SUPPLEMENTAL GROUNDWATER INVESTIGATION REPORT

Kingsbridge Armory
29 West Kingsbridge Road
Bronx, New York

Prepared For:

Related Retail
60 Columbus Circle
New York, New York

Prepared By:

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Langan Project No. 5815101

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ENGINEERING & ENVIRONMENTAL SERVICES

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1.0 INTRODUCTION

Langan Engineering & Environmental Services, P.C. (Langan) has prepared this Supplemental Groundwater Investigation Report in support of the redevelopment of the Kingsbridge Armory facility at 29 West Kingsbridge Road in the Bronx, New York ("the Site"). This report presents the results of supplemental groundwater sampling that was conducted at the Site and on the adjacent National Guard property that borders the Site to the north. The objective of the supplemental investigation was to determine whether two abandoned underground storage tanks (USTs) on the National Guard property are the source of groundwater impacts that were detected in a monitoring well in the Armory building during a 2008 Phase II Environmental Site Investigation (ESI). The supplemental investigation also included follow-up sampling of the well in which impacts were detected.

2.0 BACKGROUND

The Kingsbridge Armory is being considered for redevelopment as a multiple-use community, educational, and retail facility. The project site is located on the city block bordered by West 195th Street to the north, West Kingsbridge Road to the south, Jerome Avenue to the east, and Reservoir Avenue to the west. The Armory is bordered to the north along West 195th Street and Reservoir Road by two New York State National Guard (National Guard) maintenance buildings and a parking lot. A Site Location Map is provided as Figure 1.

Langan conducted a Phase II ESI of the Armory property in October 2008. Five volatile organic compounds (VOCs) and one semi-volatile organic compound (SVOC) were detected in well MW-3, which was installed in the northwestern portion of the sub-cellar of the Armory, at concentrations above the New York State Department of Environmental Conservation (NYSDEC) Technical and Operational Guidance Series (TOGS) Ambient Water Quality Standards (AWQS). Elevated organic vapor concentrations were also detected in soil samples collected from MW-3 and nearby borings. The Phase II ESI did not reveal an obvious source for the groundwater impacts; however, a 2007 environmental investigation conducted by TRC, Inc. identified two, abandoned 3,000-gallon and 2,000-gallon diesel and gasoline USTs located under the parking area of the National Guard property northwest of the Armory building. TRC's investigation indicated that the tanks were likely closed in September 1993. Based on the proximity of the former USTs to well MW-3, the tanks were deemed potential sources of impacted groundwater at the Site. This supplemental investigation was conducted to evaluate the off-site USTs as sources of VOC and SVOC contamination at the Site.

2.0 SUPPLEMENTAL GROUNDWATER INVESTIGATION

Langan conducted the Supplemental Groundwater Investigation on May 27 and 28, 2009. The investigation included a geophysical survey, advancement of soil borings, installation of a monitoring well, and groundwater sampling.

2.1 Geophysical Survey

Under Langan's oversight, Nova Geophysical Services of Forest Hills, New York conducted a geophysical survey in the western parking lot of the National Guard property on May 27, 2009. The survey was conducted to identify potential utilities at proposed Geoprobe boring locations and to locate the two decommissioned USTs and associated piping. The survey utilized an electromagnetic metal detector (Geonics EM-61 Pipe Locator) and a ground penetrating radar (GPR) system (MALA 250 MHz to 500 MHz GPR units). The survey methodology is discussed in detail and the survey location plan is provided in Nova's Geophysical Engineering Survey Report, which is included as Appendix A.

The survey identified two anomalies consistent with USTs underneath the southeastern and northeastern portions of the parking lot, with dimensions of approximately 19- by 27- ft and 9- by 19- ft, respectively. The UST locations were consistent with those identified in TRC's 2007 investigation report. The survey identified two former pump islands along the eastern boundaries of the USTs. The survey also detected anomalies consistent with a water line and north-south oriented sewer line that enter the parking lot from West 195th Street and transect the central and northeastern portions of the parking lot.

