Draft

Summary Report

for

Pre-Design Field Investigation
Off-Site Location GM-75

Naval Weapons Industrial Reserve Plant

Bethpage, New York

Naval Facilities Engineering Command Mid-Atlantic

Contract Number N62472-04-D-0055
Contract Task Order 66

August 2009

Draft

SUMMARY REPORT FOR PRE-DESIGN FIELD INVESTIGATION OFF-SITE LOCATION GM-75

NAVAL FACILITIES ENGINEERING COMMAND
MID-ATLANTIC

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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TABLE OF CONTENTS

TABLES

NUMBER

FIGURES

NUMBER

ACRONYMS

ASTM	American Standard of Test Methods
CLEAN	Comprehensive Long-Term Environmental Action Navy
COC	Chain of Custody
CTO	Contract Task Order
DPT	Direct Push Technology
NWIRP	Naval Weapons Industrial Reserve Plant
QA	Quality Assurance
QC	Quality Control
TOC	Total Organic Carbon
TtNUS	Tetra Tech NUS
UTD	Uni-Tech Drilling Company, Inc.
VOC	Volatile Organic Compound
VPB	Vertical Profile Boring

1.0 INTRODUCTION

This report summarizes the installation of six vertical profile borings (VPB) located off of the property owned by the Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, in Bethpage, New York. The VPBs were installed to collect subsurface lithology and depth specific groundwater samples from these borings to establish a vertical profile of groundwater contamination at each location. Tetra Tech NUS, Inc., (TtNUS) performed the work for the Naval Facilities Engineering Command Mid-Atlantic under Contract Task Order (CTO) 66 of the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract Number N62472-04-D-0055.

1.1 SCOPE OF WORK

Six VPBs (VPB-121, VPB-122, VPB-123, VPB-124, VPB-125, and VPB-126) were drilled at locations off-site in order to establish depth specific contamination (see Figure1). The boring were drilled to a depth of 750 to 841 feet below ground surface. VPB-121, VPB-122, and VPB-123 were installed in near monitoring well GM-75D2 (GM-75 area) to supplement existing data from monitoring wells in the vicinity. VPB-123 was installed to delineate the western edge of the chlorinated solvent plume in the GM-75 area. The final three borings, VPB-124, VPB-125, and VPB-126, were drilled near the Aqua New York well field where low-level detections has been detected for 2 years, but no pathway has been identified. Possible pathways include the plume migrating up from depth or flowing in side gradient of the outpost monitoring wells in the area (BPOW 3-1 and 3-2) to Aqua New York wells. Groundwater samples were collected at 20-foot intervals and analyzed for VOCs. Total depths for each VPB are as follows:

- 830 feet for VPB-121,
- 841 feet for VPB-122,
- 750 feet for VPB-123,
- 830 feet for VPB-124,
- 800 feet for VPB-125
- And 810 feet for VPB-126.

Tables 3-1 (VPB-121), 3-4 (VPB-122), 3-7 (VPB 123), 3-9 (VPB 124), 3-11 (VPB 125), and 3-13 (VPB 126) summarize groundwater-sampling activities performed at each VPB.

1.2 REPORT FORMAT

This report presents the methodology, field forms, and analytical results for the installation of the VPBs.

Section 1.0 provides a brief introduction and summary of the scope of work. Field methodologies for VPB installation are provided in Section 2.0. Boring logs, borehole geophysical logs, groundwater sample log sheets, QA sample log sheets, chains-of-custody (COCs), and analytical results for each VPB are provided in Section 3.0.

2.0 DRILLING AND SAMPLING

This section describes the field methodologies for installation of the off-site VPBs. The work was performed in accordance with the Letter Work Plan for Pre-Design Field Investigation Off-Site Location GM-75, Naval Weapons Industrial Reserve Plant (NWIRP), Bethpage, New York (TtNUS) dated October 2008. All work was performed from January through July 2009. Uni-Tech Drilling Company,Inc. (UTD), of Malaga, New Jersey, drilled the VPBs under subcontract to TtNUS. Aqua Terra Geophysics, Inc., of Bellport, New York, under subcontract to UTD, performed the borehole geophysical logging. Long Island Analytical Laboratories of Holbrook, New York and Mitkem Laboratories of Warwick, Rhode Island performed the analytical testing on the groundwater samples while AirToxics LTD of Folsom, California performed the analytical testing on the air samples, all under subcontract to TtNUS.

2.1 DRILLING METHODOLOGY

All VPBs were advanced using mud rotary drilling techniques.

2.1 .1 Mud Rotary

VPBs were advanced using mud rotary techniques. VPBs were reamed to eight inches in diameter to approximately 100 feet below ground surface. Due to sloughing of the upper borehole, 6-inch diameter, Schedule 40 PVC temporary surface casing was installed from the ground surface to approximately 100 feet below ground surface. From this point, the VPBs were reamed to 6 inches in diameter to the total depth of the boring. Drilling mud consisted of potable water and polymer-free sodium bentonite. All drilling mud was contained and recirculated in a baffled, high capacity mud pan.

Boring logs are provided for each VPB in Section 3.0.

2.2 SOIL SAMPLING

Split spoon soil samples were collected from VPBs for lithology description. The depths and frequencies of soil sampling varied for each VPB, but in general two to five split spoon samples were collected per vertical profile boring, with additional split spoon samples taken around 800 feet to determine whether the Raritan Clay Unit had been reached. In addition two soil samples were taken for Total Organic Carbon (TOC) analysis per boring.

Soil samples were collected using 2-inch diameter split-spoon samplers according to American Standard of Test Methods (ASTM) D-1586.

