2017 Offsite Soil Gas Investigation Work Plan

NWIRP Bethpage, New York

Naval Facilities Engineering Command Mid-Atlantic

Contract Number N62470-16-D-9008
Contract Task Order WE09

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NWIRP BETHPAGE, NEW YORK

NAVAL FACILITIES ENGINEERING COMMAND MID-ATLANTIC

COMPREHENSIVE LONG-TERM ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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1.0 INTRODUCTION

This Work Plan has been prepared to detail an offsite soil gas investigation in the neighborhood east of Site 1 at the former Naval Weapons Industrial Reserve Plant (NWIRP) Bethpage, Long Island, New York (Figure 1). This Work Plan was prepared by Tetra Tech for Naval Facilities Engineering Command (NAVFAC) – Mid-Atlantic under Contract N62470-16-D-9008, Contract Task Order (CTO) WE09.

Site 1 was impacted by historic releases of chlorinated solvents and is subject to cleanup of volatile organic compound (VOC)-contaminated soil and groundwater. Between 2006 and 2009, several phases of soil gas and vapor intrusion investigations were conducted. The results of the investigations indicated a need to contain and prevent further offsite migration of VOC-contaminated soil gas and to mitigate the offsite VOC-contaminated soil gas as feasible. Vapor intrusion issues were initially addressed via in-home air purification units and sub-slab depressurization units. A soil vapor extraction (SVE) Containment System was then constructed at the eastern edge of Site 1, which began operation in December 2009. The operation of this system allowed the in-home systems to be removed.

As part of the SVE Containment System program, annual testing of soil gas in the neighborhood is conducted. Evaluation of the test results show that the system is operating effectively. In 2015, increasing concentrations of cis-1,2-dichloroethene (cis-1,2-DCE) and trichloroethene (TCE) were noted in soil vapor pressure monitors (SVPMs) SVPM-2006I and -2006D, which are located on 10th Street (Figure 2). These results were confirmed during the 2016 sampling events. However, SVPM points located near Site 1 were significantly lower and has not increase during this period. Even though the VOC concentrations in SVPM-2006I and -2006D remain below action levels, further increases in concentration could trigger the need for additional response. A preliminary evaluation of the data indicates that the increasing concentration of VOCs in SVPM-2006D and -2006I may not be associated NWIRP Bethpage.

This 2017 soil gas investigation will include the installation of 18 soil gas sampling points at nine locations along right-of-ways in the residential neighborhood east of Site 1. Soil gas samples will be collected at approximate depths of 24 feet (intermediate-depth) and 50 feet (deep) below ground surface (bgs) and will be analyzed for site-specific VOCs via United States Environmental Protection Agency (U.S. EPA) method TO-15. This soil gas testing is being conducted using relevant sections of the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York and updates through August 2015 (NYSDOH 2006).

1.1 SITE HISTORY AND CONDITIONS

Activities at the NWIRP Bethpage started in 1942. The plant's primary mission was the research, prototyping, testing, design engineering, fabrication, and primary assembly of military aircraft. The facilities at NWIRP Bethpage included four plants used for assembly and prototype testing; a group of quality control laboratories, two warehouses complexes (north and south), a salvage storage area, water recharge basins, the Industrial Wastewater Treatment Plant, and several smaller support buildings. In 1996, operations ended at the facilities.

Site 1 is located along the eastern facility boundary (Figure 1). The Site occupies approximately five acres and was used as a storage area for various types of equipment, heavy materials, including transformers, and drum marshalling. Site 1 is enclosed by a six-foot high, chain-link fence. The site is relatively flat, and is covered with sandy soils, gravel, and grass. A vegetated wind row (pine) and fencing are present along the eastern edge of the site.

1.2 BACKGROUND AND CONCEPTUAL SITE MODEL (CSM)

The SVE Containment System at Site 1 consists of SVE wells, off-property and on-property soil vapor monitoring, and soil vapor treatment. Twelve SVE wells are located along the eastern boundary of Site 1 in six clusters, each cluster consisting of one intermediate-depth well and one deep well (Figure 2). Intermediate-depth extraction wells SVE-101I, SVE-102I, SVE-103I, SVE-104I, SVE-105I, and SVE-106I are screened between 25 and 35 feet bgs. Deep extraction wells SVE-101D, SVE-102D, SVE-103D, SVE-104D, SVE-105D, and SVE-106D are screened between 40 and 60 feet bgs. Groundwater is at a depth of approximately 52 to 55 feet bgs. These twelve SVE wells have been piped below the ground to a Flow Monitoring Station (FMS), where flow, vacuum, and vapor quality are monitored. The SVE lines combine into a single manifold within the FMS, and from this location, a single underground pipeline conveys the soil vapors approximately 1,400 feet to a treatment building to the west. The treatment building consists of a moisture separator, two SVE blowers, and a 5,000-lb vapor-phase granular activated carbon (VGAC). The treated vapor is discharged from the VGAC via an exhaust stack. The discharge from the SVE containment system is monitored for VOCs as identified in the NYSDEC Division of Air Resources (DAR) permit equivalent effluent limitations and NYSDEC approved modifications and monitoring requirements. Five additional SVE wells (SVE-107D, SVE-108D, SVE-109D, SVE-110D, and SVE-11D) were installed in October 2011 to address potential VOCs under Plant No. 3 and the South Warehouse Area.

Along with quarterly sampling of SVE wells, the SVE containment system operation is also assessed with quarterly monitoring of vacuum pressures and annual soil gas sampling at eighteen SVPMs located on 10th and 11th Streets in the adjacent neighborhood to the east. Three

SVPMs are co-located at each of the six SVPM clusters with screened depths of approximately 10 feet, 24 feet, and 50 feet bgs (Figure 2).

Since 2010, soil gas testing conducted in the neighborhood has shown that the SVE containment system is operating effectively. In 2015 and 2016, increasing concentrations of cis-1,2-DCE and TCE were noted in SVPM-2006I and -2006D. These SVPMs are located on 10th Street, which is located at the eastern end of the containment monitoring system (Figure 2).

Soil gas sampling results from October 2008 and 2013 through September 2016 are presented in Figure 3. The 2008 results present soil gas quality prior to the implementation of the SVE Containment System. Based on a review of the SVPM-2006D data, the concentration of cis-1,2-DCE increased from 22 microgram per cubic meter (µg/m^3) in 2014 to 390 µg/m^3 in September 2016 and the concentration of TCE increased from 2.1J µg/m^3 in 2014 to 84J µg/m^3 in September 2016. Similarly, in SVPM-2006I, the concentration of cis-1,2-DCE increased from 10 µg/m^3 in 2014 to 260 µg/m^3 in September 2016 and the concentration of TCE increased from 2.9J µg/m^3 in 2014 to 57 µg/m^3 in September 2016. cis-1,2-DCE and TCE concentrations remain at 10 µg/m^3 or less in all the shallow SVPMs, the other intermediate SVPMs, and 4 of the 5 other deep SVPMs. As a result, while these VOCs do not represent a potential current risk, they may represent a leading edge of an unknown soil gas plume further east; and increasing concentrations of VOCs could pose a concern in the future. Further discussion of the historical soil gas and groundwater data in the area is presented below.