3.2 Soil Borings and Groundwater Monitoring Well Installation

3.2.1 Soil Borings

Two direct-push soil borings (MW-4 and MW-5) were advanced with a track-mounted Geoprobe 7730DT unit in the National Guard property parking lot. The borings were advanced in preparation for installation of two monitoring wells between the southern-most UST and the northwestern portion of the Armory property. Soil samples were collected continuously from each boring into new, dedicated acetate liners with a 2-inch diameter, 5-ft macrocore sample barrel. Soil retrieved from each boring was classified for soil type and screened for organic vapors with a photoionization detector (PID).

Boring PMW-4 was advanced to 34 ft below the top of concrete, and groundwater was encountered at approximately 27 ft below top of concrete. Refusal was encountered in either rock or concrete at 18 ft below the top of concrete during advancement of boring PMW-5. Two offset borings advanced 5 ft and 9 ft west of boring PMW-5 encountered refusal at 14.5 ft and 15 ft below the top of concrete, respectively. Groundwater was not encountered in boring

MW-5 or the two offset locations. The presence of a concrete wall east of PMW-5, the Armory Building south of PMW-5, and buried utilities in this area limited access for the advancement of additional offset borings. Boring refusal and spatial limitations therefore precluded installation of well MW-5. The detailed boring logs are included as Appendix B. The soil boring locations are shown in Figure 2.

3.2.2 Monitoring Well Installation

Groundwater monitoring well MW-4 was installed in the soil boring advanced near the southwestern corner of the southern-most UST. The well was constructed of 2-inch diameter threaded, flush-joint PVC riser and 10 ft of 0.01-inch slot screen. The screen was placed across the water table interface, and the annulus was filled with clean sand (Morie #1) to a height of approximately six inches to one foot above the top of the screened interval. A two- foot layer of hydrated bentonite clay was placed above the sand pack to seal the well. The remainder of the annular space was filled with soil cuttings from the boring. The remaining soil cuttings were placed in a sealed and labeled 55-gallon drum and stored on the National Guard property pending disposal. The well was completed with a flush mount, steel well cover set into concrete and over the well for protection. A monitoring well construction log is provided in Appendix C.

3.3 Groundwater Sampling

Three groundwater samples were collected from MW-4, TRC-MW-3, which TRC installed west of the southern-most decommissioned UST, and MW-3, which is located in the northwestern portion of the sub-cellar of the Armory building. Because well MW-3 was installed with one-inch diameter riser, a peristaltic pump and dedicated, disposable polyethylene tubing were used to purge the well. Wells MW-4 and TRC-MW-3 were purged with a 2-inch diameter submersible pump and sampled in general accordance with procedures set forth in the U.S. EPA's low-flow groundwater sampling procedure to allow for collection of a representative sample ("Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures", EPA/540/S-95/504, April 1996).

The static water level in each well was measured to the nearest 0.01 foot with a decontaminated oil/water interface probe. Prior to sample collection, each well was purged at a rate less than 0.5 liters per minute in order to minimize drawdown and sample turbidity. During purging and sampling, monitoring well effluent was pumped into a flow-through cell attached to a Horiba U-22 Water Quality Monitoring System probe (Horiba U-22). The Horiba U-22 was used to monitor the purge water for hydrogen ion concentration (pH), oxidation/reduction potential, conductivity, temperature, dissolved oxygen, and turbidity. Five well volumes were purged until variations between successive groundwater parameter measurements had stabilized to within 10 percent. Purge water was contained in two 55-gallon drums, labeled,

and stored on the National Guard property. Groundwater sampling logs are provided in Appendix C.

The samples were collected into laboratory-provided containers, which were labeled and placed in ice-filled coolers pending delivery to the lab under proper chain-of-custody protocol. The samples were submitted to Spectrum Analytical, Inc. (Spectrum) of Agawam, Massachusetts for analysis of VOCs and SVOCs via EPA Methods 8260 and 8270, respectively. Spectrum is a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory. A Groundwater Sample Location and Results Map is provided in Figure 3.