2.3 GROUNDWATER SAMPLING

Groundwater samples were collected from depth specific intervals in each boring. After advancement of the borings to the appropriate sample interval, a hollow direct push technology (DPT) sampling point (hydropunch) capable of water sample collection was advanced a distance of approximately 1-foot past the split spoon sample interval to ensure representative groundwater samples. The hydropunch was opened exposing the screen to the formation and allowed to fill with groundwater (approximately 15 minutes for shallow intervals, and approximately one hour for deeper intervals). The hydropunch was then closed and raised to the ground surface. Once at ground surface, the hydropunch was opened and bottleware was filled directly from the sampler. In some instances, the sampler contained insufficient groundwater or no groundwater at all. A second attempt was made at the discretion of the field geologist in these instances. Factors considered when making a second attempt were as follows:

- If the observed lithology from the split spoon sample consisted of a low permeable unit (i.e., silt or clay), no attempt was made at this depth.
- If clay or silt was observed on the hydropunch screen after the first attempt and there was insufficient volume to obtain a sample, no second attempt was made.
- If the hydropunch malfunctioned, a second attempt was made.

Field water quality parameters of pH, specific conductance, temperature, dissolved oxygen, and turbidity were monitored, provided a sufficient volume of sample was available. Samples were placed in a cooler containing ice and held for sample pick up by the laboratory courier. All samples were submitted to the laboratory (48-hour turnaround time) for analyses of volatile organic compounds (VOCs) for the analytes listed in, and in accordance with, GC method SW846-8260B.

Groundwater sample log sheets are provided in Section 3.0 for groundwater samples collected from each VPB.

2.3.1 Groundwater QA/QC Sampling

Quality assurance (QA) and quality control (QC) samples were collected during this effort as follows:

- Trip blanks on a daily basis,
- drilling mud samples,
- submitting 10 percent of the groundwater samples to Mitkem Laboratories, a Navy approved laboratory, for VOC analysis to confirm the quick-turn laboratories,

- and collect one air sample per boring and analyze for VOCs to evaluate potential emissions.

Tables 3-3, 3-6, 3-8, 3-10, 3-12, and 3-15 summarize the QA samples collected at each VPB while Table 3-16 compares the analytical results between the two labs analyzing groundwater to ensure accurate results.

QA sample log sheets are provided in Section 3.0 for QA samples collected from each VPB.

2.4 BOREHOLE GEOPHYSICAL LOGGING

Borehole geophysical logs were recorded for all of the VPBs. Following advancement to the total depth of each boring, the drilling tools were withdrawn from the borehole. A geophysical probe was then run down the borehole and back up. The geophysical data was recorded using a Mount Sopris MGX II digital logger. The probe was multi-function and recorded a natural gamma ray log. Once gamma logging of the boring was complete, the boring was backfilled to the land surface using a bentonite slurry. Borehole abandonment was accomplished using a tremie pipe.

Geophysical borehole log printouts are provided in Section 3.0.

3.0 ANALYTICAL RESULTS

This section is a compilation of the field forms and analytical results associated with each VPB. Field forms for each VPB include the following:

- Boring logs
- Borehole geophysical logs
- Groundwater, air, and soil sample log sheets
- Laboratory results
- QA sample log sheets
- Chain of custody records
- Validation Letters and Validation Tables

A summary of VPB groundwater and QA sampling, including sample identification, depth at which the sample was collected, total and detected VOCs, lab result comparison, and soil total organic carbon (TOC) are provided in Tables 3-1, 3-2, and 3-3 (VPB-121); Tables 3-4, 3-5, and 3-6 (VPB-122); Tables 3-7 and 3-8 (VPB-123); Tables 3-9 and 3-10 (VPB-124); Tables 3-11 and 3-12 (VPB-125); Tables 3-13, 3-14, and 3-15 (VPB-126); Table 3-16 (all VPBs lab comparison); and Table 3-17 (all VPB TOC).

REFERENCES

TABLES

TABLE 3-1
TOTAL VOLATILE ORGANIC COMPOUNDS
GROUND WATER SAMPLE SUMMARY VERTICAL PROFILE BORING 121
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

Number	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	Comments
1	BP-VPB121-GW-051	51	ND	
2	BP-VPB121-GW-101	101	ND	
3	BP-VPB121-GW-152	152	ND	
4	BP-VPB121-GW-191	191	ND	
5	BP-VPB121-GW-211	211	ND	
6	NA	231	-	No groundwater sample in hydropunch
7	BP-VPB121-GW-251	251	ND	
8	BP-VPB121-GW-271	271	ND	
9	NA	291	-	No groundwater sample in hydropunch, clay observed on screen
10	BP-VPB121-GW-311	311	ND	
11	BP-VPB121-GW-331	331	ND	
12	NA	351	-	No groundwater sample collected
13	BP-VPB121-GW-371	371	7.1	
14	BP-VPB121-GW-391	391	17.9	
15	BP-VPB121-GW-411	411	ND	
16	BP-VPB121-GW-431	431	ND	
17	BP-VPB121-GW-451	451	1.5	
18	NA	471	-	No groundwater sample in hydropunch
19	BP-VPB121-GW-491	491	ND	
20	BP-VPB121-GW-511	511	3.1	
21	BP-VPB121-GW-531	531	1.2	
22	BP-VPB121-GW-551	551	ND	
23	BP-VPB121-GW-571	571	1.8	
24	NA	591	-	No groundwater sample in hydropunch
25	BP-VPB121-GW-611	611	4.1	
26	BP-VPB121-GW-631	631	7.6	
27	NA	651	-	No groundwater sample taken due to clayey silt layer at this depth interval
28	BP-VPB121-GW-671	671	3.4	
29	BP-VPB121-GW-691	691	1.6	
30	BP-VPB121-GW-711	711	1	
31	BP-VPB121-GW-731	731	ND	
32	BP-VPB121-GW-751	751	ND	
33	BP-VPB121-GW-771	771	ND	
34	BP-VPB121-GW-791	791	ND	
35	BP-VPB121-GW-811	811	ND	

Notes:
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable
1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 10-foot interval or at the direction of the site geologist.
2. Total VOCs does not include lab constituents acetone (max 14 µg/L) or toluene (max 2 µg/L).