Additional soil gas results for cis-1,2-DCE from previous sampling events in the study area are presented on Figure 4. In 2008, for the deep soil gas samples located near Site 1, cis-1,2-DCE concentrations ranged from non-detect to 23 µg/m^3. In 2014, for deep soil gas samples located near BCP, cis-1,2-DCE concentrations ranged from non-detect to 28.6 µg/m^3. These results are significantly less than the cis-1,2-DCE concentration of 390 µg/m^3 in SVPM-2006D in 2016.

Shallow (water table) groundwater results for cis-1,2-DCE and TCE in the study area are presented on Figure 5. The cis-1,2-DCE (maximum concentration of 140 microgram per liter [µg/L] in 2006) and TCE (maximum concentration of 13 µg/L in 2006) results are relatively low. Based on more recent data near these SVPMs, cis-1,2-DCE and TCE were not detected in 2015 in groundwater monitoring well HN-42S groundwater, located approximately 700 feet east of SVPM-2006D and -2006I. In addition, on-property groundwater data from the 2015 sampling event showed low level VOCs (i.e., the maximum cis-1,2-DCE concentration was 22 µg/L and maximum TCE concentration was 9.4 µg/L). The groundwater data do not suggest the presence of significant groundwater contamination near SVPM-2006D and -2006I that would account for the current levels of these VOCs. As a result, the source of the increasing cis-1,2-DCE and TCE concentrations in SVPM-2006I and -2006D is unknown.

Figure 6 presents a CSM that depicts the current understanding of the investigation area. cis-1,2-DCE and TCE may be emanating from soil gas not completely captured by the BCP Soil Gas Containment system, soil gas that had migrated off property prior to its operation, or from volatilization of these VOCs from the residual groundwater plume to the east. The vacuum field of the SVE Containment System at Site 1 could pull VOCs in soil gas from the east/northeast towards SVPM-2006D and -2006I.

1.3 OBJECTIVE

The objectives of this soil gas investigation are:

1) Evaluate what impact, if any, the cis-1,2-DCE and TCE detections in SVPM-2006I and -2006D piezometers have on the SVE Containment System.
2) Determine whether the SVE Containment System is pulling these vapors from a non-NWIRP source.
3) Update the CSM to support future decisions and actions regarding operation of the SVE Containment System.

1.4 SAMPLING APPROACH

The study area being evaluated for this soil gas investigation is the residential neighborhood east, north, and south of SVPM-2006I and 2006D. Existing SVPMs to the west provide adequate coverage in that area. Temporary soil gas sampling points will be installed along town right-of-ways in the residential neighborhood and sampled the same day.

Nine soil gas sampling locations are planned (Figure 7). These locations were selected to cover the area east, north, and south of SVPM-2006D and -2006I. Each of the sample locations will consist of two soil gas sampling points, at approximate depths of 24 and 50 feet bgs. The depth of 50 feet bgs corresponds to the soil gas sample being collected approximately 2 feet above the water table. The actual water table depth at the time of sampling will be confirmed using groundwater monitoring well HN-42S at the start of the sampling event and the depth of the deeper sample point may be adjusted accordingly. The sampling points at each location will be offset approximately 2 to 3 feet apart. The soil gas points will be installed using direct-push technology (DPT). After sampling, the temporary sampling points will be removed from ground and the soil boring will be filled/abandoned with clean sand.

Table 1 presents each of the proposed soil gas samples, corresponding sample nomenclature, and analytical method. Each soil gas sample will be analyzed for VOCs using U.S. EPA Method TO-15 by a Navy and New York State Environmental Laboratory Approval Program (ELAP) certified laboratory (U.S. EPA 1999). The analyte list is site specific and is presented in Attachment A. This list was derived based on historical detections of VOC compounds in soil gas or groundwater at Site 1 and the BCP area. Detection limits for target VOCs will be less than or equal to 1.0 to 3.0 $\mu g/m^3$ (see Attachment A). One outdoor or ambient air sample will be collected per day and analyzed for VOCs.

2.0 FIELD ACTIVITIES

The soil gas investigation consists of advancing 18 temporary soil gas sampling points at 9 locations at approximate depths of 24 and 50 feet bgs. The general field activities for the soil gas sampling are as follows:

1. Identify and mark planned sample locations.
2. Conduct utility clearance activities.
3. Install 18 soil gas sampling points at 9 locations.
4. Collect soil gas samples and analyze for VOCs via USEPA TO-15 method.

The planned soil gas locations are presented on Figure 7. Table 1 identifies the sample location, proposed sample depth, sample identification, and matrix for each sample. Soil gas sampling procedures are detailed in Attachment B. The field sampling team will maintain a field logbook and sample log sheets summarizing important information and will include the following details:

- sample identification
- date and time of sample collection
- sampling depth
- identity of samplers
- sampling methods and devices
- purge volumes
- volume of soil vapor extracted
- the vacuum before and after samples are collected
- wind speed and direction
- ambient temperature
- barometric pressure
- relative humidity

- chain of custody (COC) protocols and records used to track samples from sampling point to analysis. An example of the Soil Gas Sample Log Sheet is presented in Attachment C.

SUMMA® canisters will be utilized for collecting all soil gas samples and 30 minute regulators will be used for soil gas sample collection. The SUMMA® canisters do not require preservation with ice or refrigeration during shipment. SUMMA® canisters will be shipped to the laboratory via overnight carrier (e.g., Federal Express) for analysis. Once the soil gas samples have been collected, the temporary soil gas monitoring points will be abandoned by removing the drive rods, and filling the resulting hole with clean sand. In the event that a soil gas sample cannot be collected within 2 hours, the hole will be abandoned. Another boring will be installed approximately 2 to 3 feet away, and the sample collection depth will be raised by 5 feet.

Outdoor (ambient) air samples will also be collected simultaneously during the soil gas sampling. The SUMMA® canister will be positioned at an upwind location near the associated soil vapor monitoring points at a height of 4 feet above grade. The outdoor/ambient air sample will be obtained over a 4- to 8-hour time period during each day of sampling and will be shipped with soil gas samples to a fixed-based laboratory as described above.

All sample containers (SUMMA® canisters) will be labeled with a unique sample identifier. The sample identification code will consist of up to 14 characters, as described below.

- The first four characters indicate the site from which the sample is to be collected:
  BPS1 (Bethpage Site 1)

- The next two characters indicate the matrix:
  BPS1-SG (Soil Gas)

- The next four characters indicate the sampling location:
  BPS1-SG3001 (Location 1)

- The next two characters indicate the depth of the sample
  BPS1-SG3001-24 (24 feet bgs)

Any other pertinent information regarding sample identification will be recorded in the field logbooks or on sample log sheets. These identification codes may be updated in the field based on actual depths of sample collection.

3.0 REPORTING

A report will be prepared that documents field procedures, field activities, and sampling results. The sample results will be validated and summarized in tables and figures. After receipt and validation of the soil gas analytical data, the CSM will be updated and presented in the report.

The concentration and spatial patterns of soil gas results will be used to support future decisions and actions regarding potential modification of the Site 1 SVE Containment System operation and/or whether any additional action is needed to address soil gas in the neighborhood.