4.0 OBSERVATIONS AND RESULTS

4.1 Field Observations

Soil observed in the borings consisted of fill, which is comprised of brown fine to coarse-grained sand with traces of silt, gravel, timber, concrete, and brick. Groundwater was encountered in monitoring wells TRC-MW-3 and MW-4 at a depth of approximately 27 ft below the top of concrete in the parking lot. The depth to groundwater in MW-3 was 4.2 ft below the top of the sub-cellar floor slab.

Field indications of a spill or other impacts to soil on the National Guard property were not observed during the investigation. PID readings in soil boring MW-4 ranged from 1.0 ppm (24-26 ft depth interval) to 1.9 ppm (4-5 ft depth interval). PID readings in the three MW-5 offset borings ranged from 0.0 ppm to 0.6 ppm. Minor staining was observed in conjunction with asphalt fragments in soil samples collected from below the concrete in boring MW-4 and the MW-5 offset borings. Consistent with Langan's observations during the 2008 Phase II ESI, a petroleum odor was observed in monitoring well MW-3 in the Armory sub-cellar.

4.2 Analytical Results

Analytical results from the groundwater samples were compared to NYSDEC TOGS AWQS. One VOC, 4-isopropyltoluene, was detected in the groundwater sample collected from well MW-4 at a concentration of 804 µg/L, which exceeds the TOGS AWQS standard of 5 ug/L. VOCs and SVOCs were not detected at concentrations above TOGS AWQS in the groundwater samples collected from wells MW-3 and TRC-MW-3. Seven VOCs (naphthalene, n-butylbenzene, n-propylbenzene, isopropylbenzene, methyl tert-butyl ether, toluene, and 4-isopropyltoluene were detected in the sample collected from well MW-3 at concentrations below the TOGS AWQS. Analytical detections of VOCs and SVOCs in the groundwater samples are presented in Table 1. The laboratory analytical report is provided in Appendix E.

5.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the field observations and analytical results from the soil borings and groundwater samples, we conclude that:

- The elevated VOC and SVOC concentrations observed in well MW-3 during the 2008 investigation appear to have attenuated to levels below regulatory standards and were not detected during this supplemental investigation, and
- Evidence of an off-site spill associated with the decommissioned USTs on the National Guard property is not present.

Further investigation is not recommended at this time.

6.0 LIMITATIONS

This Supplemental Groundwater Investigation report was prepared expressly for Related Retail for the Kingsbridge Armory Project in the Bronx, New York and for the objectives defined herein (due diligence). Langan cannot assume responsibility for the use of this Report for any property other than the specific site addressed in this report, or by any third party without specific written authorization from Langan.

The conclusions, opinions, and recommendations provided in this report are based on subsurface conditions ascertained from the analysis of a limited number of samples and from environmental reports prepared by other professionals that were provided by "the Client". Recommendations provided are contingent upon one another and no recommendation should be followed independent of the others. Actual conditions encountered may differ substantially from those presented herein and should be brought to our attention whereby we may determine how such changes may affect our conclusions, opinions and recommendations.