TABLE 3-2
DETECTED COMPOUNDS FOR VERTICAL PROFILE BORING 121
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

No.	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	TCE	PCE	Tol.	Ace.
1	BP-VPB121-GW-051	51	ND				
2	BP-VPB121-GW-101	101	ND				
3	BP-VPB121-GW-152	152	ND				10
4	BP-VPB121-GW-191	191	ND				14
5	BP-VPB121-GW-211	211	ND				
6	NA	231	No sample				
7	BP-VPB121-GW-251	251	ND				
8	BP-VPB121-GW-271	271	ND				
9	NA	291	No sample				
10	BP-VPB121-GW-311	311	ND				
11	BP-VPB121-GW-331	331	ND				
12	NA	351	No sample				
13	BP-VPB121-GW-371	371	7.1	6	1.1		
14	BP-VPB121-GW-391	391	17.9	14	3.9		
15	BP-VPB121-GW-411	411	ND				
16	BP-VPB121-GW-431	431	ND				
17	BP-VPB121-GW-451	451	1.5	1.5			
18	NA	471	No sample				
19	BP-VPB121-GW-491	491	ND				11
20	BP-VPB121-GW-511	511	3.1	3.1			
21	BP-VPB121-GW-531	531	1.2	1.2			
22	BP-VPB121-GW-551	551	ND				
23	BP-VPB121-GW-571	571	1.8	1.8			
24	NA	591	No sample				
25	BP-VPB121-GW-611	611	4.1	4.1		1.8	
26	BP-VPB121-GW-631	631	7.6	7.6			
27	NA	651	No sample				
28	BP-VPB121-GW-671	671	3.4	3.4			
29	BP-VPB121-GW-691	691	1.6	1.6			
30	BP-VPB121-GW-711	711	1	1			
31	BP-VPB121-GW-731	731	ND				
32	BP-VPB121-GW-751	751	ND			2	
33	BP-VPB121-GW-771	771	ND				
34	BP-VPB121-GW-791	791	ND				
35	BP-VPB121-GW-811	811	ND				

Notes:
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable
All results are in µg/L
TCE: Trichloroethene
PCE: Tetrachloroethene
Tol.: Toluene
Ace.: Acetone
1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 10-foot interval or at the direction of the site geologist.

TABLE 3-3
QA/QC Sample Summary
Vertical Profile Boring 121
Naval Weapons Industrial Reserve Plant
Bethpage, New York

Number	Sample ID	Depth (ft bgs)	Total VOCs (µg/L)	Comments
1	BP-VPB-TB-052809	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
2	BP-VPB-TB-060109	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
3	BP-VPB-TB-060309	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
4	BP-VPB-TB-060809	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
5	BP-VPB-TB-061009	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water

Notes
ft bgs: Below ground surface
µg/L: micrograms per liter
NA: Not applicable
ND: Not detected

Table 3-4
TOTAL VOLATILE ORGANIC COMPOUNDS
GROUND WATER SAMPLE SUMMARY VERTICAL PROFILE BORING 122
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

Number	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	Comments
1	BP-VPB122-GW-051	51	ND	
2	BP-VPB122-GW-101	101	ND	
3	BP-VPB122-GW-151	151	1	
4	BP-VPB122-GW-191	191	2	
5	BP-VPB122-GW-211	211	ND	
6	NA	231	NA	No groundwater sample in hydropunch
7	BP-VPB122-GW-251	251	14	
8	BP-VPB122-GW-271	271	ND	
9	BP-VPB122-GW-291	291	3	
10	BP-VPB122-GW-312	312	17	
11	BP-VPB122-GW-332	332	2	
12	NA	350	NA	No groundwater sample collected due to a hard silty clay layer at this depth
13	BP-VPB122-GW-371	371	ND	
14	BP-VPB122-GW-391	391	140	
15	BP-VPB122-GW-411	411	223	
16	BP-VPB122-GW-431	431	176	
17	NA	451	NA	No groundwater sample in hydropunch
18	NA	471	NA	No groundwater sample in hydropunch
19	BP-VPB122-GW-491	491	8	
20	BP-VPB122-GW-511	511	7	
21	BP-VPB122-GW-531	531	24	
22	BP-VPB122-GW-551	551	3	
23	BP-VPB122-GW-571	571	8	
24	BP-VPB122-GW-591	591	ND	
25	BP-VPB122-GW-611	611	ND	
26	BP-VPB122-GW-631	631	ND	
27	BP-VPB122-GW-651	651	ND	
28	BP-VPB122-GW-671	671	ND	
29	BP-VPB122-GW-691	691	ND	
30	BP-VPB122-GW-711	711	ND	
31	BP-VPB122-GW-731	731	ND	
32	NA	751	NA	No groundwater sample in hydropunch
33	BP-VPB122-GW-771	771	ND	
34	NA	790	NA	No groundwater sample collected due to a tight clayey sand layer at this depth
35	BP-VPB122-GW-811	811	ND	

Notes:
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable

1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 10-foot interval or at the direction of the site geologist.

