SITE 1 -

Former Drum Marshalling Area

Phase II Soil Vapor Testing

Conceptual Site Model (CSM) and

Data Quality Objectives (DQO) –

NWIRP BETHPAGE

Bethpage, New York

Naval Facilities Engineering Command
Mid-Atlantic

Contract No. N62472-03-D-0057
Contract Task Order 147

August 2008

SITE 1 - FORMER DRUM MARSHALLING AREA

Introduction

The NWIRP-Bethpage was established in 1933 (Figure 1). Since its inception, the plant's primary mission has been 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 1998, operations ended at the facilities.

Site 1 is located in the middle third of the NWIRP Bethpage facility and is east of Plant No. 3, see Figure 2. The Site occupies approximately four acres, and contains a concrete storage pad and an abandoned cesspool leach field. Historically, this site was also used as a storage area for various types of equipment and heavy materials, including transformers. Site 1 is enclosed by a six-foot high, chain-link fence. The site is relatively flat, with the eastern portion covered with sandy soils, gravel, grass, and one concrete pad. The western portion of the site is predominantly covered with concrete. A vegetated wind row (pine) and wood fence are present along the eastern edge of the site to reduce community visibility.

Conceptual Site Model (CSM)

Site 1 (Former Drum Marshalling Area) was first identified as a potential source of contamination in an Initial Assessment Study (IAS) in 1986 and contamination was confirmed by a Remedial Investigation (RI) in the early 1990s. Site 1 originally consisted of two former drum marshalling pads that were used to store drums containing waste materials from operations at Plant No. 3 and potentially other sources at the facility. The waste drums reportedly contained chlorinated and non-chlorinated solvents, and liquid cadmium and chromium wastes. In addition, underlying most of Site 1 is approximately 120 abandoned cesspools that were designed to discharge sanitary waste waters from Plant No. 3. These cesspools were approximately 10 feet in diameter and 16 feet deep. Based on field observations, the cesspools are currently filled with soil. It is possible that non-sanitary wastes may have been discharged through this system. In 2005, due of proximity and similar nature of contamination, adjacent areas of concern consisting of the Drywell/AOC 34-07, Drywell/AOC 20-08, AOC 23 – Former Aboveground Storage Tanks, AOC 30 – Storage Sheds, and AOC 35 – Former Sludge Drying Beds were combined with Site 1 for investigative purposes.

The subsurface geology in the investigative area consists of the Upper Glacial Formation and the underlying Magothy Formation. The Upper Glacial Formation consists of mainly coarse sands and gravels and ranges from 30 to 45 feet thick. The Magothy Formation consists of alternating sequences and varying percentages of sand, silts, and clays. Generally, grain size decreases with depth in this formation and distinct clay units have been observed during historical investigations. These clay units have been found to be laterally discontinuous in their distribution.

Groundwater has been encountered below the investigative area in the Magothy Formation and previous investigations have indicated that depth to groundwater in the area is approximately 50 feet bgs. Groundwater flow direction was determined to generally be to the south/southeast and horizontal hydraulic conductivity has been estimated at 100 ft/day in the Magothy Formation. Hydraulic gradient across the area are typically low and have been estimated at 0.001 ft/ft.

Historical investigations have delineated sources of volatile organic compound (VOC) contamination in soil and groundwater. The investigations have shown the historical extent of shallow groundwater contamination to exist approximately 100 feet east of the eastern boundary of Site 1. Soil and groundwater remediation of VOCs via the AS/SVE system between 1998 and 2002 reduced VOC concentrations in groundwater by more than 99 percent. Remedial goals were based on protection of groundwater and minimization of solvent emissions during subsequent soil removal action. The residual VOCs are in line with the remedial goals. However, the remedial goals did not consider possible soil vapor migration to the adjacent residential neighborhood. With the possible exception of soil vapor migration, Site 1 does not present a current risk to human health or the environment.