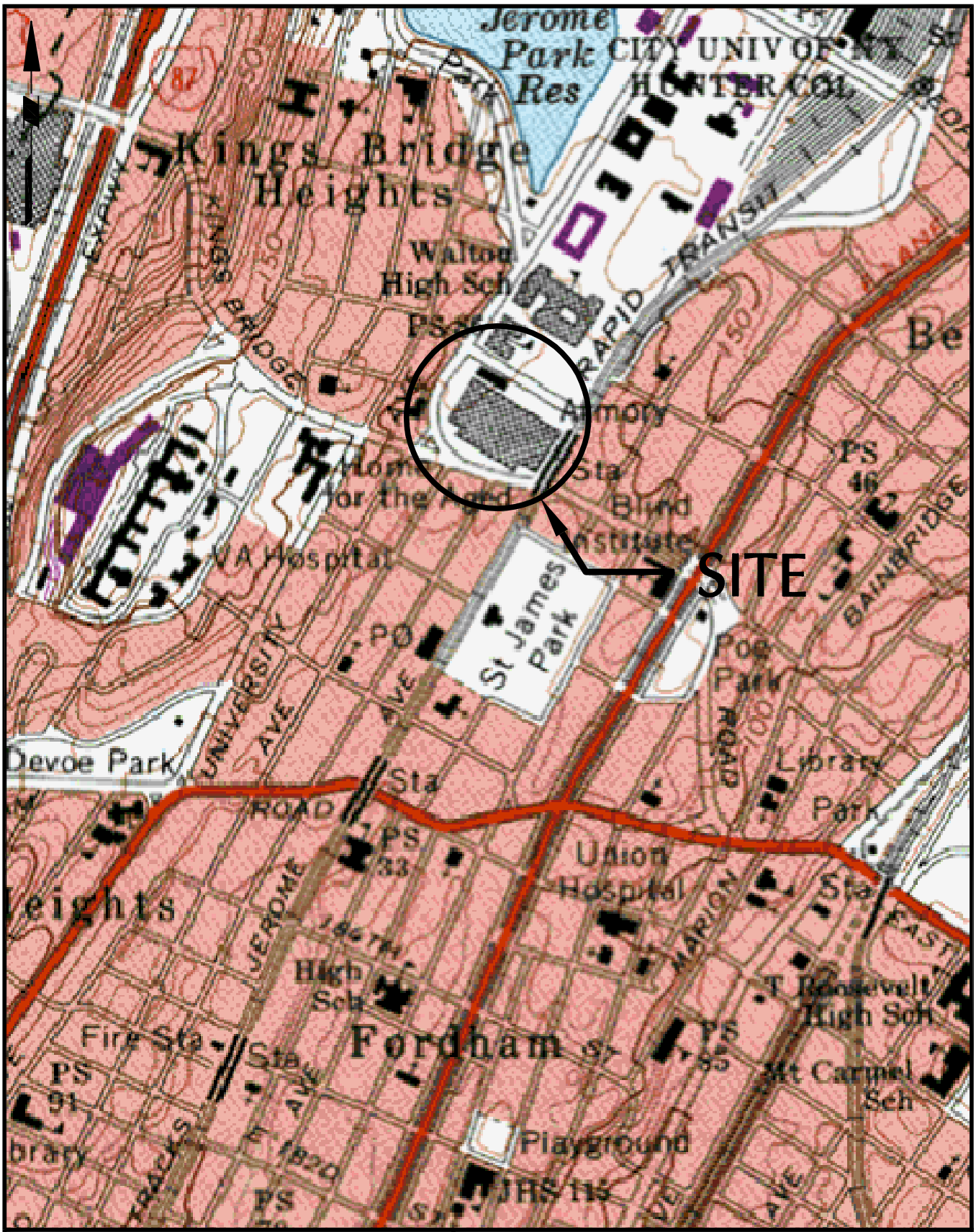
TABLE 1
ANALYTICAL DETECTIONS OF VOCs and SVOCs IN GROUNDWATER SAMPLES
SUPPLEMENTAL GROUNDWATER INVESTIGATION
KINGSBRIDGE ARMORY
BRONX, NEW YORK
LANGAN PROJECT NO. 5815101

Sample ID Lab Sample Number Sampling Date	NYSDEC TOGS 1.1.1 AMBIENT WATER QUALITY STANDARDS	PMW-4/5-27-09 220-6174-2 5/27/2009 15:40		PMW-4/5-27-09 220-6249-2 5/27/2009 15:40		TRC-MW-3/5-27-09 220-6249-1 5/27/2009 12:30			MW-3/5-28-09 220-6147-1 5/28/2009 14:50		
VOCs (µg/L)											
4-Isopropyltoluene	5	**804**	E	**626**	V11	<	0.5	U		1.9	
Acetone	50*	8.9	J	NA		<	2.6	U	<	2.6	U
Chloroform	7	1.4		NA		<	0.8	U	<	0.8	U
cis-1,2-Dichloroethene	5	< 0.4	U	NA			0.4	J	<	0.4	U
Isopropylbenzene	5	< 0.4	U	NA		<	0.4	U		0.5	J
Methyl tert-butyl ether	10	< 0.3	U	NA		<	0.3	U		0.6	J
Naphthalene	10	< 0.7	U	NA		<	0.7	U		5.1	
n-Butylbenzene	5	< 0.6	U	NA		<	0.6	U		2.9	
n-Propylbenzene	5	< 0.6	U	NA		<	0.6	U		1	
Tetrachloroethene	5	1		NA			0.5	J	<	0.5	U
Toluene	5	< 0.6	U	NA		<	0.6	U		0.7	J
Trichloroethene	5	0.9	J	NA		<	0.5	U	<	0.5	U
SVOCs (µg/L)											
Total SVOCs	--	ND		ND		ND			ND		