2. Does not include lab constituents acetone (max 20 µg/L), toluene (max 6 µg/L), and chloroform (max 18 µg/L)

TABLE 3-5
DETECTED COMPOUNDS FOR VERTICAL PROFILE BORING 122
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

No.	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)	TCE	PCE	1,1-DCA	1,1-DCE	cis-1,2-DCE	trans-1,2-DCE	CF	Tol.	Ace.
1	BP-VPB122-GW-51	51	ND									
2	BP-VPB122-GW-101	101	ND								6	
3	BP-VPB122-GW-151	151	1	1								
4	BP-VPB122-GW-191	191	2	2								
5	BP-VPB122-GW-211	211	ND									11
6	NA	231	No sample									
7	BP-VPB122-GW-251	251	14	4		8	2			3		
8	BP-VPB122-GW-271	271	ND									
9	BP-VPB122-GW-291	291	3			3				18		
10	BP-VPB122-GW-312	312	17	8	5	4				2		
11	BP-VPB122-GW-332	332	2			2				7		20
12	NA	350	No sample									
13	BP-VPB122-GW-371	371	ND									
14	BP-VPB122-GW-391	391	140	132	2	1	3	2				
15	BP-VPB122-GW-411	411	223	215	1		3	4		2		
16	BP-VPB122-GW-431	431	176	172			2		2			
17	NA	451	No sample									
18	NA	471	No sample									
19	BP-VPB122-GW-491	491	8	8								
20	BP-VPB122-GW-511	511	7	7								
21	BP-VPB122-GW-531	531	24	20	4							
22	BP-VPB122-GW-551	551	3	3								
23	BP-VPB122-GW-571	571	8	8								
24	BP-VPB122-GW-591	591	ND									
25	BP-VPB122-GW-611	611	ND									
26	BP-VPB122-GW-631	631	ND									
27	BP-VPB122-GW-651	651	ND									10
28	BP-VPB122-GW-671	671	ND									13
29	BP-VPB122-GW-691	691	ND									
30	BP-VPB122-GW-711	711	ND									
31	BP-VPB122-GW-731	731	ND									
32	NA	751	No sample									
33	BP-VPB122-GW-771	771	ND									
34	NA	790	No sample									
35	BP-VPB122-GW-811	811	ND									

Notes
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable
All results are in µg/L
TCE: Trichloroethene
PCE: Tetrachloroethene
1,1-DCA: 1,1-Dichlorethane
1,1-DCE: 1,1-Dichlorethene
cis-1,2-DCE: cis-1,2-Dichlorothene
trans-1,2-DCE: trans-1,2-Dichloroethene
CF: Chloroform
Tol.: Toluene
Ace.: Acetone
1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 10-foot interval or at the direction of the site geologist.

TABLE 3-6
QA/QC Sample Summary
Vertical Profile Boring 122
Naval Weapons Industrial Reserve Plant
Bethpage, New York

Number	Sample ID	Depth (ft bgs)	Total VOCs (µg/L)	Comments
1	BP-VPB-TB-041409	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
2	BP-VPB-TB-042209	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
3	BP-VPB-TB-042709	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
4	BP-VPB122-DM-800	800	ND	Drilling mud sample

Notes
ft bgs: Below ground surface
µg/L: micrograms per liter
NA: Not applicable
ND: Not detected

TABLE 3-7
TOTAL VOLATILE ORGANIC COMPOUNDS
GROUND WATER SAMPLE SUMMARY VERTICAL PROFILE BORING 123
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

Number	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	Comments
1	BP-VPB123-GW-051	51	ND	
2	BP-VPB123-GW-101	101	ND	
3	BP-VPB123-GW-151	151	NA	No groundwater sample, hydropunch would not open
4	BP-VPB123-GW-171	171	ND	
5	NA	211	NA	No attempt to sample groundwater due to a sandy clay at this depth
6	BP-VPB123-GW-231	231	ND	
7	BP-VPB123-GW-251	251	1	
8	BP-VPB123-GW-271	271	ND	
9	BP-VPB123-GW-292	292	ND	
10	NA	311	NA	No attempt to sample groundwater due to a stiff sandy clay at this depth
11	BP-VPB123-GW-331	331	ND	
12	BP-VPB123-GW-351	351	7	
13	BP-VPB123-GW-371	371	ND	
14	BP-VPB123-GW-391	391	ND	
15	BP-VPB123-GW-411	411	ND	
16	BP-VPB123-GW-431	431	ND	
17	BP-VPB123-GW-451	451	ND	
18	BP-VPB123-GW-472	472	1.1	
19	BP-VPB123-GW-491	491	ND	
20	BP-VPB123-GW-511	511	ND	
21	BP-VPB123-GW-531	531	ND	
22	BP-VPB123-GW-551	551	ND	
23	NA	571	NA	No groundwater sample, hydropunch was dry
24	NA	591	NA	No attempt to sample groundwater due to a stiff silty/sandy clay
25	NA	611	NA	No attempt to sample groundwater, clay layer at this depth
26	NA	631	NA	No attempt to sample groundwater, clay layer at this depth
27	BP-VPB123-GW-651	651	ND	
28	BP-VPB123-GW-671	671	ND	
29	BP-VPB123-GW-691	691	ND	
30	BP-VPB123-GW-711	711	ND	
31	BP-VPB123-GW-731	731	ND	
32	NA	751	NA	Lost split spoon at 750', boring discontinued

Notes
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable
1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 100-foot interval or at the direction of the site geologist.
2. Total VOCs does not include detects of Acetone (max 31 µg/L), Naphthalene (max 1.8 µg/L), Methyl Ethyl Ketone (max 6 µg/L),

TABLE 3-8
QA/QC Sample Summary
Vertical Profile Boring 123
Naval Weapons Industrial Reserve Plant
Bethpage, New York

Number	Sample ID	Depth (ft bgs)	Total VOCs (µg/L)	Comments
1	BP-VPB-TB-032309	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
2	BP-VPB-TB-032509	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
3	BP-VPB-TB-033009	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
4	BP-VPB-TB-040109	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
5	BP-VPB-TB-040709	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
6	BP-VPB-TB-040809	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water

Notes
ft bgs: Below ground surface
µg/L: micrograms per liter
NA: Not applicable
ND: Not detected