4.0 SCHEDULE

Pending approval of this work plan and receipt of access agreements with the Town of Oyster Bay, the fieldwork will start within approximately 4 to 8 weeks with the soil gas sample collection being completed within two weeks.

ACRONYMS

bgs	below ground surface
cis-1,2-DCE	cis-1,2-dichloroethene
BCP	Bethpage Community Park
COC	chain of custody
CLEAN	Comprehensive Long-Term Environmental Action Navy
DAR	Division of Air Resources
DPT	direct-push technology
ELAP	Environmental Laboratory Approval Program
FMS	Flow Monitoring Station
ml/min	milliliters per minute
NWIRP	Naval Weapons Industrial Reserve Plant
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
SVE	soil vapor extraction
SVPM	Soil Vapor Pressure Monitor
TCE	trichloroethene
VGAC	vapor phase granular activated carbon
VOC	Volatile organic compound
U.S. EPA	United States Environmental Protection Agency
$\mu g/m^3$	micrograms per cubic meter
µg/L	micrograms per liter

REFERENCES

New York State Department of Health (NYSDOH), 2006. FINAL Guidance for Evaluating Soil Vapor Intrusion in the State of New York. October.
With updates through August 2015 at:
https://health.ny.gov/environmental/indoors/vapor_intrusion/update.htm

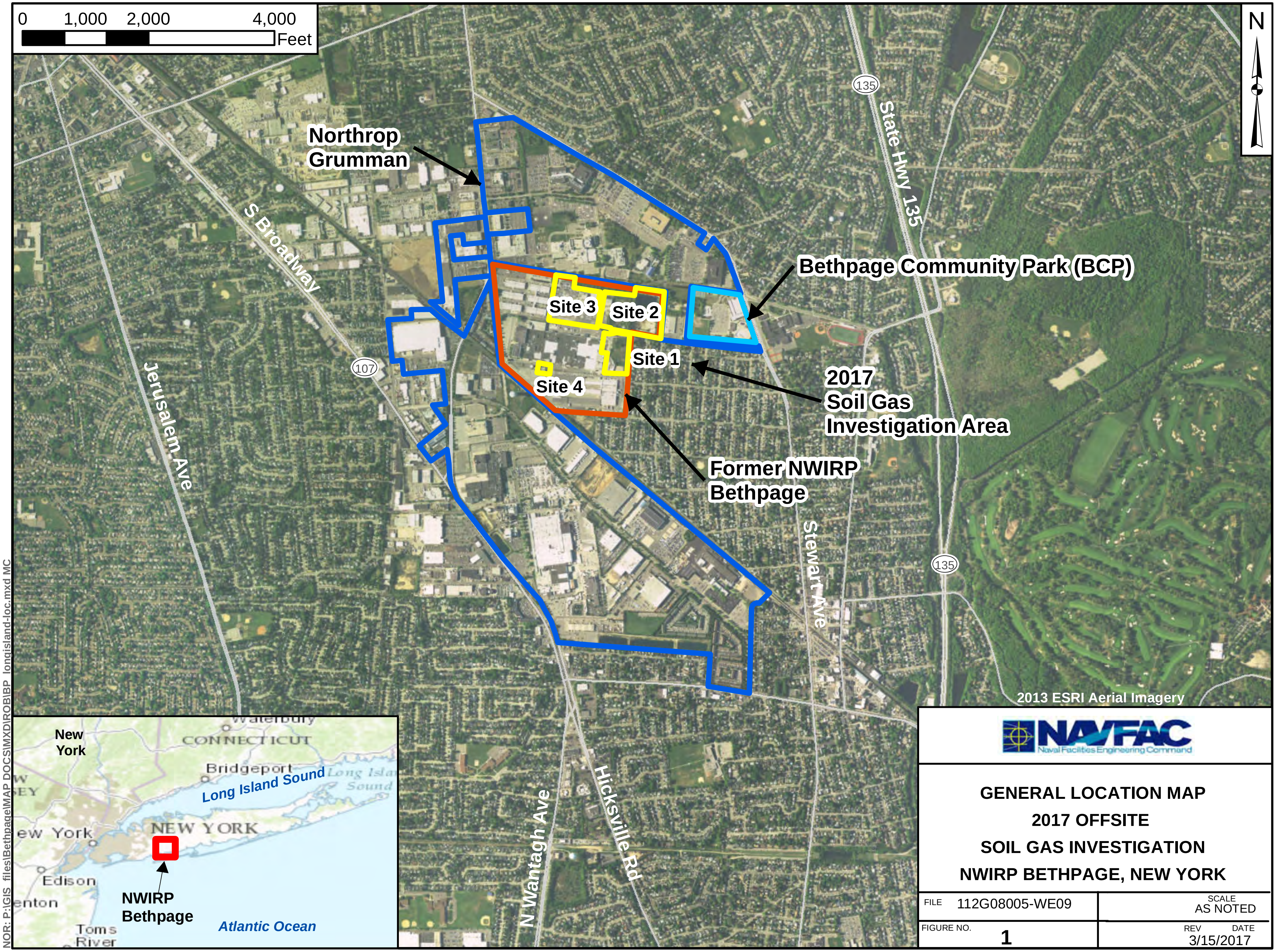
United States Environmental Protection Agency (USEPA), 1999. Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air Second Edition Compendium Method TO-15 Determination Of Volatile Organic Compounds (VOCs) In Air Collected In Specially-Prepared Canisters And Analyzed By Gas Chromatography/ Mass Spectrometry (GC/MS). January.

TABLE 1
SOIL GAS SAMPLE SUMMARY
2017 OFFSITE SOIL GAS INVESTIGATION
NWIRP BETHPAGE, NEW YORK

Sample Locations (1)	Proposed Depths (feet bgs)(2)	Sample ID	Matrix
SG3001	24	BPS1-SG3001-XX	Air
SG3001	50	BPS1-SG3001-XX	Air
SG3002	24	BPS1-SG3002-XX	Air
SG3002	50	BPS1-SG3002-XX	Air
SG3003	24	BPS1-SG3003-XX	Air
SG3003	50	BPS1-SG3003-XX	Air
SG3004	24	BPS1-SG3004-XX	Air
SG3004	50	BPS1-SG3004-XX	Air
SG3005	24	BPS1-SG3005-XX	Air
SG3005	50	BPS1-SG3005-XX	Air
SG3006	24	BPS1-SG3006-XX	Air
SG3006	50	BPS1-SG3006-XX	Air
SG3007	24	BPS1-SG3007-XX	Air
SG3007	50	BPS1-SG3007-XX	Air
SG3008	24	BPS1-SG3008-XX	Air
SG3008	50	BPS1-SG3008-XX	Air
SG3009	24	BPS1-SG3009-XX	Air
SG3009	50	BPS1-SG3009-XX	Air
Quality Control Samples			
Duplicate(3)	TBD	BPS1-DUP01	Air
Duplicate(3)	TBD	BPS1-DUP02	Air
Outdoor/Ambient Air(4)	NA	BPS1-ODA3001-XX	Air
Outdoor/Ambient Air(4)	NA	BPS1-ODA3002-XX	Air
Outdoor/Ambient Air(4)	NA	BPS1-ODA3003-XX	Air
Outdoor/Ambient Air(4)	NA	BPS1-ODA3004-XX	Air
Outdoor/Ambient Air(4)	NA	BPS1-ODA3005-XX	Air

bgs: below ground surface
NA: Not applicable.
TBD: To be determined.
VOCs: Volatile organic compounds.
XX: Bottom of sample interval in feet. For example, a soil gas sample collected at SG3001 at 24 feet bgs would be BPS1-SG3001-24.