NOTES:
Groundwater samples were compared to New York State Department of Environmental Conservation (NYSDEC) Technical and Operations Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards (AWQS).
Only detected concentrations are presented.
NYSDEC TOGS exceedances are highlighted and in **BOLD.**

VOCs: Volatile Organic Compounds
SVOCs: Semi-Volatile Organic Compounds
µg/L: Micrograms per Liter

QUALIFIERS
U = Analyte was not detected at or above the reporting limit.
J = Laboratory esitmated value.
* = Value is a TOGS Guidance Value and not a standard.
ND = Non detected
V11 = Analyte concentration confirmed by duplicate analysis.
E = The concentration indicated for this analyte is an estimated value.
-- = No standard
NA = Not analysed



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NJ Certificate of Authorization No: 24GA27996400

SITE LOCATION MAP

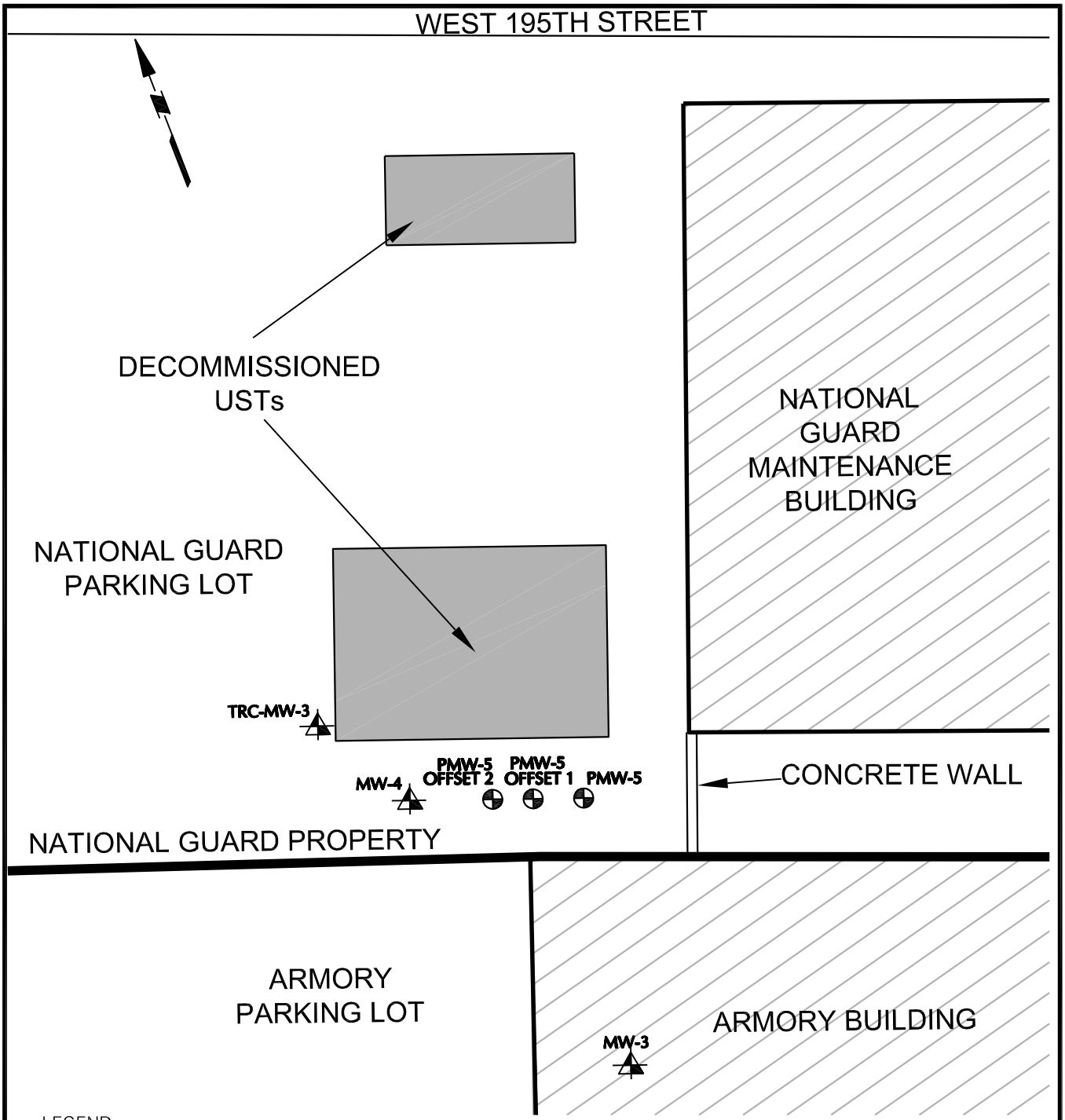
KINGSBRIDGE ARMORY

BRONX NEW YORK

Project No.	Date	Scale	Dwg. No.
5815101	6/12/09	NTS	1

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LEGEND

- TRC-MW-3 — MONITORING WELL INSTALLED BY TRC DURING 2007 INVESTIGATION
- MW-4 — MONITORING WELL
- PMW-5 — SOIL BORING
- SITE BOUNDARY
- BUILDING OUTLINE

NOTES:

1. PLAN TAKEN FROM "SUBSURFACE INVESTIGATION PLAN (EXISTING CONDITIONS)" BY LANGAN ENGINEERING, DATED AUGUST 15, 2008.

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GROUNDWATER MONITORING WELL AND SOL BORING PLAN

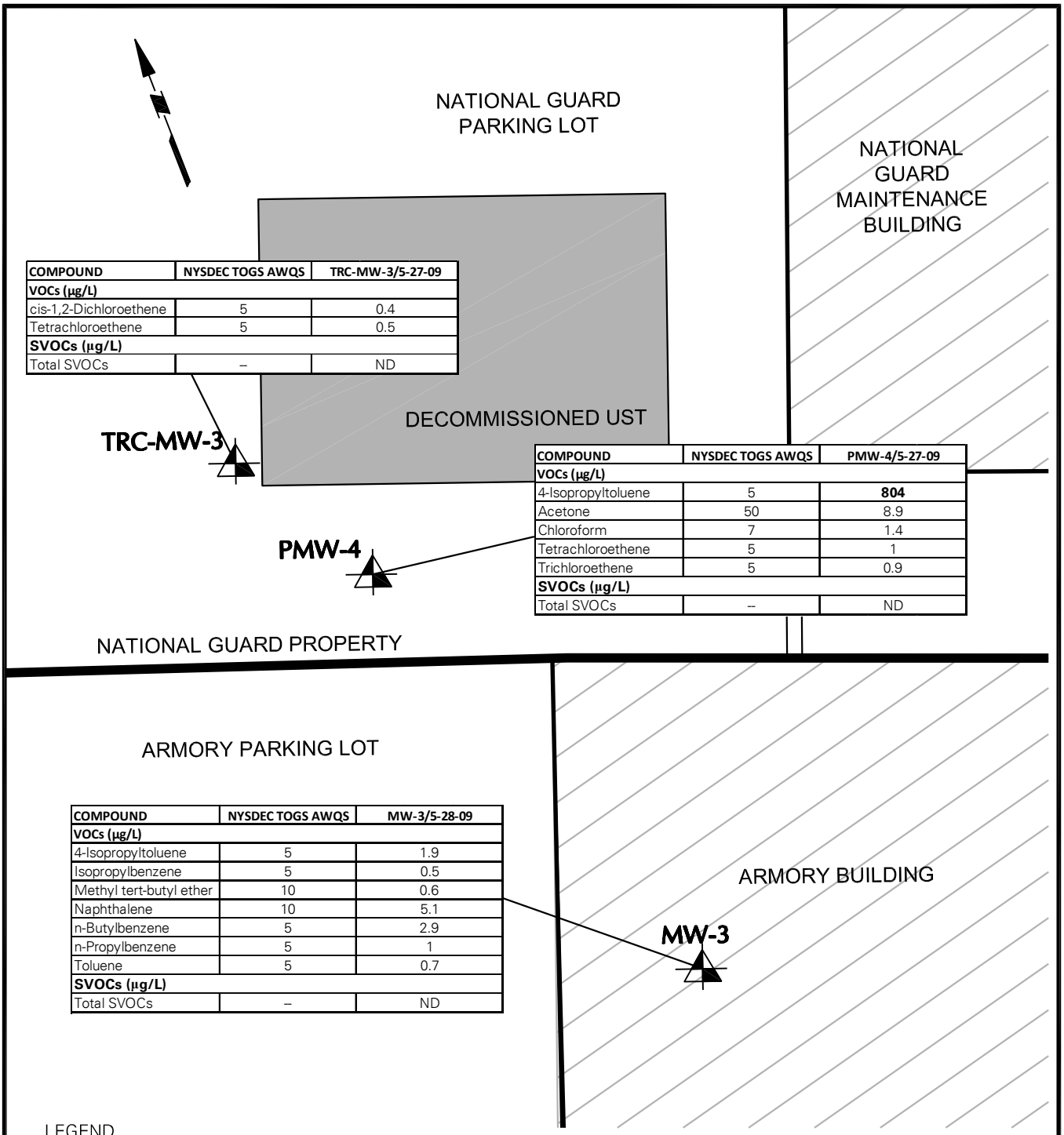
KINGSBRIDGE ARMORY

BRONX NEW YORK

Project No.	Date	Scale	Dwg. No.
5815101	6/16/09	1" = 15'	2

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Filename: U:\Data1\5815101\Cadd Data - 5815101\Dwg\Environmental\Groundwater Monitoring Well Plan.dwg Date: 6/17/2009 Time: 18:08 User: sknoop Style Table: Langan.stb Layout: Fig 1 - Nat'l Guard



COMPOUND	NYSDEC TOGS AWQS	TRC-MW-3/5-27-09
VOCs (µg/L)		
cis-1,2-Dichloroethene	5	0.4
Tetrachloroethene	5	0.5
SVOCs (µg/L)		
Total SVOCs	–	ND

COMPOUND	NYSDEC TOGS AWQS	PMW-4/5-27-09
VOCs (µg/L)		
4-Isopropyltoluene	5	**804**
Acetone	50	8.9
Chloroform	7	1.4