TABLE 3-9
TOTAL VOLATILE ORGANIC COMPOUNDS
GROUND WATER SAMPLE SUMMARY VERTICAL PROFILE BORING 124
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

Number	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	Comments
1	BP-VPB124-GW-051	51	ND	
2	BP-VPB124-GW-101	101	ND	
3	BP-VPB124-GW-152	152	ND	
4	BP-VPB124-GW-191	191	ND	
5	BP-VPB124-GW-211	211	ND	
6	BP-VPB124-GW-231	231	ND	
7	BP-VPB124-GW-251	251	ND	
8	BP-VPB124-GW-271	271	ND	
9	BP-VPB124-GW-291	291	ND	
10	BP-VPB124-GW-312	312	4	
11	BP-VPB124-GW-331	331	ND	
12	BP-VPB124-GW-351	351	ND	
13	BP-VPB124-GW-371	371	ND	
14	BP-VPB124-GW-391	391	ND	
15	BP-VPB124-GW-411	411	ND	
16	BP-VPB124-GW-431	431	ND	
17	BP-VPB124-GW-451	451	ND	
18	NA	471	NA	No sample collected
19	BP-VPB124-GW-491	491	ND	
20	BP-VPB124-GW-511	511	ND	
21	BP-VPB124-GW-531	531	ND	
22	BP-VPB124-GW-551	551	ND	
23	BP-VPB124-GW-571	571	ND	
24	BP-VPB124-GW-592	592	ND	
25	NA	611	NA	No groundwater sample, hydropunch was dry
26	BP-VPB124-GW-631	631	ND	
27	BP-VPB124-GW-651	651	ND	
28	NA	671	NA	No attempt to sample groundwater, clayey silt at this depth interval
29	BP-VPB124-GW-691	691	ND	
30	BP-VPB124-GW-711	711	ND	
31	BP-VPB124-GW-731	731	ND	
32	BP-VPB124-GW-751	751	ND	
33	NA	771	NA	No attempt to sample groundwater, tight clayey sand at this depth interval
34	NA	791	NA	No attempt to sample groundwater, tight clayey sand at this depth interval
35	BP-VPB124-GW-812	812	ND	

Notes
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable
1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 100-foot interval or at the direction of the site geologist
2. Total VOCs does not include detects of Acetone (max 27 µg/L), 1,2,4-Trichlorobenzene (max 1 µg/L), Naphthalene (max 2 µg/L), 1,2,3-Trichlorobenzene (max 1 µg/L), Methyl Ethyl Ketone (max 3 µg/L), Chloromethane (max 4 µg/L)

TABLE 3-10
QA/QC Sample Summary
Vertical Profile Boring 124
Naval Weapons Industrial Reserve Plant
Bethpage, New York

Number	Sample ID	Depth (ft bgs)	Total VOCs (µg/L)[1]	Comments
1	BP-VPB-TB-030309	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
2	BP-VPB-TB-030909	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
3	BP-VPB-TB-033009	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
4	BP-VPB-TB-031109	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
5	BP-VPB-TB-031609	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water

Notes
ft bgs: Below ground surface
µg/L: micrograms per liter
NA: Not applicable
ND: Not detected
[1] Does not include laboratory constituents methylene chloride, 1,4-Dichlorobenzene, 1,2,4-Trichlorobenzene, Hexachlorobutadiene, Naphthalene, and 1,2,3-Tichlorobenzene

TABLE 3-11
TOTAL VOLATILE ORGANIC COMPOUNDS
GROUND WATER SAMPLE SUMMARY VERTICAL PROFILE BORING 125
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

Number	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	Comments
1	NA	51	NA	No sample in hydropunch, lost drilling fluid at 45'-47'
2	BP-VPB125-GW-071	71	ND	
3	BP-VPB125-GW-101	101	ND	
4	BP-VPB125-GW-151	151	ND	
5	BP-VPB125-GW-203	203	ND	
6	NA	211	NA	No sample collected
7	BP-VPB125-GW-231	231	ND	
8	BP-VPB125-GW-251	251	ND	
9	BP-VPB125-GW-271	271	ND	
10	BP-VPB125-GW-291	291	ND	
11	BP-VPB125-GW-311	311	ND	
12	BP-VPB125-GW-331	331	ND	
13	BP-VPB125-GW-351	351	ND	
14	BP-VPB125-GW-371	371	ND	
15	BP-VPB125-GW-391	391	ND	
16	BP-VPB125-GW-411	411	ND	
17	BP-VPB125-GW-432	432	ND	
18	NA	451	NA	No groundwater in hydropunch, gray clay on hydropunch screen
19	BP-VPB125-GW-471	471	ND	
20	BP-VPB125-GW-491	491	ND	
21	BP-VPB125-GW-511	511	ND	
22	BP-VPB125-GW-531	531	ND	
23	BP-VPB125-GW-551	551	ND	
24	BP-VPB125-GW-571	571	ND	
25	BP-VPB125-GW-591	591	ND	
26	BP-VPB125-GW-611	611	ND	
27	BP-VPB125-GW-632	632	ND	
28	BP-VPB125-GW-651	651	ND	
29	BP-VPB125-GW-671	671	ND	
30	BP-VPB125-GW-691	691	ND	
31	BP-VPB125-GW-711	711	ND	
32	BP-VPB125-GW-731	731	-	No Sample
33	BP-VPB125-GW-751	751	ND	
34	NA	771	NA	No groundwater sample taken due to clay on split spoon
35	NA	791	NA	No groundwater sample taken due to sandy clay at 800'

Notes

bgs: Below ground surface

µg/L: micrograms per liter

ND: Not detected

NA: Not applicable

1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 100-foot interval or at the direction of the site geologist