1 21-Day results for the Site Specific VOCs (Attachment A) from Navy-approved laboratory via United States Environmental Protection Agency Method TO-15.
2 Actual depths of soil gas samples may vary slightly due to the water table and dense/tight lithological conditions.
3 Duplicate samples will be selected in the field at a rate of 1 per 10 samples collected
4 Outdoor air samples will be collected over a 4- to 8- hour time period during each day of soil gas sampling. Samples will be collected at approximately 4 feet above ground surface, upwind of the soil gas sample locations. Actual number of samples may vary depending on actual days required to complete the sampling.



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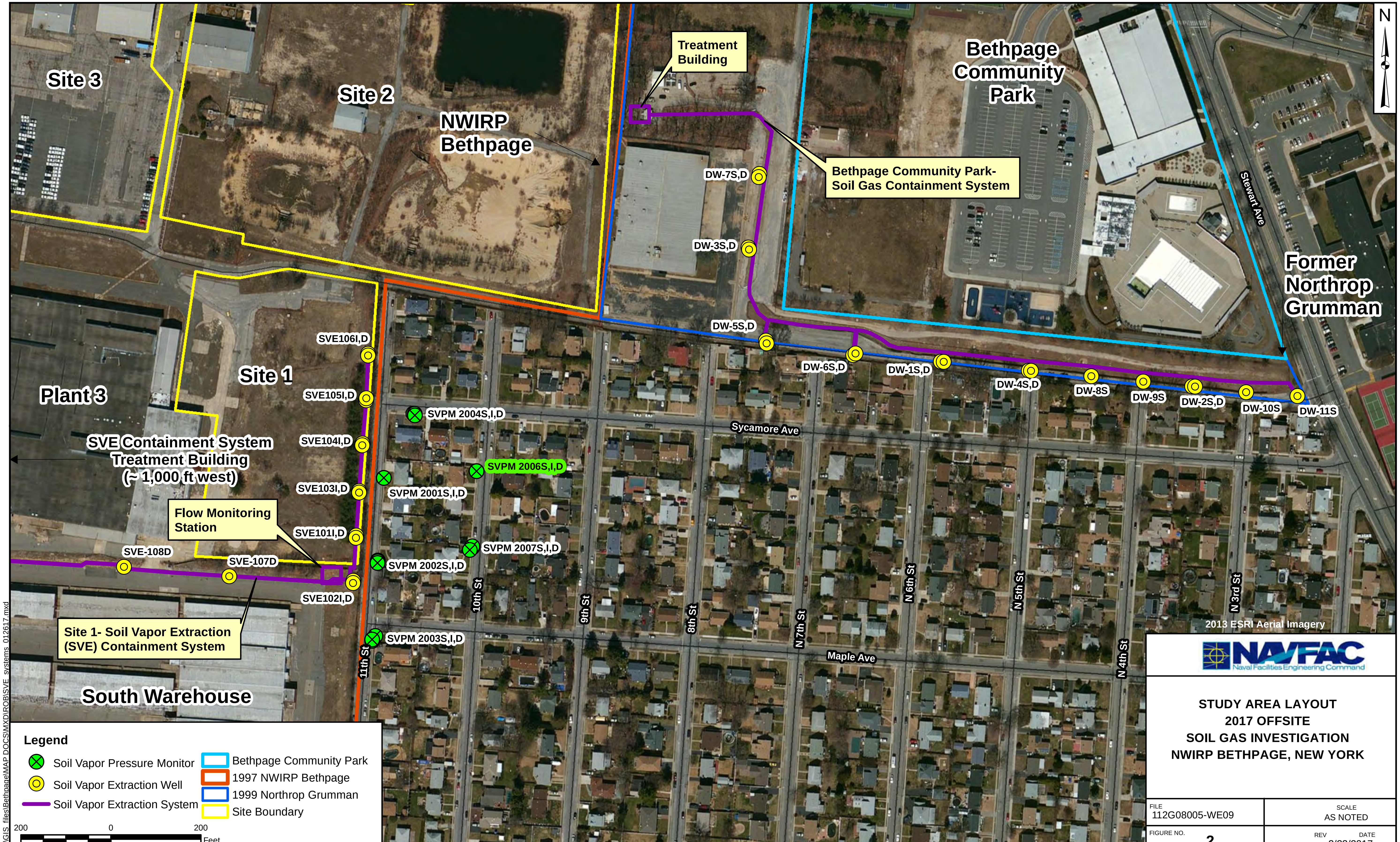

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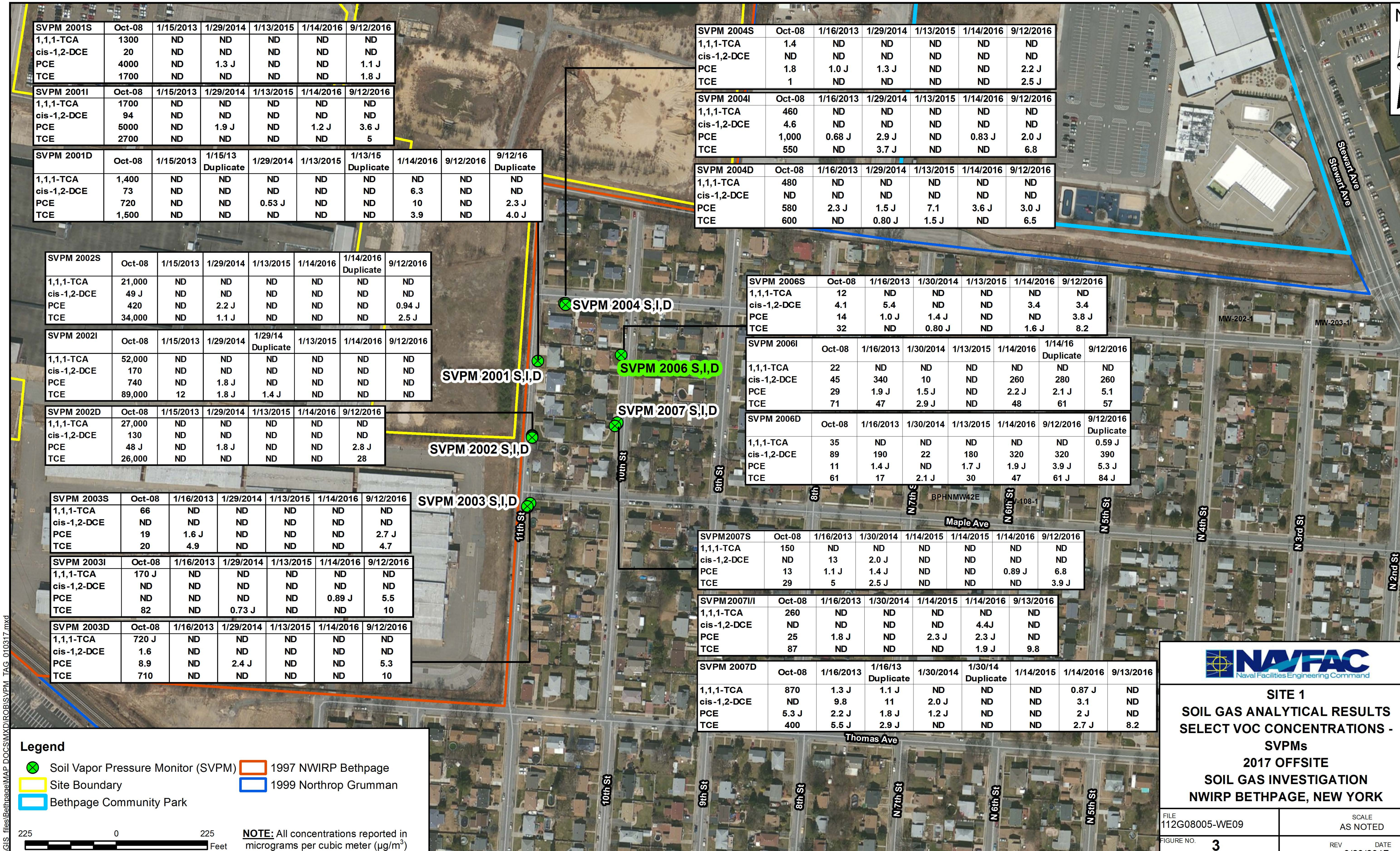