In 2006, the New York State Department of Health (NYSDOH) finalized guidance that identified soil vapor migration from contaminated soils and groundwater to indoor air quality as a potential exposure route. The 1995 ROD did not identify this pathway as a potential concern. In January 2008, the Navy collected soil gas samples at the facility fence line, approximately 70 feet from residential housing. Samples were collected at depths of approximately 8, 20, and 45 feet below ground surface (bgs) (Figure 3). Data is presented in a draft report (TtNUS, 2008) and documents findings of TCE at concentrations up to 19,000 micrograms per cubic meter of soil gas ($\mu g/m^3$) at 7 feet bgs, 180,000 $\mu g/m^3$ at 20 feet bgs, and 150,000 $\mu g/m^3$ at 50 feet bgs. For comparison, NYSDOH Indoor Air Quality Criteria for TCE is 5 $\mu g/m^3$ and sub slab guidance for action is 250 $\mu g/m^3$. Based on distance from the site to the residential housing, lower concentrations of TCE would be expected under the housing area. Other VOCs, including PCE and 1,1,1-TCA, were also detected at concentrations up to 90,000 $\mu g/m^3$ in the soil gas samples.

Given the AS/SVE remediation of VOCs in the soil and groundwater at Site 1 and the results of the recent soil vapor testing at the site, it is likely that residual VOCs are present in fine grained material at the site and may migrate via soil vapor diffusion in the unsaturated portion of subsurface soils. The recent soil vapor testing also suggests that soil vapor migration from Site 1 could potentially be impacting the adjacent residential area. Further evaluation and delineation of VOC contaminated soil vapor is needed to determine whether there is a potential vapor migration pathway. The attached Figure 4 presents the proposed Phase II soil vapor sampling locations. Figure 5 provides a graphical representation of the conceptual site model.

Data Quality Objectives (DQO)

DQOs are qualitative and quantitative statements, developed using the DQO Process, that clarify study objectives, define the appropriate type of data, and specify tolerable levels of potential decision errors that will be used as a basis for establishing the quality and quantity of data needed to support the decisions. DQOs define the performance criteria that limit the probabilities of making decision errors by considering the purpose of collecting data; defining the appropriate type of data needed; and specifying tolerable probabilities of making decision errors. The seven-step DQO process is as follows:

Step 1 - State the Problem
Step 2 - Identify the Goal of the Study
Step 3 - Identify Information Inputs
Step 4 - Define the Boundaries of the Study
Step 5 - Develop the Analytical Approach
Step 6 - Specify Performance and Acceptance Criteria
Step 7 – Develop the Plan for Obtaining Data

Step 1

Step 1 of the DQO Process is where the problem is described and a conceptual model for the site is developed (CSM presented above).

Site 1 (Former Drum Marshalling Area) has been identified as a possible source of soil vapor contamination that could be potentially impacting the residential area east and southeast of the site. Soil gas results collected in January 2008 indicated elevated levels of soil gas along the eastern property boundary (Figure 3). Site history and background information along with the conceptual site model (Figure 5) are presented above.

Step 2

Step 2 of the DQO Process should identify study questions and objectives of the investigation and define alternative actions.

The primary objectives of the phase II soil vapor testing at Site 1 are to evaluate and delineate the extent of VOC contaminated soil vapor, and if necessary, determine which residential homes may be considered for indoor air and sub-slab air sampling.

Step 3

Step 3 of the DQO Process should identify the data and information needed to answer the study questions and meet the goals of the project.

Additional soil gas sampling in the residential area to the east and southeast of Site 1 is needed to evaluate and delineate the extent of VOC contaminated soil vapor offsite. Delineation of the extent of VOC contaminated soil gas is needed to establish the area of concern and also determine which homes, if any, be considered for indoor air and sub-slab air sampling.

Step 4

Step 4 of the DQO Process should define the target population, determine the spatial limits of the study area, and define the scale of inference.

Figure 4 shows the proposed soil vapor testing that will be conducted east and southeast of Site 1. Proposed soil vapor testing in the southeastern direction is based on historical groundwater flow direction. Initially eight soil vapor monitoring locations will be installed and sampled. Based on the results, up to eight additional soil vapor monitoring locations (several locations presented on Figure 4) may be installed to delineate the extent of VOC contaminated soil vapor.

Step 5

Step 5 of the DQO Process should define the parameters of interest, specify the type of inference, and develop the logic for drawing conclusions from findings.