2. Total VOCs does not include detects of Acetone (max 72 µg/L), 1,2,4-Trichlorobenzene (2 µg/L), Naphthalene (max 4 µg/L), Hexachlorobutadiene (1 µg/L), 1,2,3-Trichlorobenzene (2 µg/L), Methyl Ethyl Ketone (max 14 µg/L), 2-Hexanone (1 µg/L), Chlorobenzene (2 µg/L), and Chloromethane (4 µg/L)

TABLE 3-12
QA/QC Sample Summary
Vertical Profile Boring 125
Naval Weapons Industrial Reserve Plant
Bethpage, New York

Number	Sample ID	Depth (ft bgs)	Total VOCs (µg/L)[1]	Comments
1	BP-VPB-TB-012809	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
2	BP-VPB-TB-020209	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
3	BP-VPB-TB-020409	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
4	BP-VPB-TB-020909	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
5	BP-VPB-TB-021109	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
6	BP-VPB-TB-021709	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water

Notes
ft bgs: Below ground surface
µg/L: micrograms per liter
NA: Not applicable
ND: Not detected
[1]Does not include laboratory constituent methylene chloride

TABLE 3-13
TOTAL VOLATILE ORGANIC COMPOUNDS
GROUND WATER SAMPLE SUMMARY VERTICAL PROFILE BORING 126
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

Number	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)[2]	Comments
1	BP-VPB126-GW-051	51	ND	
2	BP-VPB126-GW-101	101	ND	
3	BP-VPB126-GW-151	151	ND	
4	BP-VPB126-GW-191	191	65.2	
5	BP-VPB126-GW-211	211	15	
6	BP-VPB126-GW-231	231	381.4	
7	BP-VPB126-GW-251	251	11	
8	BP-VPB126-GW-271	271	15	
9	BP-VPB126-GW-291	291	7	
10	BP-VPB126-GW-311	311	6	
11	BP-VPB126-GW-331	331	5	
12	NA	351	NA	No groundwater sample taken due to clay at this depth interval
13	BP-VPB126-GW-371	371	2.8	
14	BP-VPB126-GW-391	391	2.3	
15	BP-VPB126-GW-411	411	ND	
16	NA	431	NA	No groundwater sample taken due to a stiff sandy clay at this depth interval
17	BP-VPB126-GW-451	451	1.5	
18	BP-VPB126-GW-471	471	ND	
19	BP-VPB126-GW-491	491	ND	
20	BP-VPB126-GW-511	511	ND	
21	BP-VPB126-GW-531	531	ND	
22	BP-VPB126-GW-551	551	ND	
23	BP-VPB126-GW-571	571	ND	
24	BP-VPB126-GW-591	591	ND	
25	BP-VPB126-GW-611	611	ND	
26	BP-VPB126-GW-631	631	ND	
27	BP-VPB126-GW-651	651	1.3	
28	NA	671	NA	No groundwater sample taken due to clay at this depth interval
29	BP-VPB126-GW-691	691	ND	
30	NA	711	NA	No groundwater sample taken due to a red gray clay at this depth interval
31	NA	731	NA	No groundwater sample, hydropunch was dry
32	BP-VPB126-GW-751	751	137	
33	NA	771	NA	No groundwater sample, hydropunch was dry
34	BP-VPB126-GW-791	791	2	
35	BP-VPB126-GW-801	801	ND	

Notes:
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not Detected
NA: Not Applicable

1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 10-foot interval or at the direction of the site geologist.

2. Total VOCs does not include chloromethane (max 1.7 µg/L), toluene (max 1.8 µg/L), carbon disulfide (max 1.3 µg/L), carbon tetrachloride (max 1.5 µg/L), acetone (max 17.5 µg/L), methylene chloride (max 6.8 µg/L), and methyl tert-butyl ether (max 1.4 µg/L)

TABLE 3-14
DETECTED COMPOUNDS FOR VERTICAL PROFILE BORING 126
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

No.	Sample ID	Depth (feet bgs)[1]	Total VOCs (µg/L)	TCE	PCE	cis-1,2-DCE	CM	Tol.	CD	CT	Ace.	MC	MTBE
1	BP-VPB126-GW-051	51	ND										
2	BP-VPB126-GW-101	101	ND					1.8					
3	BP-VPB126-GW-151	151	ND					1.6					
4	BP-VPB126-GW-191	191	65.2		65.2			1.5				6.1	1.4
5	BP-VPB126-GW-211	211	15		15								
6	BP-VPB126-GW-231	231	381.4	2.1	378	1.3						6.8	
7	BP-VPB126-GW-251	251	11		11								
8	BP-VPB126-GW-271	271	15		15								
9	BP-VPB126-GW-291	291	7		7								
10	BP-VPB126-GW-311	311	6		6								
11	BP-VPB126-GW-331	331	5		5								
12	NA	351	No sample										
13	BP-VPB126-GW-371	371	2.8		2.8								
14	BP-VPB126-GW-391	391	2.5		2.5			1.3					
15	BP-VPB126-GW-411	411	ND										
16	NA	431	No sample										
17	BP-VPB126-GW-451	451	1.5		1.5				1.3				
18	BP-VPB126-GW-471	471	ND										
19	BP-VPB126-GW-491	491	ND										
20	BP-VPB126-GW-511	511	ND										
21	BP-VPB126-GW-531	531	ND										
22	BP-VPB126-GW-551	551	ND									6	
23	BP-VPB126-GW-571	571	ND								10.5		
24	BP-VPB126-GW-591	591	ND								17.5		
25	BP-VPB126-GW-611	611	ND								13.6		
26	BP-VPB126-GW-631	631	ND										
27	BP-VPB126-GW-651	651	ND				1.3				13.9		
28	NA	671	No sample										
29	BP-VPB126-GW-691	691	ND				1.7						
30	NA	711	No sample										
31	NA	731	No sample										
32	BP-VPB126-GW-751	751	137	137			1.6			1.5			
33	NA	771	No sample										
34	BP-VPB126-GW-791	791	2	2									
35	BP-VPB126-GW-811	811	ND										