SVPM 2001S	Oct-08	1/15/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	1300	ND	ND	ND	ND	ND
cis-1,2-DCE	20	ND	ND	ND	ND	ND
PCE	4000	ND	1.3 J	ND	ND	1.1 J
TCE	1700	ND	ND	ND	ND	1.8 J

SVPM 2001I	Oct-08	1/15/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	1700	ND	ND	ND	ND	ND
cis-1,2-DCE	94	ND	ND	ND	ND	ND
PCE	5000	ND	1.9 J	ND	1.2 J	3.6 J
TCE	2700	ND	ND	ND	ND	5

SVPM 2001D	Oct-08	1/15/2013	1/15/13 Duplicate	1/29/2014	1/13/2015	1/13/15 Duplicate	1/14/2016	9/12/2016	9/12/16 Duplicate
1,1,1-TCA	1,400	ND	ND	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	73	ND	ND	ND	ND	ND	6.3	ND	ND
PCE	720	ND	ND	0.53 J	ND	ND	10	ND	2.3 J
TCE	1,500	ND	ND	ND	ND	ND	3.9	ND	4.0 J

SVPM 2002S	Oct-08	1/15/2013	1/29/2014	1/13/2015	1/14/2016	1/14/2016 Duplicate	9/12/2016
1,1,1-TCA	21,000	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	49 J	ND	ND	ND	ND	ND	ND
PCE	420	ND	2.2 J	ND	ND	ND	0.94 J
TCE	34,000	ND	1.1 J	ND	ND	ND	2.5 J

SVPM 2002I	Oct-08	1/15/2013	1/29/2014	1/29/14 Duplicate	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	52,000	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	170	ND	ND	ND	ND	ND	ND
PCE	740	ND	1.8 J	ND	ND	ND	ND
TCE	89,000	12	1.8 J	1.4 J	ND	ND	ND

SVPM 2002D	Oct-08	1/15/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	27,000	ND	ND	ND	ND	ND
cis-1,2-DCE	130	ND	ND	ND	ND	ND
PCE	48 J	ND	1.8 J	ND	ND	2.8 J
TCE	26,000	ND	ND	ND	ND	28

SVPM 2003S	Oct-08	1/16/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	66	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	ND	ND	ND	ND	ND
PCE	19	1.6 J	ND	ND	ND	2.7 J
TCE	20	4.9	ND	ND	ND	4.7

SVPM 2003I	Oct-08	1/16/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	170 J	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	ND	ND	ND	ND	ND
PCE	ND	ND	ND	ND	0.89 J	5.5
TCE	82	ND	0.73 J	ND	ND	10

SVPM 2003D	Oct-08	1/16/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	720 J	ND	ND	ND	ND	ND
cis-1,2-DCE	1.6	ND	ND	ND	ND	ND
PCE	8.9	ND	2.4 J	ND	ND	5.3
TCE	710	ND	ND	ND	ND	10

SVPM 2004S	Oct-08	1/16/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	1.4	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	ND	ND	ND	ND	ND
PCE	1.8	1.0 J	1.3 J	ND	ND	2.2 J
TCE	1	ND	ND	ND	ND	2.5 J

SVPM 2004I	Oct-08	1/16/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	460	ND	ND	ND	ND	ND
cis-1,2-DCE	4.6	ND	ND	ND	ND	ND
PCE	1,000	0.68 J	2.9 J	ND	0.83 J	2.0 J
TCE	550	ND	3.7 J	ND	ND	6.8

SVPM 2004D	Oct-08	1/16/2013	1/29/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	480	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	ND	ND	ND	ND	ND
PCE	580	2.3 J	1.5 J	7.1	3.6 J	3.0 J
TCE	600	ND	0.80 J	1.5 J	ND	6.5

SVPM 2006S	Oct-08	1/16/2013	1/30/2014	1/13/2015	1/14/2016	9/12/2016
1,1,1-TCA	12	ND	ND	ND	ND	ND
cis-1,2-DCE	4.1	5.4	ND	ND	3.4	3.4
PCE	14	1.0 J	1.4 J	ND	ND	3.8 J
TCE	32	ND	0.80 J	ND	1.6 J	8.2

SVPM 2006I	Oct-08	1/16/2013	1/30/2014	1/13/2015	1/14/2016	1/14/16 Duplicate	9/12/2016
1,1,1-TCA	22	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	45	340	10	ND	260	280	260
PCE	29	1.9 J	1.5 J	ND	2.2 J	2.1 J	5.1
TCE	71	47	2.9 J	ND	48	61	57

SVPM 2006D	Oct-08	1/16/2013	1/30/2014	1/13/2015	1/14/2016	9/12/2016	9/12/2016 Duplicate
1,1,1-TCA	35	ND	ND	ND	ND	ND	0.59 J
cis-1,2-DCE	89	190	22	180	320	320	390
PCE	11	1.4 J	ND	1.7 J	1.9 J	3.9 J	5.3 J
TCE	61	17	2.1 J	30	47	61 J	84 J

SVPM2007S	Oct-08	1/16/2013	1/30/2014	1/14/2015	1/14/2015	1/14/2016	9/12/2016
1,1,1-TCA	150	ND	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	13	2.0 J	ND	ND	ND	ND
PCE	13	1.1 J	1.4 J	ND	ND	0.89 J	6.8
TCE	29	5	2.5 J	ND	ND	ND	3.9 J

SVPM2007I/I	Oct-08	1/16/2013	1/30/2014	1/14/2015	1/14/2016	9/13/2016
1,1,1-TCA	260	ND	ND	ND	ND	ND
cis-1,2-DCE	ND	ND	ND	ND	4.4J	ND
PCE	25	1.8 J	ND	2.3 J	2.3 J	ND
TCE	87	ND	ND	ND	1.9 J	9.8