As presented in the work plan, Table 4 designates the targeted list of VOCs in soil gas derived from the soil gas sampling conducted in January 2008 [including 1,1-dichloroethene, 1,1-dichloroethane, chloroform, cis-1,2-dichloroethene, 1,1,1-trichloroethane, benzene, tetrachloroethene (PCE), and trichloroethene (TCE)]. Each of these chemicals are associated with the site. The proposed screening level for each of these compounds is also presented on Table 4. The proposed screening levels are based on the most recent EPA Regional Screening Levels for residential air (July, 2008). For the non-carcinogenic compounds, the direct residential air screening levels will be used and for carcinogenic compounds, risk levels of $1x10^{-4}$ to $1x10^{-6}$ was used to calculate the proposed soil vapor screening levels/ranges presented on Table 4. Direct air guidelines developed by the NYSDOH for PCE and TCE are being used for these compounds. Regional residential air levels are calculated for direct exposure, therefore the proposed soil vapor screening levels/ranges would be reasonable and conservative risk based values for screening soil vapor results collected during this investigation.

Initial soil vapor sampling results from the initial round of sampling (24 soil gas monitoring points) will be compared to the proposed screening levels and up to 24 additional soil vapor monitoring points may be installed as necessary to delineate extent of contamination.

Step 6

Step 6 of the DQO Process should determine the probability limits for false rejection and false acceptance decision errors, and develop the performance criteria for the new data being collected or acceptable criteria for existing data being considered for use.

The initial soil vapor testing will consist of 8 locations with a total of 24 soil vapor samples at depths of approximately 8, 20, and 50 feet below ground surface (bgs) at each location. Laboratory results will be compared to the proposed screening levels and sample results that exceed the screening criteria will determine where it is necessary to step out into the residential neighborhood to install up to 8 locations with 24 additional soil vapor monitoring points. These additional soil vapor monitoring points may be used to further delineate extent of VOC contaminated soil vapor to determine which residential homes may be considered for indoor air or sub-slab air sampling.

Step 7

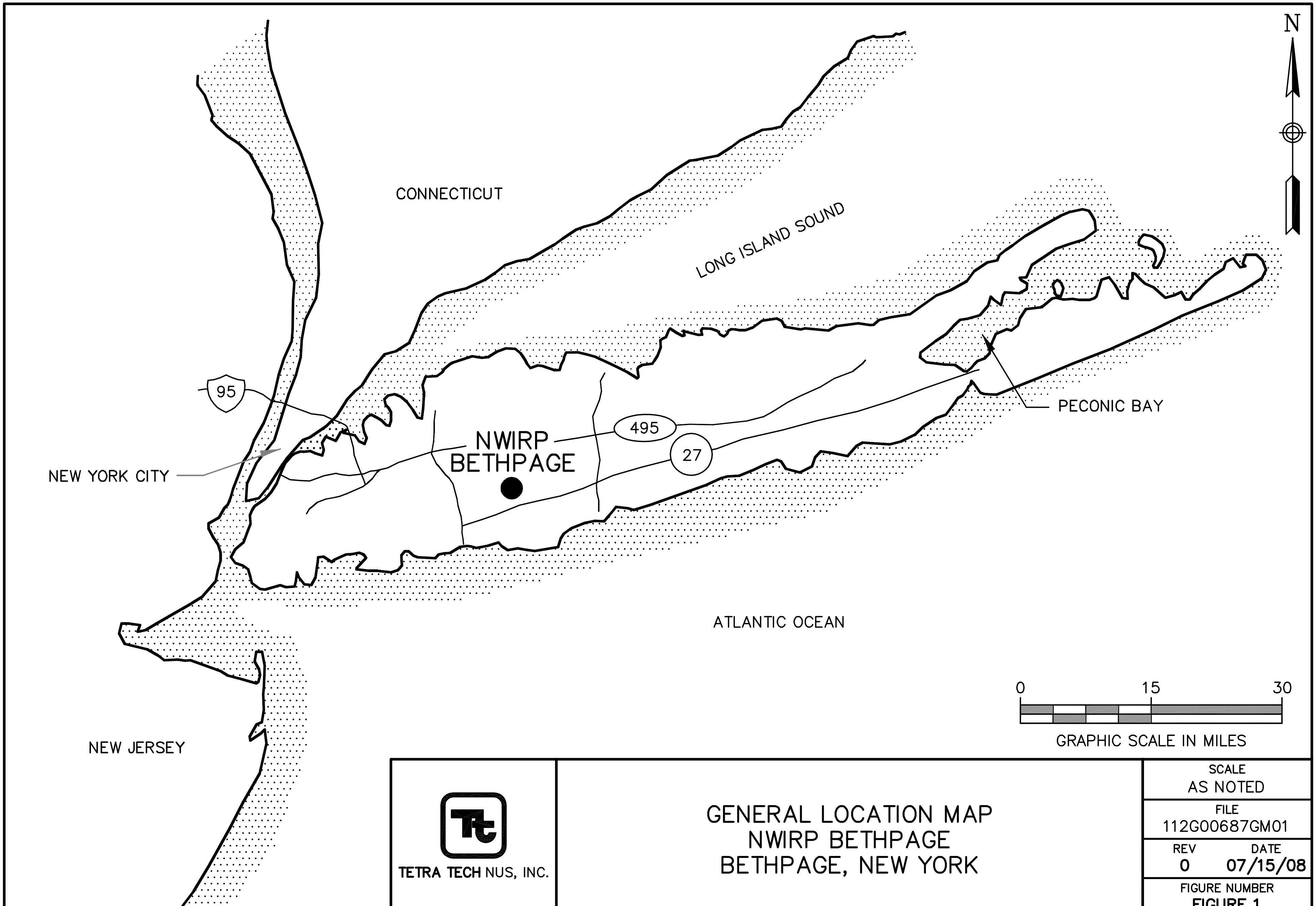
Step 7 of the DQO Process is for developing the plan for obtaining data and selection of the most resource-effective data collection system.