Tetrachloroethene	5	1
Trichloroethene	5	0.9
SVOCs (µg/L)		
Total SVOCs	--	ND

COMPOUND	NYSDEC TOGS AWQS	MW-3/5-28-09
VOCs (µg/L)		
4-Isopropyltoluene	5	1.9
Isopropylbenzene	5	0.5
Methyl tert-butyl ether	10	0.6
Naphthalene	10	5.1
n-Butylbenzene	5	2.9
n-Propylbenzene	5	1
Toluene	5	0.7
SVOCs (µg/L)		
Total SVOCs	–	ND

LEGEND

PMW-4 GROUNDWATER SAMPLE LOCATION

SITE BOUNDARY

BUILDING OUTLINE

NOTES:

1. ONLY DETECTED CONCENTRATIONS ARE PRESENTED.
2. NYSDEC TOGS AWQS EXCEEDANCES ARE **BOLD**.
3. ND = NON-DETECT.
4. PLAN TAKEN FROM "SUBSURFACE INVESTIGATION PLAN (EXISTING CONDITIONS)" BY LANGAN ENGINEERING, DATED AUGUST 15, 2008.

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GROUNDWATER SAMPLE LOCATION AND RESULTS MAP
KINGSBRIDGE ARMORY

BRONX NEW YORK

Project No.	Date	Scale	Dwg. No.
5815101	6/12/09	1" = 10'	3

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