SVPM 2007D	Oct-08	1/16/2013	1/16/13 Duplicate	1/30/2014	1/30/14 Duplicate	1/14/2015	1/14/2016	9/13/2016
1,1,1-TCA	870	1.3 J	1.1 J	ND	ND	ND	0.87 J	ND
cis-1,2-DCE	ND	9.8	11	2.0 J	ND	ND	3.1	ND
PCE	5.3 J	2.2 J	1.8 J	1.2 J	ND	ND	2 J	ND
TCE	400	5.5 J	2.9 J	ND	ND	ND	2.7 J	8.2

Legend

- Soil Vapor Pressure Monitor (SVPM)
- Site Boundary
- Bethpage Community Park
- 1997 NWIRP Bethpage
- 1999 Northrop Grumman

225 0 225 Feet

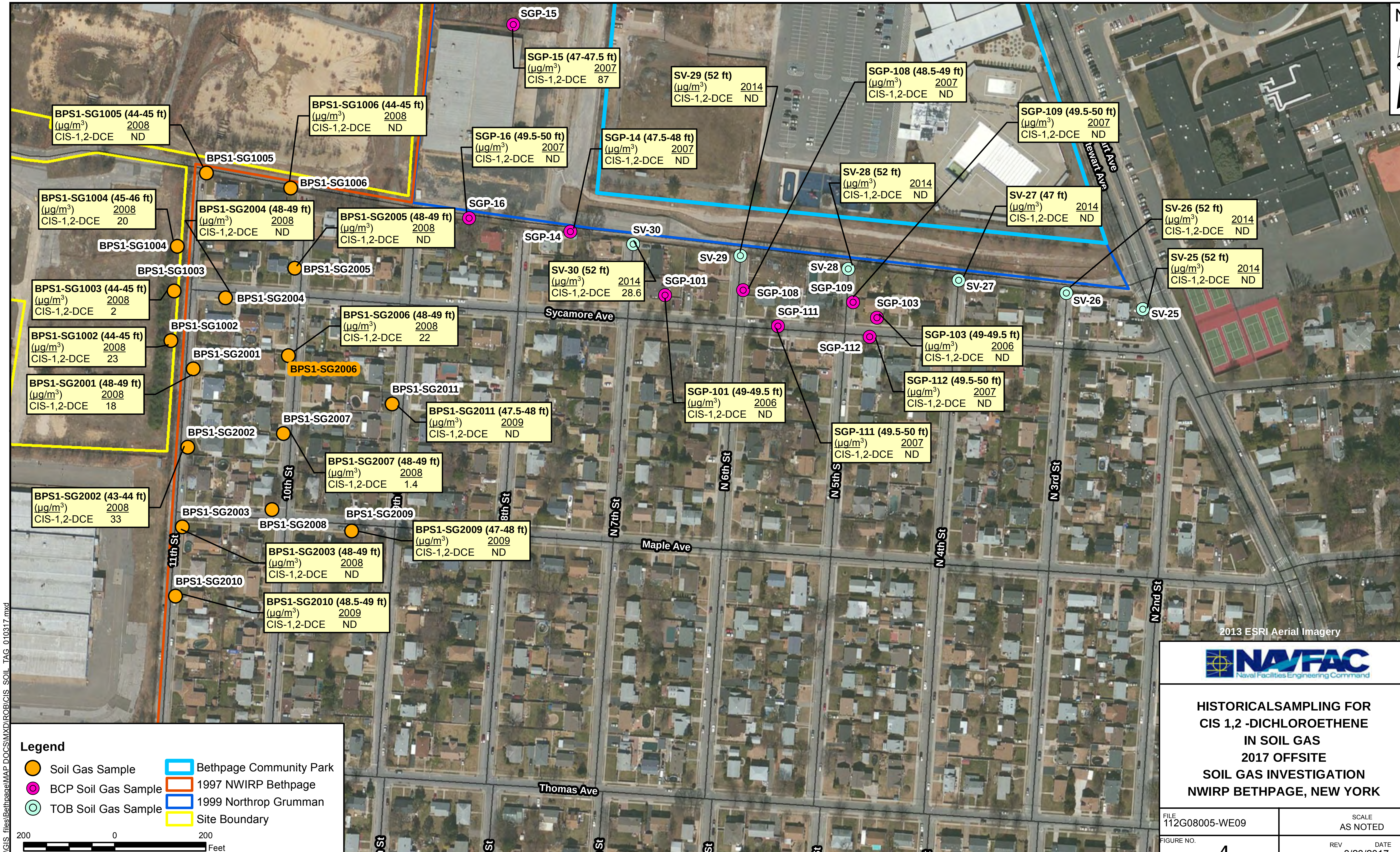
NOTE: All concentrations reported in micrograms per cubic meter ($\mu g/m^3$)

NAVFAC Naval Facilities Engineering Command

SITE 1
SOIL GAS ANALYTICAL RESULTS
SELECT VOC CONCENTRATIONS - SVPMs
2017 OFFSITE
SOIL GAS INVESTIGATION
NWIRP BETHPAGE, NEW YORK