Soil vapor samples will be collected via temporary soil vapor monitoring points installed with direct-push technology. Prior to installing the soil vapor monitoring points, subsurface lithology will be determined at each of the locations by advancing macrocores down to approximately 50 feet bgs. Actual depths for installing the soil vapor monitoring points will be determined in the field based on lithological units observed in the subsurface. Each soil gas sample will be analyzed according to EPA Method TO-15 by an ELAP certified laboratory. One field blank will also be collected for each day of soil vapor testing. Attachment B and C in the work plans provide the TO-15 analyte list and actual sampling procedures to be used during the investigation. The sampling method and procedures will follow the Guidance for Evaluating Soil

Vapor Intrusion in the State of New York (October 2006) prepared by the New York Department of Health.

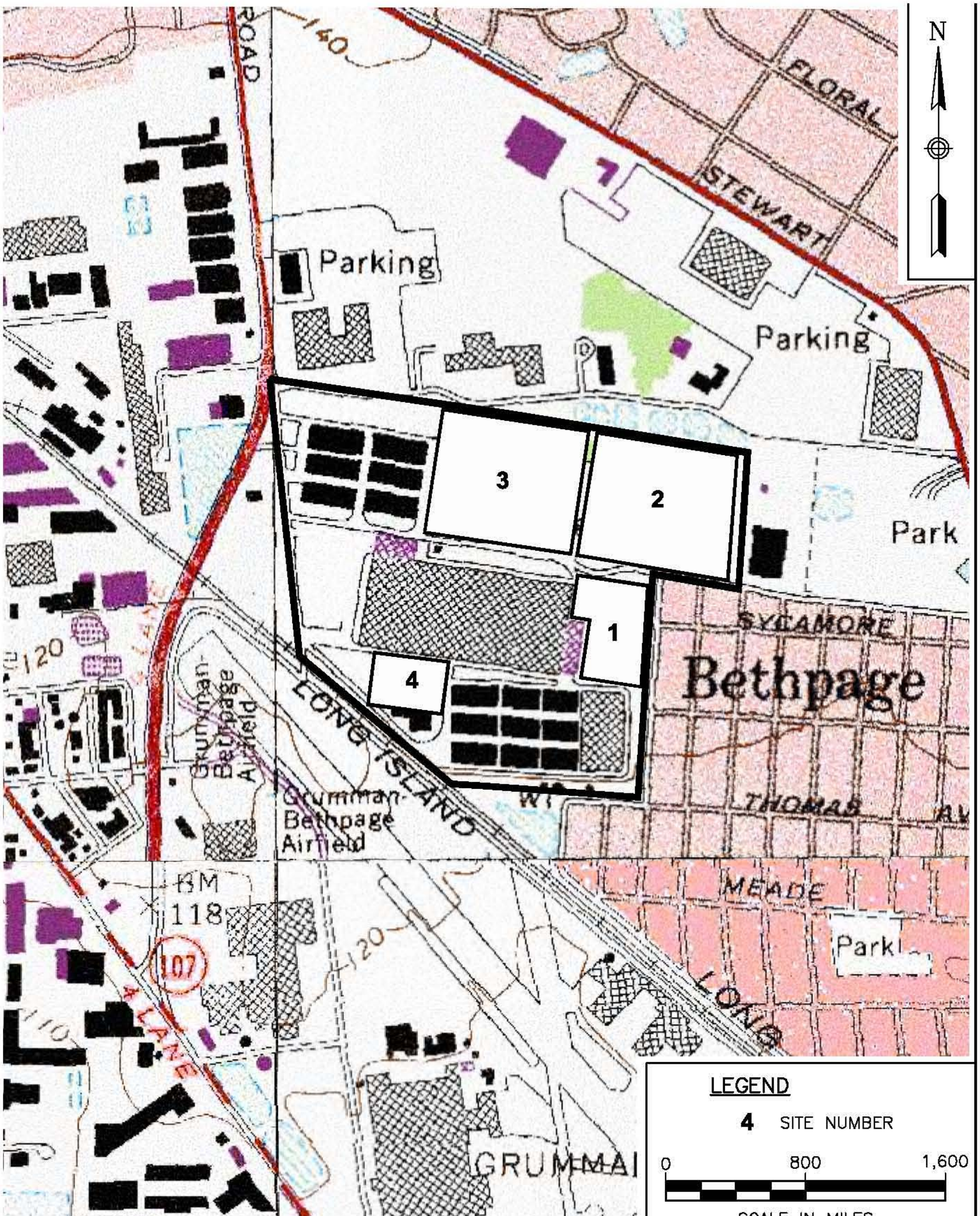
FIGURES

112G00687/0210/112G00687GM02.DWG 07/15/08 MKB



TETRA TECH NUS, INC.	GENERAL LOCATION MAP NWIRP BETHPAGE BETHPAGE, NEW YORK	SCALE AS NOTED FILE 112G00687GM01 REV 0 DATE 07/15/08 FIGURE NUMBER **FIGURE 1**

