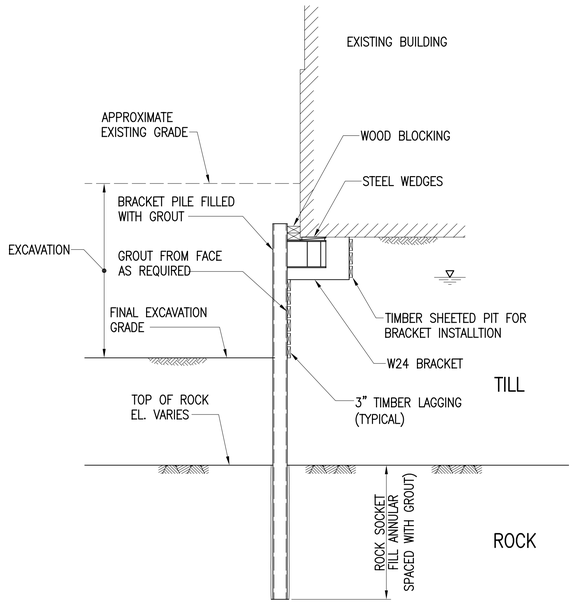
**Table 1 — Options for Controlling NAPL Migration**

| Perimeter Segment | NAPL Conditions | Options for Controlling Migration |
|---|---|---|
| A to B | DNAPL at depth. No mobile DNAPL. | ▪ No DNAPL control required. |
| A to H | DNAPL at depth. DNAPL unlikely to be mobile. | ▪ If DNAPL found mobile, then sheet piling may be used to check DNAPL movement along selected portions of segment A-H.<br>▪ Soldier beams and lagging if no DNAPL control required |
| B to C | Subsurface conditions unknown<br>LNAPL and DNAPL conditions largely unknown. | ▪ Sheet piles to bedrock only if DNAPL control required. Sheet to above smear zone if LNAPL control required.<br>▪ Underpin spread footing and subsequent grouting if only LNAPL control necessary and/or DNAPL shallow and building foundation is shallow. |
| C to D,<br>D to E,<br>E to F,<br>F to G, | NAPL release area and LNAPL and DNAPL smear zone. NAPL on top of bedrock. NAPL conditions beneath NYCTA Building and NYCTA building foundation unknown, but foundation is probably shallow or on bedrock at this point. | ▪ Underpin spread footing(s) with subsequent grouting, if LNAPL control necessary and/or DNAPL is shallow and building foundations are shallow, or use Jack piles with sheeting to control NAPL. If jack piles and sheeting are used, jack piles and sheeting will be driven to till or refusal. Jack piles will be affixed to adjacent building and sheet piles will be bolted to inboard side of jack piles, with approx. 1-ft between piles & sheeting. Bracing may be used in alleyway, if required.<br>▪ Examine foundation walls and grout joints if foundation walls are on bedrock to check NAPL movement.<br>▪ Use existing foundation walls and no action if foundation walls on bedrock are sound and seen to check NAPL migration. |
| G to H | Extent of NAPL unknown. | ▪ Underpin with spread footing and grouting. Selected if only LNAPL control necessary and/or DNAPL shallow and building foundation shallow.<br>▪ Examine foundation walls and grout joints if walls are on bedrock to check NAPL movement.<br>▪ Use existing foundation walls and no action if foundation walls on bedrock are sound and seen to check NAPL migration.<br>▪ Sheet piles to bedrock if only NAPL control required. Sheet to above smear zone.<br>▪ Soldier beams and lagging if no DNAPL control required |



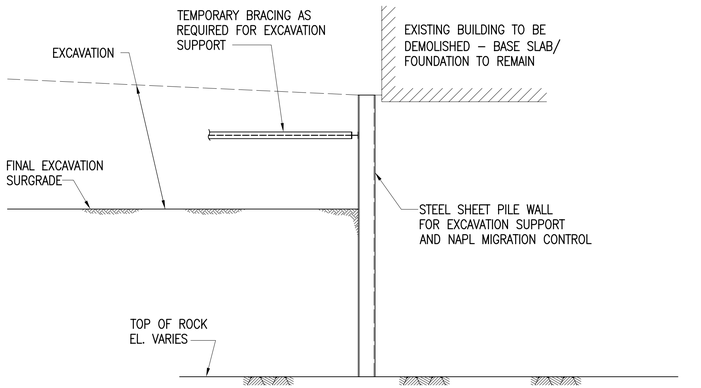

## SCHEMATIC SHEET PILE WALL SECTION 1

N.T.S



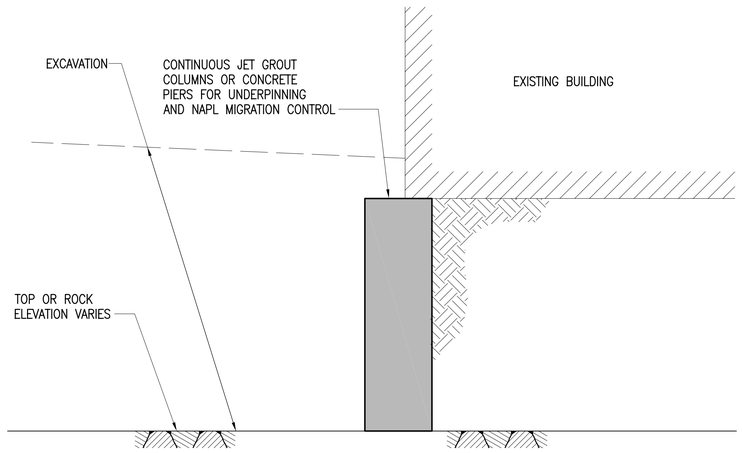

## SCHEMATIC UNDERPINNING SECTION 3

N.T.S




## SCHEMATIC SHEET PILE WALL SECTION 2

N.T.S




## SCHEMATIC UNDERPINNING SECTION 4

N.T.S

**NOTE:**
ELEVATIONS ARE REFERENCED TO THE NYCT DATUM WHICH IS 100.1 FT. BELOW THE BOROUGH OF QUEENS DATUM. THE BOROUGH OF QUEENS DATUM IS 2.725 FEET ABOVE NGVD.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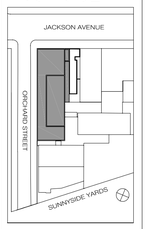
# 28-10 JACKSON AVENUE

JACKSON AVENUE
LONG ISLAND CITY, NY



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