FILE 112G08005-WE09	SCALE AS NOTED
FIGURE NO. 3	REV DATE 3/23/2017

P:\GIS_files\Bethpage\MAP DOCS\MXD\ROB\SVPM_TAG_010317.mxd



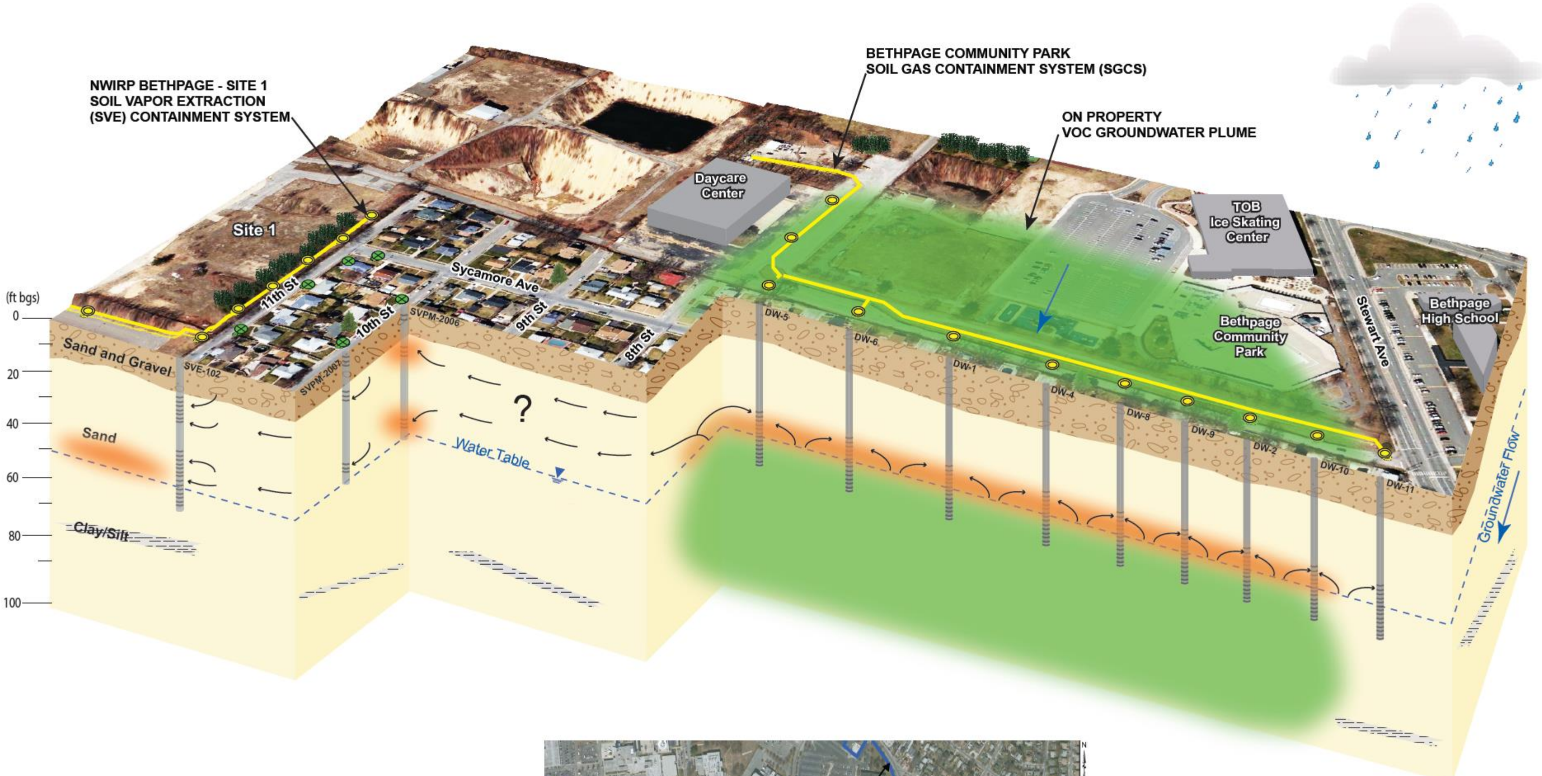
HISTORICALSAMPLING FOR
CIS 1,2 -DICHLOROETHENE
IN SOIL GAS
2017 OFFSITE
SOIL GAS INVESTIGATION
NWIRP BETHPAGE, NEW YORK

FILE 112G08005-WE09 | SCALE AS NOTED
FIGURE NO. 4 | REV | DATE 3/23/2017

NAVFAC Naval Facilities Engineering Command

HISTORICAL SAMPLING FOR CIS 1,2 -DICHLOROETHENE AND TRICHLOROETHENE IN GROUNDWATER 2017 OFFSITE SOIL GAS INVESTIGATION NWIRP BETHPAGE, NEW YORK

FILE	SCALE
112G08005-WE09	AS NOTED
FIGURE NO. 5	REV DATE 3/23/2017



Legend

- SVPM Well
- SVE Well (Depressurization Well)
- SVE System Line
- Water Table
- Groundwater Flow
- Sand and Gravel
- Sand
- Clay Silt/Sandy Clay
- Bethpage Community Park (BCP) OU3 Plume
- Soil Vapor - CIS-1,2-DCE

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FIGURE 6
CONCEPTUAL SITE MODEL
2017 OFFSITE
SOILGAS INVESTIGATION
BETHPAGE, NEW YORK

FILE	SCALE
112G08005-WE09	NOT TO SCALE
	DATE 1/31/2017

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PROPOSED SOIL GAS SAMPLE LOCATIONS 2017 OFFSITE SOIL GAS INVESTIGATION NWIRP BETHPAGE, NEW YORK

FILE 112G08005-WE09	SCALE AS NOTED
FIGURE NO. 7	REV / DATE 3/23/2017

ATTACHMENT A

TARGET COMPOUND LIST
(VOCs: TO-15 ANALYTE LIST)

ATTACHMENT A
SOIL GAS TARGET ANALYTE LIST
2017 OFFSITE SOIL GAS INVESTIGATION
NWIRP BETHPAGE, NEW YORK

Chemical Abstracts Service (CAS) Number	Analyte	Target Detection Limit (µg/m^3)
71-55-6	1,1,1-Trichloroethane	<2
76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane [Freon-113]	<1
75-35-4	1,1-Dichloroethene	<2
75-34-3	1,1-Dichloroethane	<1
107-06-2	1,2-Dichloroethane	<1
78-93-3	2-Butanone [MEK]	<3
591-78-6	2-Hexanone	<2
71-43-2	Benzene	<1
75-15-0	Carbon disulfide	<1
56-23-5	Carbon tetrachloride	<1
108-90-7	Chlorobenzene	<1
75-45-6	Chlorodifluoromethane [Freon-22]	<1
75-00-3	Chloroethane	<2
67-66-3	Chloroform	<1
74-87-3	Chloromethane	<2
156-59-2	cis-1,2-Dichloroethene	<1
75-71-8	Dichlorodifluoromethane [Freon-12]	<1
100-41-4	Ethylbenzene	<1
179601-23-1	m/p-Xylene [3/4-Xylene]	<1
95-47-6	o-Xylene	<1
100-42-5	Styrene	<1
127-18-4	Tetrachloroethene	<1
108-88-3	Toluene	<1
156-60-5	trans-1,2-Dichloroethene	<2
79-01-6	Trichloroethene	<1
75-69-4	Trichlorofluoromethane [Freon-11]	<1
75-01-4	Vinyl chloride	<1

µg/m^3 micrograms per cubic meter.
1) Analyte list is based on volatile organic compounds detected in soil gas or groundwater at Naval Weapons Industrial Reserve Plant Bethpage Site 1 and Bethpage Community Park Area.

2) Laboratory detection limits will be <1 µg/m^3, except for the 7 compounds indicated above with detection limits at <2 and <3 µg/m^3.

3) Detection limits are estimated based on typical laboratory method detection limits. Actual detection limits achived will be presented in the soil gas investigation report.

ATTACHMENT B

SOIL GAS SAMPLING PROCEDURES

<u>Soil Gas Sampling Procedures</u>

Soil vapor or soil gas sampling procedures are specified below. Many of these sampling precautions are universally applicable in environmental sample collection as part of general safe work practices (see the site specific Health and Safety Plan [HASP] for additional details) and quality assurance work practices. Precautions are as follows:

- Sampling personnel should not handle hazardous substances (e.g., gasoline), permanent marking pens, or smoke before and/or during the sampling event.

- Sampling crew should also wear nitrile gloves when handling tubing, connectors or SUMMA® canisters to avoid potential cross-contamination.

- Care should also be taken to ensure that the flow controller is pre-calibrated by the supplying laboratory to the proper sample collection time (confirm with laboratory). Sample integrity is maintained if the sampling event is shorter than the target duration, sample integrity can be compromised if the event is extended to the point that the canister reaches atmospheric pressure. Sampling personnel should record vacuum pre- and post-sampling, post-sampling vacuum should not reach zero vacuum (2 inches of Hg is target).