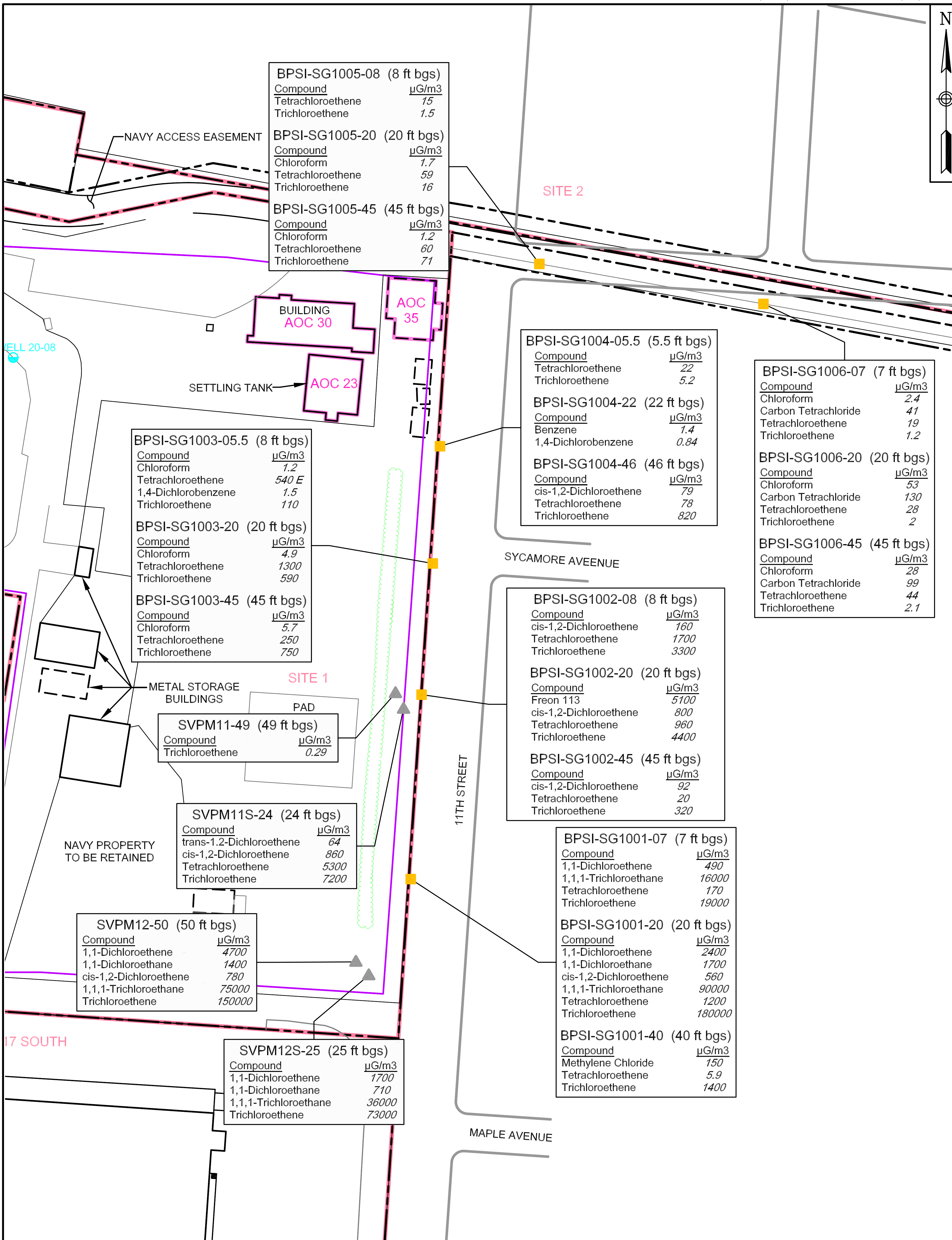
112G00687/0210/112G00687BM01.DWG 07/15/08 MKB



TETRA TECHNUS, INC.

SITE LOCATION MAP
SITE 1
NWIRP BETHPAGE
BETHPAGE, NEW YORK

SCALE	AS NOTED
FILE	112G00687BM01
REV	0
DATE	07/15/08
FIGURE NUMBER	FIGURE 2



LEGEND

- DRY WELL
- SOIL GAS SAMPLE LOCATION
- SOIL VAPR PRESSURE MONITOR
- PROPERTY LINE
- FENCE LINE
- SITE BOUNDARY
- AOC BOUNDARY

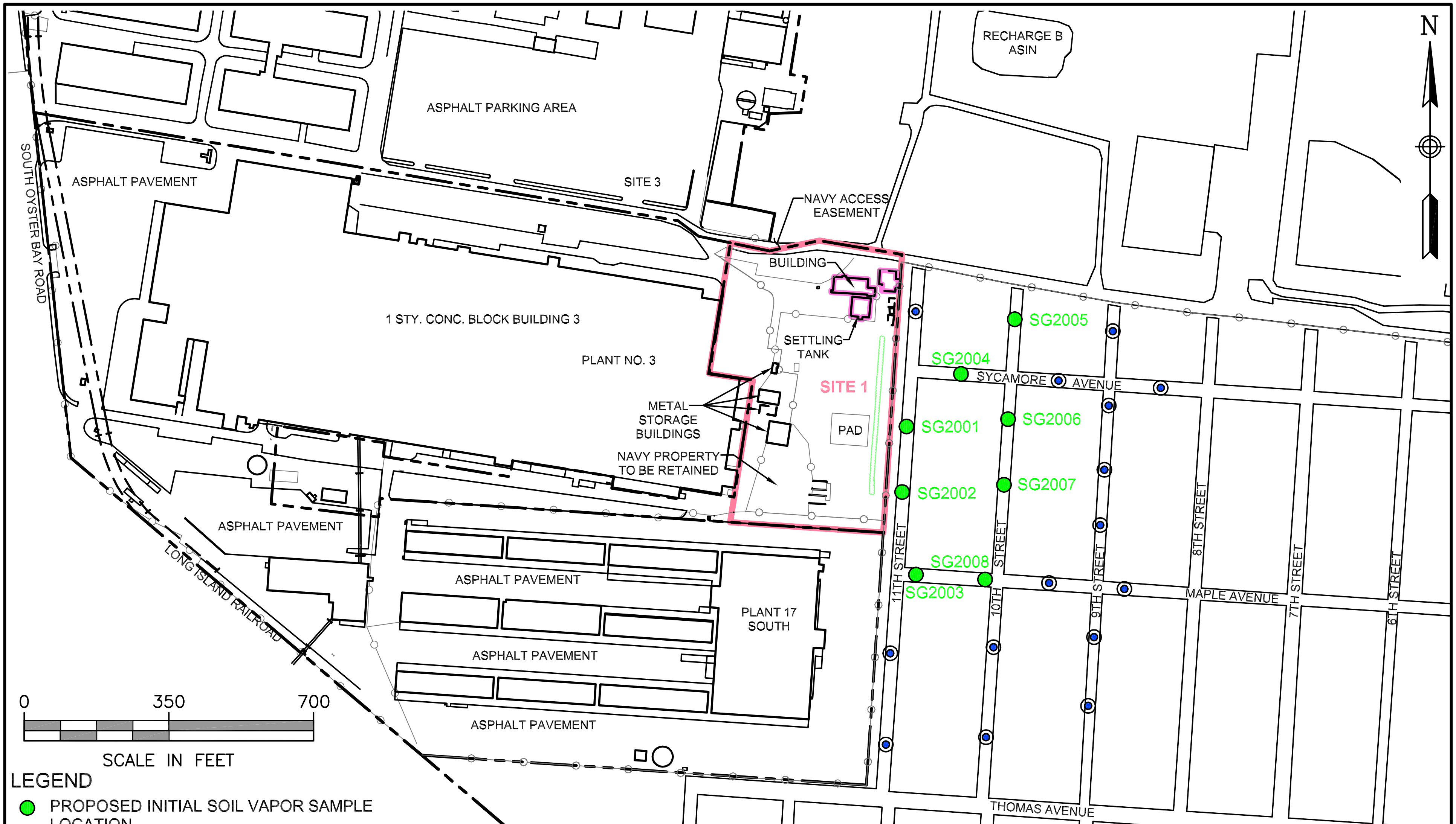
NOTE:
FIGURE PRESENTS VOLATILE ORGANIC COMPOUNDS THAT EXCEED EPA REGION 3 RBCs FOR INDOOR AIR. FOR COMPARISON, NEW YORK STATE DEPARTMENT OF HEALTH INDOOR AIR CRITERIA FOR TCE AND PCE ARE 5 µg/m³ AND 100 µg/m³ RESPECTIVELY.

0 80 160
SCALE IN FEET

TETRA TECH NUS, INC.

SOIL GAS RESULTS – JANUARY 2008
SITE 1
NWIRP BETHPAGE
BETHPAGE, NEW YORK

FILE	SCALE
112GN9845GM01	AS NOTED
FIGURE NUMBER: FIGURE 3	REV: 0 DATE: 07/22/08



LEGEND

- PROPOSED INITIAL SOIL VAPOR SAMPLE LOCATION
- PROPOSED OPTIONAL - SOIL VAPOR SAMPLE LOCATION

NOTE

Proposed soil vapor sampling locations are to be placed in grass strips between the sidewalk and street were applicable. Locations shown are approximate and actual locations will be placed based on field conditions (i.e. aboveground and underground utilities).

TETRA TECH NUS, INC.

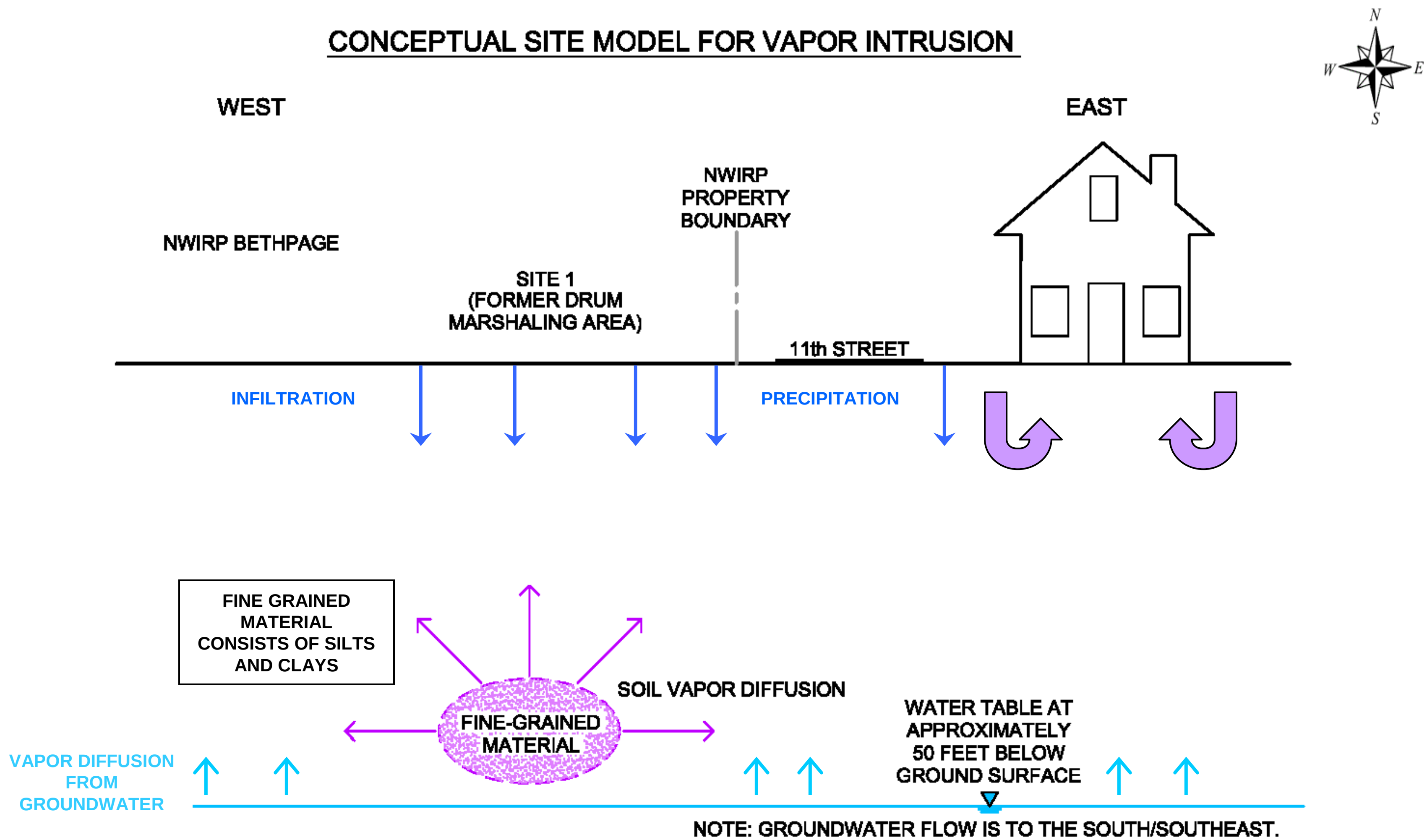
SOIL VAPOR SAMPLING LOCATIONS
SITE 1
NWIRP BETHPAGE
BETHPAGE, NEW YORK

SCALE: AS NOTED

FILE: 112G00687GM01

REV: 0 DATE: 07/22/08

FIGURE NUMBER: FIGURE 4



TETRA TECH

Project No. 112G01687

FIGURE 5:
CONCEPTUAL SITE MODEL
Site 1
CTO – 147
NWIRP Bethpage
Bethpage, New York

Legend:

- VAPOR DIFFUSION FROM GROUNDWATER
- PRECIPITATION
- INFERRED VAPOR MIGRATION BENEATH HOMES
- SOIL VAPOR DIFFUSION