Notes
bgs: Below ground surface
µg/L: micrograms per liter
ND: Not detected
NA: Not applicable
All results are in µg/L
TCE: Trichloroethene
PCE: Tetrachloroethene
cis-1,2-DCE: cis-1,2-Dichloroethene
CM: Chloromethane
Tol.: Toluene
CD: Carbon Disulfide
CT: Carbon Tetrachloride
Ace.: Acetone
MC: Methylene Chloride
MTBE: Methyl Tertiary Butyl Ether
1. Samples were taken on 20-foot centers starting at 200 ft bgs to the total depth of the borehole. Where a sample could not be obtained from the designated interval, an attempt was made at the next 10-foot interval or at the direction of the site geologist.

TABLE 3-15
QA/QC Sample Summary
Vertical Profile Boring 126
Naval Weapons Industrial Reserve Plant
Bethpage, New York

Number	Sample ID	Depth (ft bgs)	Total VOCs (µg/L)[1]	Comments
1	BP-VPB-TB-061609	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
2	BP-VPB-TB-062209	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
3	BP-VPB-TB-062409	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
4	BP-VPB-TB-062909	NA	ND	Trip blank prepared in the field using laboratory supplied analyte-free water
5	BP-VPB126-DM-700	700	ND	Drilling mud sample taken from 700 feet
6	BP-VPB-SW-063009	NA	NA	Source water sample from water truck

Notes
ft bgs: Below ground surface
µg/L: micrograms per liter
NA: Not applicable
ND: Not detected
[1]Does not include laboratory constituent methylene chloride (max 28.8 µg/L)

TABLE 3-16
Lab Result Comparison Table from Vertical Profile Borings
NWIRP Bethpage, New York

Sample ID	Total VOCs (µg/L)		TCE		PCE		1,1,1-Trichloroethane		1,1-Dichloroethane		1,1-Dichloroethene		cis-1,2-Dichloroethene		Chloroform		1,2,3-TCB	
	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.
BP-VPB121-GW-152	ND	ND																
BP-VPB121-GW-371	7.1	4.1	6	4.1 J	1.1													
BP-VPB121-GW-551	ND	ND																
BP-VPB121-GW-671	3.4	1.6	3.4	1.6 J														
BP-VPB122-GW-312	17	20.5	8	9 J	5	5.1 J			4	6.7J					2	2 J		
BP-VPB122-GW-391	140	174	132	160 J	2	3.7 J		1.5 J	1	2.1 J	3	3.8 J	2	2.9 J				
BP-VPB122-GW-651	ND	ND																
BP-VPB122-GW-731	ND	ND																
BP-VPB123-GW-251	1	4.1	1	1.5 J						2.6 J								
BP-VPB123-GW-411	ND	ND																
BP-VPB123-GW-711	ND	ND																
BP-VPB123-GW-731	ND	ND																
BP-VPB124-GW-271	ND	ND															1	
BP-VPB124-GW-331	ND	ND																
BP-VPB124-GW-571	ND	ND																
BP-VPB124-GW-691	ND	ND																
BP-VPB125-GW-203	ND	ND																
BP-VPB125-GW-432	ND	ND																
BP-VPB125-GW-651	ND	ND																
BP-VPB125-GW-751	ND	ND																
BP-VPB126-GW-271	15				15	6.2 J												
BP-VPB126-GW-391	2.5				2.5	1.1 J												
BP-VPB126-GW-691	ND																	
BP-VPB126-GW-751	137		137	150														

Notes:
µg/L: micrograms per liter
ND: Not Detected
LIA: Long Island Analytical Laboratories
Mit.: Mitkem Laboratories
All results shown are in µg/L
TCE: Trichloroethane
PCE: Tetrachloroethane
1,2,3-TCB: 1,2,3-Trichlorobenzene
1,2,4-TCB: 1,2,4-Trichlorobenzene
Blank Cells are not detected values

TABLE 3-16
Lab Result Comparison Table from Vertical Profile Borings
NWIRP Bethpage, New York

Sample ID	1,2,4-TCB		Acetone		Methyl Ethyl Ketone		Naphthalene		Chlorobenzene		Freon 113		Toluene		Chloromethane		Carbon Tetrachloride	
	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.	LIA	Mit.
BP-VPB121-GW-152			10															
BP-VPB121-GW-371																		
BP-VPB121-GW-551																		
BP-VPB121-GW-671																		
BP-VPB122-GW-312																		
BP-VPB122-GW-391												37 J						
BP-VPB122-GW-651			10	5 J														
BP-VPB122-GW-731																		
BP-VPB123-GW-251			23	13	2													
BP-VPB123-GW-411				4.0 J														
BP-VPB123-GW-711																		
BP-VPB123-GW-731																		
BP-VPB124-GW-271	1			9.3			2											
BP-VPB124-GW-331				10														
BP-VPB124-GW-571			13	10														
BP-VPB124-GW-691				6.6														
BP-VPB125-GW-203			11						2									
BP-VPB125-GW-432			69	22	7													
BP-VPB125-GW-651			55	13	6													
BP-VPB125-GW-751			13	5.1														
BP-VPB126-GW-271																		
BP-VPB126-GW-391													1.3					
BP-VPB126-GW-691				11											1.7			
BP-VPB126-GW-751															1.6		1.5	1.7 J

Notes:
µg/L: micrograms per lit
ND: Not Detected
LIA: Long Island Analyt
Mit.: Mitkem Laboratori
All results shown are in
TCE: Trichloroethane
PCE: Tetrachloroethan
1,2,3-TCB: 1,2,3-Trichl
1,2,4-TCB: 1,2,4-Trichl
Blank Cells are not dete

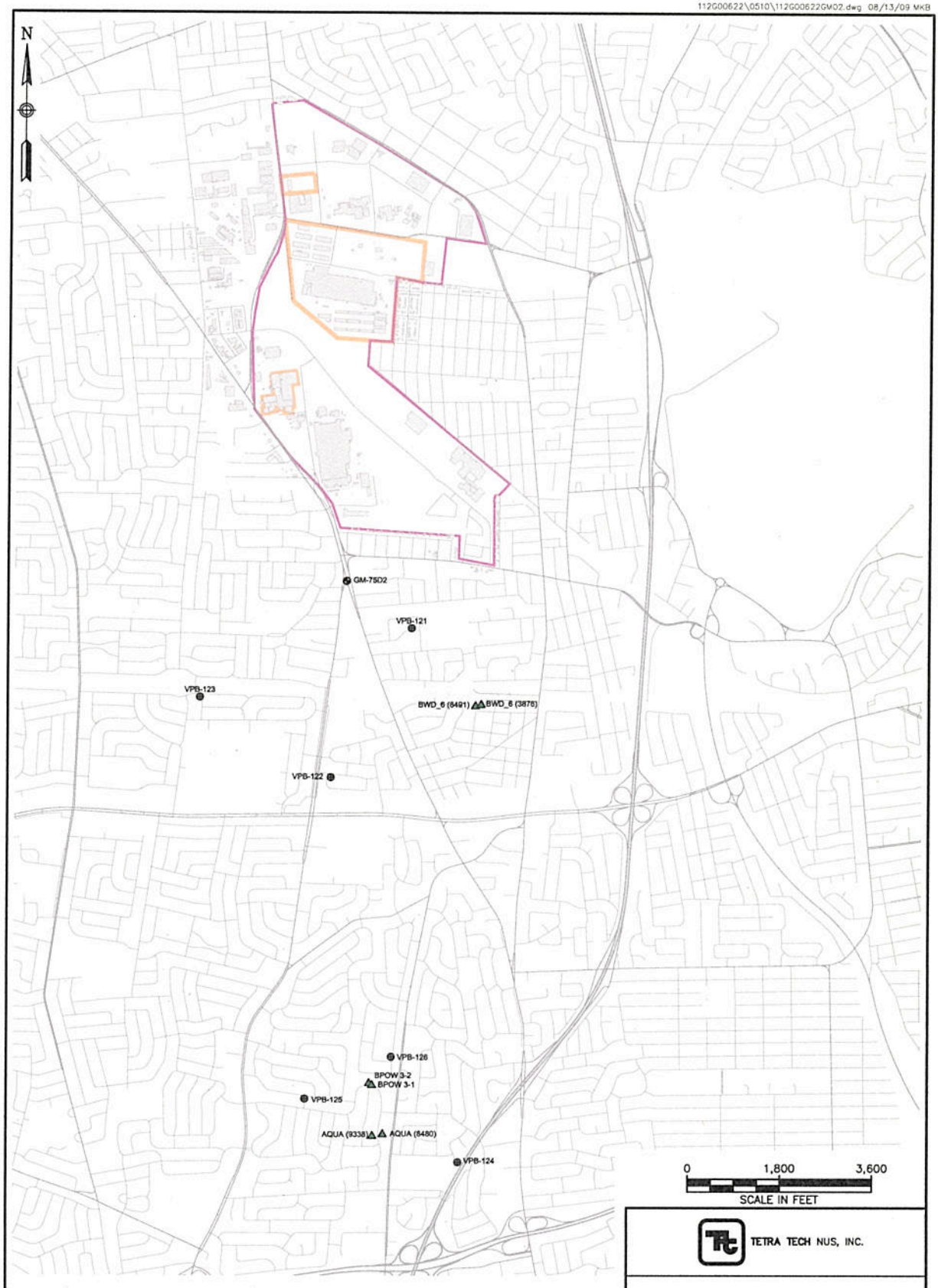
TABLE 3-17
Total Organic Carbon from Vertical Profile Borings
NWIRP Bethpage, New York

Sample ID	Depth (ft bgs)	Total Organic Carbon (mg/Kg)
BP-VPB121-SB-151M	151	ND (5000)
BP-VPB121-SB-651M	651	ND (5000)
BP-VPB122-SB-311M	311	ND (5000)
BP-VPB122-SB-351M	351	60,000
BP-VPB123-SB-291M	291	ND (4900)
BP-VPB123-SB-611M	611	9,500
BP-VPB124-SB-311M	311	14,000
BP-VPB124-SB-671M	671	ND (5000)
BP-VPB125-SB-202M	202	14,000
BP-VPB125-SB-431M	431	18,000
BP-VPB126-SB-351M	351	36,000
BP-VPB126-SB-670M	670	6,600

Notes:
ft bgs: Feet below ground surface
mg/Kg: Milligrams per kilogram
ND (5000): Not Detected (Reporting Limit)

FIGURES

112G00622\0510\112G00622GM02.dwg 08/13/09 MKB



LEGEND

- GROUNDWATER SAMPLING LOCATION
- VERTICAL PROFILE BORING
- WATER SUPPLY WELL
- BUILDING
- HIGHWAY
- MAJOR LOCAL ROAD
- MINOR LOCAL ROAD
- 1997 NORTHROP-GRUMMAN BETHPAGE BOUNDARY
- 1997 NWIRP BETHPAGE BOUNDARY

TETRA TECH NUS, INC.

VERTICAL PROFILE BORING LOCATION MAP
NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
BETHPAGE, NEW YORK

FILE	SCALE
112G00622GM02	AS NOTED
FIGURE NUMBER	REV / DATE
FIGURE 1	0 / 08/13/09