- Care must be taken to maintain integrity of sampling tubing. Tubing exposed to contaminants can yield false-positive VOC concentrations (due to the low detection limits required). Consequently, do not store tubing near sources of possible contamination including fuels, solvents, exhaust, smoke, etc. Use new lengths of tubing for each sample and replace between samples.

- During helium gas tracer testing, use caution not to pressurize system, this may drive helium vapor down into soil gas sampling point (SGP).

- Equipment used for sampling and tracer gas testing should also be kept clean and stored in a manner to maintain fitness for use.

- If samples from multiple depths are to be collected at a given location, separate boreholes should be advanced for each sample to be collected. Continuous coring will be performed, as needed, to prevent smearing of the borehole walls. The shallowest sample will collected first to determine the sampling sequence. Sample boreholes should be separated by a minimum of 5 feet (field conditions may warrant slight modifications in borehole locations).

<u>Soil Gas Sampling</u>

<u>If a semi-permanent SGP is determined as necessary for investigation (i.e., more than one round of sampling is needed), then a different SGP installation and sampling methodology would be required.</u>

For temporary SGPs using a PRT system (or similar system), the following procedure should be followed:

1. Advance an assembly consisting of interconnected lengths of decontaminated 1.25-inch diameter steel drive rods, affixed with an expendable PRT system point holder and expendable PRT system point at the downhole end, to the bottom of the desired sampling interval.

2. When the desired sample depth is reached, retract the sampling assembly approximately 6 inches (or greater if necessary), allowing the expendable point to fall off, and creating a void in the subsurface for soil gas sample collection. Remove pull cap of probe rod and position direct push rig to allow collection of sample.

3. Fit PRT tubing with PRT adaptor, secure connection and fit PRT adaptor with O-ring.

4. Insert PRT tubing into steel drive rod. Work tubing to bottom of drive rod until contact with expendable point holder is made. Cut PRT tubing, leaving two feet of extra tubing outside of probe rod.

5. Grasp PRT tubing and apply downward pressure while rotating counterclockwise to engage threads with point holder. When threads are fully seated, pull up gently on tubing to test proper thread engagement.

6. Proceed with soil gas sample collection (With PRT system no bentonite sealing material is required; the system is airtight).

The following methodology should be followed for preparation of SUMMA® -Type canister and initiation of the collection of the sample:

1. Record the following information from the site; if necessary (contact the local airport or other suitable information source to obtain the information):

   a. Wind speed and direction;

   b. Ambient temperature;

   c. Barometric pressure; and

   d. Relative humidity.

2. Connect a short piece of tubing to the sampling port using a Swagelok® fitting.

3. Check the seal established around the soil gas probe by using a tracer gas (e.g., helium). Once the seal in integrity has been verified, additional trace gas testing may not be conducted.

The tracer gas procedures are as follows:

a. Punch a small hole in sheeting to accept sample port. Hole should be tight around port.

b. Place plastic sheeting on ground surrounding sample port.

c. Place clean bucket (open side to ground) over sample port.

d. Check seal with plastic sheeting, should be tight.

e. Seal bucket to plastic sheeting with clay sealing material.

f. Insert incoming helium line into pre-drilled hole in bucket.

g. Pull sample collection tube through pre-drilled hole in bucket.

h. Fill bucket with helium gas (use caution not to pressurize system, this may drive helium gas down into gas point)

4. Connect a portable vacuum pump to the sample tubing. Purge 1 to 2 (target 1.5) volumes of air from the gas point and sampling line using a portable pump [purge volume= 1.5 $\pi r^2 h$] at a rate of approximately 100 mL/min.

    a. After purging 1.5 volumes of air from the gas point, collect some of purge air in Tedlar bag for helium analysis.

    b. Check purged air for helium contamination with portable helium detector.

    c. Air purged from system must maintain <10% helium.

5. If seal around sampling port appears adequate based on helium test, remove the brass plug from the SUMMA® canister and connect the flow controller with in-line particulate filter and vacuum gauge to the SUMMA® canister. Do not open the valve on the SUMMA® canister yet. Record the flow controller number with the appropriate SUMMA® canister number in the field notebook and sampling log sheets.

    a. If seal is not adequate, troubleshoot for leaks and re-test using helium tracer gas.

    b. Do not take sample until tracer gas requirements are met (<10% helium in purged air).

6. Connect the clean sample collection tubing to the flow controller and the SUMMA® canister valve. Record in the field notebook the time sampling began and the canister vacuum.

7. If required, collect duplicate sample by attaching second SUMMA® canister with stainless steel '"T" fitting.

8. Connect the unoccupied end of the tubing to the tubing protruding from subsurface sampling port.

9. Open the SUMMA® canister valve and collect sample.

10. Photograph the SUMMA® canister, capturing the sample ID if possible. Also photograph canister and surrounding area, capture any available landmarks for future use in photographic logs (e.g. buildings, roads, etc).

The following methodology should be followed for completion of SUMMA®-Type sampling:

1. Arrive at the SUMMA® canister location at least 10 to 15 minutes prior to the end of the required sampling interval (e.g., 30 to 60 minutes).

2. Record the final vacuum measurement. Close the valve on the SUMMA® canister to cease sample collection. The canister should have a minimum amount of vacuum (approximately 2 inches of Hg or slightly greater).

3. Record the date and local time of valve closing in the field notebook, Soil Gas Sample Collection Log, and COC.

4. Remove the particulate filter and flow controller from the SUMMA® canister, re-install the brass plug on the canister fitting, and tighten with the appropriate wrench.

5. Package the canister and flow controller in the shipping container supplied by the laboratory for return shipment to the laboratory. The SUMMA® canister does not require preservation with ice or refrigeration during shipment. Apply custody seals if required by field sampling plan.

6. Complete the appropriate forms and sample labels as directed by the laboratory.

7. Ship the container to the laboratory (via overnight carrier [e.g., Federal Express]) for analysis. Once the soil gas sample has been collected, the temporary gas points will be abandoned by removing the drive rods, and filling the resulting hole with clean sand.

Ambient air samples should be collected simultaneously during soil gas sampling. These samples are positioned upwind and near the associated SGP at a height of 4 feet above grade. The ambient air sample will be collected via SUMMA® canister and obtained over an eight-hour time period for each day of sampling.

ATTACHMENT C

SOIL GAS SAMPLING LOG SHEET

SOIL GAS SAMPLING LOG SHEET

Project Site Name:	NWIRP Bethpage Site 1	**Sample ID No.:**	
Project/CTO No.:		**Sample Location:**	
Company:		**Sampled By:**	

SAMPLING DATA:

	Wind speed (Visual)	Wind Direction (estimated)	Ambient temperature (°F)	Barometric Pressure (in.)	Relative Humidity (%)	Weather Description
Date:						
Time:						
Container Type:						

		Duplicate Sample (if collected)			
Canister #		**Canister #**			
Filter Type/Flow		**Filter Type/Flow**			
Start Time Vacuum		in Hg			in Hg
End Time Vacuum		in Hg			in Hg

Purge Data (Time)	Flow Rate (mL/minute)	Total volume	PID Reading (ppm)	Helium Reading (ppm)	Comments/Observations

Notes: