Well Installation Work Plan

for

Arrowwood Housing Sites
Naval Submarine Base New London
Groton, Connecticut

Naval Facilities Engineering Command
Mid-Atlantic

Contract Number N62467-04-D-0055
Contract Task Order 426

November 2007

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WELL INSTALLATION WORK PLAN

for

ARROWWOOD HOUSING SITES
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION - NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260
King of Prussia, Pennsylvania 19406

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PREPARED UNDER THE DIRECTION OF:

STEPHEN A. VETERE, P.E.
PROJECT MANAGER
TETRA TECH NUS, INC.
WILMINGTON, MASSACHUSETTS

APPROVED FOR SUBMISSION BY:

JOHN J. TREPANOWSKI, P.E.
PROGRAM MANAGER
TETRA TECH NUS, INC.
KING OF PRUSSIA, PENNSYLVANIA

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1.0 PROJECT INTRODUCTION

This Well Installation Work Plan was prepared under the Comprehensive Long-Term Environmental Action Navy (CLEAN) Contract No. N62467-04-D-0055, Contract Task Order (CTO) 426. The Statement of Work for CTO 426 directs Tetra Tech to develop a work plan to determine the number and location of groundwater monitoring wells needed to support post-remediation groundwater monitoring at four properties located at the former Arrowwood Housing Sites at the Naval Submarine Base (NSB) New London in Groton, Connecticut. This Work Plan presents the technical approach for installing monitoring wells at these sites.

Under this Work Plan, Tetra Tech will be responsible for performing the following activities:

- Mobilizing and demobilizing;
- Advancing hollow-stem auger (HSA) soil borings;
- Collecting soil samples, classifying soils, and performing field headspace screening;
- Installing and developing 2-inch diameter groundwater monitoring wells; and
- Characterizing and disposing of investigation-derived waste (IDW).

This Work Plan is divided into two sections:

Section 1.0 describes the site location and provides a brief description of the removal actions performed in 2006 at each property.

Section 2.0 presents the Site Management Plan and Well Installation Plan as one, integrated approach for conducting fieldwork activities. The plan addresses the project organization and responsibilities of personnel engaged in performing field investigation activities; the projected field operations schedule; and site access and security. The plan also provides detailed guidance on how activities will be performed to meet the objectives of the well installation task. This Work Plan will be used by Tetra Tech field personnel as a guide for performing all field activities according to designated, accepted protocols.

Appendix A consists of example field forms that will be used during soil boring advancement and well installation.

1.1 SITE BACKGROUND INFORMATION

Naval Submarine Base (NSB) New London is located in Groton, Connecticut on the east bank of the Thames River approximately 6 miles north of Long Island Sound. NSB is the home port for attack

submarines with the main base occupying more than 687 acres. An additional 530 acres are used for housing Navy families.

The Arrowwood Housing Sites are located on Arrowwood Drive within the Nautilus Park housing area approximately 1 mile south of the NSB, to the east of Connecticut Route 12. These properties are the former site of several duplex residential dwellings for NSB personnel. The structures on the Arrowwood Housing Sites have been demolished as part of the redevelopment of this area, and new townhomes have been constructed on many of the properties.

Several of the properties on Arrowwood Drive have been impacted by releases of fuel oil from underground storage tanks (USTs). From May to July 2006, the Navy performed removal actions at 11 properties located on Arrowwood Drive. Removal activities included the excavation of petroleum-impacted soils until field screening indicated that the limits of the release area had been reached. The Navy collected confirmatory soil samples for laboratory analysis from the sidewalls and bottom (where practical) of the soil excavations and backfilled the excavations with clean material. A total of approximately 1,750 tons of petroleum impacted soils were removed and disposed during these removal actions (TtEC, 2006).

Groundwater was encountered during soil excavation at seven of the Arrowwood Drive properties. Groundwater (present as surface water at the bottom of soil excavation) samples were collected from these properties and analyzed for Extractable Total Petroleum Hydrocarbons (ETPH) during removal activities. At four of these properties, the concentration of ETPH detected in groundwater samples exceeded the Connecticut Department of Environmental Protection (CTDEP) GA/GAA Groundwater Protection Criteria (GWPC) of 500 ppb, which is the remediation goal for the site. Groundwater samples collected from these four properties did not exceed the CTDEP Residential Volatilization Criteria (VC) (TtEC, 2006). At a fifth property, the excavation of petroleum-impacted soils destroyed monitoring wells that were being utilized for an existing post-remediation monitoring program (HRP, 2006).

In the following sections, a more detailed description of the removal actions performed to date at the four subject properties is provided.

1.1.1 47/49 Arrowwood Drive

On 1 June 2006, the Navy excavated a 20 x 30 x 8-foot deep area of clean overburden from the 47/49 Arrowwood Drive property. Petroleum-impacted soils were encountered at 8 feet below ground surface (bgs) and soil excavation continued to approximately 15 feet bgs. The final size of the soil excavation was 20 x 30 x 15 feet deep (TtEC, 2006).

Groundwater was encountered at 10 feet bgs during excavation at this property. A visible oil sheen was detected on the surface water that accumulated in the excavation, and a sample of this water was collected. The water exhibiting a sheen was extracted from the excavation into a vacuum truck for off-site disposal, and a second sample of the water within the excavation was collected. The concentration of ETPH detected in both of these samples exceeded the CTDEP GA/GAA GWPC (TtEC, 2006).

After the collection of water samples, the soil excavation was backfilled with bank run gravel to the top of the water table, and the excavation was backfilled to original grade using native overburden material (TtEC, 2006).

1.1.2 109/113 Arrowwood Drive

Data from a previous investigation indicated the presence of petroleum-impacted soils to the east of the former UST location at the 109/113 Arrowwood Drive property. On 31 May 2006, the Navy completed a 40 foot wide excavation at this property to remove petroleum-impacted soils. Impacted soils were encountered at 5 feet bgs, and excavation continued until soil screening with the PID indicated soil screening levels below 1 ppm/v. Sidewall and bottom soil confirmation samples were collected to verify the limits of impacted soils. The total depth of excavation was 9 feet bgs (TtEC, 2006).

Groundwater was encountered at 6.5 feet bgs during excavation at 109/113 Arrowwood Drive. A visible oil sheen was detected on the surface water that accumulated in the excavation, and a sample of this water was collected. The water exhibiting a sheen was extracted from the excavation into a vacuum truck for off-site disposal, and a second sample of the water within the excavation was collected. Laboratory results from both of these water samples indicated that the concentration of ETPH in groundwater was still above the CTDEP GA/GAA GWPC (TtEC, 2006).

After the collection of water samples, the soil excavation was backfilled with bank run gravel to the top of the water table, and the excavation was backfilled to original grade using native overburden material (TtEC, 2006).

1.1.3 122/124 Arrowwood Drive

A release of No. 2 fuel oil occurred at 122/124 Arrowwood Drive (date unknown), which resulted in the removal of the tank in March 2002. During removal of the tank, approximately 250 tons of petroleum-impacted soil was excavated and free-phase petroleum was encountered at the groundwater surface within the tank excavation. This material was removed by vacuum truck. In March 2002, a 10-inch diameter recovery/monitoring well (MW-1) was placed in the excavation area. Two additional monitoring

wells (MW-2, MW-3) were also installed. In April-June 2002, a site investigation was performed, five monitoring wells were installed (MW-4 through MW-8), and soil samples were collected. In October 2002, monitoring wells MW-9 and MW-10 were installed. Four additional wells (MW-11 through MW-14) were subsequently installed to further investigate impacts to groundwater at 122/124 Arrowwood Drive (TtNUS, 2006).

After removal of the UST, groundwater samples collected from monitoring wells located in the vicinity of 122/124 Arrowwood Drive indicated concentrations of ETPH above CTDEP GA/GAA GWPC. EA Engineering, Science, and Technology (EA) prepared a Corrective Action Plan (CAP) in 2003 recommending that monitoring wells be sampled for comparison to CTDEP GA/GAA groundwater standards for BTEX, ETPH, and MTBE. The CAP also recommended denitrification-based bioremediation (DBB) for the dissolved-phase and sorbed-phase petroleum contamination. DBB treatment was conducted from November 2003 through July 2004 and results are detailed in the Post-Treatment Sampling and Assessment Report (EA, November 2004).

Based on the results of the DBB, EA recommended quarterly monitoring for one year at nine monitoring wells and at one surface water location for EPTH, BTEX and MTBE to verify the effectiveness of the treatment effort. Three of the four planned quarterly rounds of sampling were performed prior to the soil removal activities discussed in the following paragraph. Results from groundwater and surface water sampling performed in September 2005, December 2005, and March 2006 (prior to soil removal) are summarized on Tables 1-1 and 1-2, respectively. The analytical results from these three rounds of samples indicated that only EPTH was present above the GA/GAA GWPC (HRP, 2006).

In May 2006, the Navy excavated a large area of petroleum-impacted soils resulting from the release at 122/124 Arrowwood Drive. The excavation area extended beneath Arrowwood Drive onto the 131/135 Arrowwood Drive property, encompassing an area of approximately 5,000 square feet. Sidewall and bottom confirmation samples were collected from the entire excavation area and sent to the laboratory for analysis. Only one confirmation sample contained a concentration of ETPH above detection limits (20 ppm, which was below remediation goals).

Groundwater was encountered at 4 feet bgs during excavation at 122/124 Arrowwood, and a sample was collected for laboratory analysis. The sample contained 377 µg/L ETPH, which is above the GA/GAA GWPC for ETPH of 100 µg/L. Since concentrations of ETPH are present above the GWPC at this property, groundwater monitoring is required to comply with Connecticut regulations.

1.1.4 191/195 Arrowwood Drive

On 16 May 2006, the Navy began the removal of petroleum-impacted soils at 191/195 Arrowwood Drive. Impacted soils were encountered at 4 feet bgs and excavation continued to the depth of bedrock (12 feet bgs). The Navy field-screened soils during excavation using a PID and continued excavating until PID readings from excavated soils were below 10 ppm/v. After all of the impacted soils were removed, confirmation samples were collected from the excavation at a rate of one per 20 linear feet of excavation sidewall to verify the attainment of cleanup goals. Confirmation samples were collected from immediately above the water table.

Groundwater was encountered at approximately 8 to 10 feet bgs during soil excavation at 191/195 Arrowwood Drive. A visible oil sheen was detected on the surface water that accumulated in the excavation, and a sample of this water was collected. The water exhibiting a sheen was extracted from the excavation into a vacuum truck for off-site disposal and a second sample of the water within the excavation was collected. Laboratory results from both of these water samples indicated that the concentration of ETPH in groundwater was still above the CTDEP GA/GAA GWPC (TtEC, 2006).

After the collection of water samples, the soil excavation was backfilled with bank run gravel to the top of the water table, and the excavation was backfilled to original grade using native overburden material (TtEC, 2006).

1.2 ENVIRONMENTAL SETTING

A brief description of the environmental setting in the Arrowwood Drive area is presented in this section.

1.2.1 Site Topography

In general, the topography of the Arrowwood Drive area slopes downward from a high along Gungywamp Road toward the Beaverdam Brook wetlands located to the south. Currently, the northern portion of the Arrowwood Drive complex and the areas immediately north of the wetlands are relatively flat, with most of the relief occurring in the central portion of the complex. Some re-grading occurred during demolition and redevelopment of the Arrowwood Drive residences.

1.2.2 Site Geology

According to the Geologic Map of the Uncasville Quadrangle, Connecticut: Surficial Geology (Goldsmith, 1960), the native surficial materials within the area occupied by the Arrowwood Housing Sites consist of

ground moraine deposits consisting of till varying from light-grey sandy gravelly till to a compact, gray fissile till containing more silt and clay size particles. Surficial materials within the limits of soil excavations consist of bank run gravel that was used as backfill material.

1.2.3 Bedrock Geology

According to the Bedrock Geological Map of Connecticut, the Mamacoke Formation underlies the Arrowwood Housing Sites. The Mamacoke Formation consists of inter-layered light to dark gray, medium-grained gneiss and Potter Hill Granite Gneiss, a light-pink to gray, tan weathering, fine- to medium-grained, well-foliated granitic gneiss (CGNHS, 1990). During soil removal at 191/195 Arrowwood Drive, bedrock was encountered at approximately 12 feet below ground surface (TtEC, 2006).

1.2.4 Site Hydrology

Groundwater elevation measurements obtained by HRP Associates during groundwater monitoring at 122/124 Arrowwood Drive indicated that groundwater flow is from northwest to southeast in the 122/124 Arrowwood area. Groundwater depths in this portion of the Arrowwood complex were measured between 3 and 6 feet below ground surface.

1.2.4.1 Groundwater Classification

Groundwater beneath the Arrowwood Housing Sites is classified by CTDEP as GAA. The GAA classification applies to groundwater that may be used as a current or future public water supply suitable for drinking without treatment, or that is hydraulically connected to a surface water body that is used as a drinking water supply. Groundwater sampling results that are obtained during this project will be compared to CTDEP Remediation Standard Regulation (RSR) criteria that have been developed to evaluate groundwater in a GA/GAA groundwater area:

- Ground Water Protection Criteria (GWPC) – These criteria are intended to be protective of groundwater that is used as a drinking water source and for other domestic uses.

- Surface Water Protection Criteria (SWPC) – These criteria are intended to protect the existing use of a surface water body, wetland, or intermittent stream into which groundwater discharges.

- Volatilization Criteria (VC) – These criteria are intended to protect the occupants of buildings or future buildings from the migration of volatile organic compounds (VOCs) from groundwater into a building or other permanent structure.

1.2.4.2 Surface Water Classification

The surface water classification of Beaverdam Brook, located to the south (downgradient) of the Arrowwood Housing Sites, is AA. The AA classification indicates that the surface water present in this area may be used as an existing or proposed drinking water supply, a fish and wildlife habitat, for recreation, or as a supply for agricultural and industrial applications.

1.3 OBJECTIVE AND OVERVIEW OF FIELD ACTIVITIES

The purpose of the investigation outlined in this Work Plan is to install a network of monitoring wells that will support post-remediation monitoring at four former Arrowwood Drive properties where petroleum-impacted soils were removed during the spring and summer of 2006. Four rounds of quarterly groundwater sampling will be conducted from this well network to evaluate the effectiveness of soil remediation at these four properties. A groundwater sampling work plan describing field sampling procedures and laboratory analyses will be submitted under separate cover.

2.0 SITE MANAGEMENT/WELL INSTALLATION PLAN

This section presents the project organization, personnel responsibilities, schedule, and site control subjects. This section also includes a description of field activities and procedures that will be utilized to install monitoring wells at the Arrowwood Housing Sites.

2.1 PROJECT ORGANIZATION AND SCHEDULE

This section describes the project organization and schedule, including responsibilities of the personnel involved in performing the field work. Key project personnel and their responsibilities are outlined below.

2.1.1 Personnel Responsibilities

A Field Operations Leader (FOL) will supervise the Tetra Tech field personnel conducting the work outlined in this Work Plan. The FOL will report directly to the Tetra Tech Project Manager. Responsibilities of the FOL include supervising field operations and coordinating daily with the drilling subcontractor; ensuring the procedures specified in the Work Plan are properly implemented (and if any field changes need to be made, a Field Modification Record (FMR) will be processed and approved); maintaining daily drilling and sampling schedules; and reporting to the Project Manager on a regular basis regarding the progress of the field activities.

A Site Safety Officer (SSO) will be appointed from the Tetra Tech field team personnel. The SSO will assist in implementing the Health and Safety Plan (HASP). The SSO will report directly to the Tetra Tech CLEAN Health and Safety Manager on any health and safety issues. The SSO will also report any hazards, injuries, or decisions to stop work to the FOL whom, in turn, will contact the Tetra Tech Project Manager. The overall Tetra Tech project organization and responsibilities of key management personnel are discussed in Section 2.0 of the Implementation Plan for CTO 426, dated April 26, 2007.

2.1.2 Schedule

The schedule for CTO 426 includes the completion of well installation activities by October 30, 2007 so that quarterly groundwater monitoring can commence in November 2007. As such, mobilization for monitoring well installation is scheduled for mid October 2007.

2.2 SITE CONTROL

The following subsections contain information regarding the control of activities at the Site.

2.2.1 Site Access

The Arrowwood Housing Sites are located on Navy-owned land, therefore property access agreements are not anticipated to be necessary for this work.

2.2.2 Utility Clearance and Other Permits

Tetra Tech will be responsible for obtaining clearance of all underground utilities at all drilling locations prior to mobilizing drilling equipment. No subsurface investigation will be performed without underground utility clearances, which must be obtained at least 72 hours prior to beginning onsite work. All sampling locations that involve digging (soil borings) will be staked and marked with white paint as required by Connecticut "Call Before You Dig" prior to notifying them of the intent to advance soil borings.

2.2.3 Field Office/Command Post

Support vehicles and associated facilities will be sited at various locations on the Arrowwood Housing Sites depending upon where work is being performed. Investigation-derived waste (IDW) containers will be staged at an on-site location approved by the Navy until waste characterization is complete and they can be removed from the site for proper disposal.

2.2.4 Site Security/Control

As directed by the FOL, all removable Tetra Tech equipment will be returned to the Tetra Tech field office (i.e. stored and locked in field support vehicles) and secured at the end of each working day. Unfinished work and work areas will be secured each day to prevent tampering or accidental injury to the public. Appropriate security measures such as fencing, barricades, caution tape, or storage containers will be used to secure work and staging areas.

2.3 FIELD INVESTIGATION ACTIVITIES

The field investigation activities consist of the following subtasks:

- Mobilization;
- Advancement of hollow-stem auger (HSA) soil borings and collection of soil samples;
- Installation and development of 2-inch diameter groundwater monitoring wells;

- Monitoring well location survey;
- IDW characterization and disposal; and
- Demobilization.

2.3.1 Mobilization/Demobilization

This section describes the mobilization of both Tetra Tech personnel and Tetra Tech subcontractor personnel.

2.3.1.1 Tetra Tech Mobilization/Demobilization

Prior to beginning any field work, all Tetra Tech field team members will review the Statement of Work (SOW), this Work Plan, the HASP, and all applicable Standard Operating Procedures (SOPs). In addition, the SSO and FOL will hold a field team orientation meeting prior to beginning the field work to familiarize personnel with the scope of the field activities.

Equipment mobilization may include, but will not be limited to, transporting and preparing the following equipment:

- Field screening equipment
- Health and safety equipment
- Decontamination equipment
- Subcontractor equipment (to be conducted by the subcontractor)

The FOL will coordinate the Tetra Tech mobilization. The FOL will also coordinate any equipment purchases and rentals necessary to conduct the field investigation. The equipment for well installation oversight, soil sampling, field screening, and health and safety activities will be transported to the site as needed.

2.3.1.2 Subcontractor Mobilization/Demobilization

Subcontractors will be procured for drilling services and IDW characterization and disposal. Once the procurement process has been completed, a "Notice to Proceed" will be issued by Tetra Tech to the selected subcontractor to initiate mobilization for each service.

The drilling subcontractor and IDW disposal subcontractor will be responsible for mobilizing and demobilizing the equipment and personnel necessary to perform the work outlined in their respective specifications, including any permits required by federal, state, and local authorities.

2.3.2 Advancement of HSA Soil Borings

Tetra Tech will subcontract with an OSHA-40-hour trained drilling company to advance 15 HSA soil borings. Four soil borings will be advanced at the former 47/49 Arrowwood Drive (Figure 2-1), three soil borings will be advanced at the former 109/113 Arrowwood Drive (Figure 2-2), five soil borings will be advanced at the former 122/124 Arrowwood Drive (Figure 2-3), and four soil borings will be advanced at the former 191/195 Arrowwood Drive (Figure 2-4). Each soil boring will be completed as a 2-inch diameter monitoring well (see Section 2.3.4).

2.3.3 Collection of Soil Samples from HSA Borings

Soil samples will be collected from HSA soil borings at continuous 2-foot depth intervals from the ground surface to the water table using a 2.0-inch inside diameter split-barrel sampler. Soil borings will be advanced to a depth of 8 feet below the water table or to refusal, whichever is encountered first. The Tetra Tech field geologist will be responsible for the following activities during soil sampling:

- Identifying the sample depth interval and recording it on the Boring Log Form (Appendix A).
- Determining the amount of soil sloughed in the top of the sampler.
- Screening each soil sample using a photo-ionization detector (PID) equipped with a 10.6 electonvolt (eV) bulb. Observations will be recorded on the Boring Log Form (Appendix A).
- Classifying soil samples according to the Unified Soil Classification System (USCS), noting the depth of change in each strata and any other pertinent visual observations (i.e., discolorations, odors, residual product). This information will be recorded on the Boring Log Form (Appendix A), which will also serve as the sample log sheet for soil samples collected from soil borings.
- Collecting soil samples for jar headspace analysis.
- Decontaminating Tetra Tech soil sampling equipment prior to each use (See Section 2.5).

Soil samples from each 2-foot depth interval will be field screened for the presence of organic vapors using a PID. The procedure for the headspace screening is provided below:

(1) Soil or “mason” type jars with a volume of 16 oz. (approximately 500 ml) are preferred. Jars with a volume of less than 8 oz. (approximately 250 ml) should not be used.

(2) Half-fill a clean glass jar with the sample to be analyzed. Quickly cover the open top with one or two sheets of clean aluminum foil. Replace screw cap and tightly seal the jar.

(3) Vigorously shake jars for 15 seconds. Allow headspace to develop for at least 10 minutes. When temperatures are below 32º F, headspace development should be done in a heated vehicle or building. Vigorously shake jars again for 15 seconds.

(4) Remove screw-lid and expose the foil. Quickly puncture the foil with instrument sampling probe, to a point about one-half of the headspace depth. Be careful that the probe does not pick up water droplets or soil particles.

(5) Record the highest meter response as the jar headspace concentration. Maximum response should occur between 2 and 5 seconds after inserting the probe through the foil and into the jar. Erratic meter response may occur when organic vapor concentrations are high or when excess moisture is present. These readings should not be used.

(6) PID field instruments should be operated and calibrated to yield "total organic vapors" in ppm (v/v) as benzene. PID instruments must be operated with a 10.0 +/- eV lamp source. Operation, maintenance, and calibration should be performed in accordance with the manufacturer's specifications. For jar headspace analysis, instrument calibration should be checked and adjusted every 10 analyses (or each time the instrument is used, if less than 10 samples are analyzed).

Jar headspace analysis results will be recorded on the Boring Log Form alongside the soil description for the appropriate depth interval.

2.3.4 Installation and Development of Groundwater Monitoring Wells

This section details the well construction and well development procedures that will be followed during the field investigation.

2.3.4.1 Well Construction

The 15 2-inch I.D. monitoring wells will be constructed according to the guidelines provided in this section. A typical well construction diagram is included as Figure 2-5.

- The monitoring wells will be constructed of 2-inch I.D., non-glued, flush-threaded Schedule 40 PVC casing. The well screen will be equipped with a push-in or threaded PVC end plug. The monitoring wells will be placed directly into the HSA borings. The wells will be constructed with a sand filter pack and bentonite chip filter pack seal.

- The monitoring well screens will be constructed of a PVC section approximately 10 feet in length and will be placed to intersect the top of water table, with approximately 2 feet of stick-up above the water table. Screen length may be reduced in borings completed below the water table that do not reach a depth of 15 feet bgs due to a shallow water table or refusal. Well screen slot size will be 0.010-inches.

- A sand filter pack will be placed around the well screens to a depth of 2 feet above the screen. A filter pack seal consisting of a 2-foot layer of bentonite pellets will be placed above the filter packs.

- The annular space between the boreholes and the well risers will be backfilled with native material to within 0.5 feet of the ground surface.

- The monitoring wells will be completed with a flush-mounted steel protective well casing marked “monitoring well”.

- A concrete surface seal (Quikrete® or equivalent) will be placed to a radius of approximately 0.5 feet around the protective cover. The seal will be flush-with-grade and extend around the protective well cover to a depth of approximately 0.5 feet bgs.

- The monitoring wells will be developed as described in Section 2.3.4.2.

Monitoring well construction details will be documented by the field geologist on a Well Construction Log Sheet (Appendix A).

2.3.4.2 Well Development

The Tetra Tech geologist will develop the 15 new monitoring wells and two existing monitoring wells that were encountered during a 19 June 2007 site reconnaissance (MW-13 and MW-14). The new monitoring wells will be developed at least 24 hours after installation to remove fines from around the well screens. Turbidity measurements will be taken every 3 to 5 minutes during well development. Both the new and existing groundwater monitoring wells will be developed using a Wattera pump until the turbidity of the extracted groundwater is less than 50 nephelometric turbidity units (NTU). If a well is not completely developed within 1 hour (i.e. turbidity remains higher than 50 NTU), but the turbidity measurements appear to have stabilized, then well development will not continue past one hour. If turbidity measurements are still decreasing after one hour, but have not reduced below 50 NTU, then well development will continue until turbidity measurements begin to stabilize or for a maximum of one additional hour.

Development water will be containerized and staged on site until waste characterization samples are collected and laboratory analysis is completed. Subsequent to the receipt of waste characterization results, development water will be shipped off site for proper disposal according to the procedures outlined in Section 2.3.6 of this Work Plan.

2.3.5 Monitoring Well Location Survey

Tetra Tech will determine horizontal locations of all monitoring wells and surface water sampling location SW-1 (installed previously by EA Engineering) Global Positioning System (GPS) instrument survey, where possible. The relative elevation (based on arbitrary datum) of the monitoring wells and the surface water sampling station will be determined using standard instrument survey techniques.

2.3.6 Control and Disposal of Investigation-Derived Waste (IDW)

Investigation-derived waste handling procedures will be implemented as follows:

- Excess samples from the soil borings will be monitored for volatile organic vapors with a PID as they are generated. All excess sample will be containerized in labeled 55-gallon open-head DOT-approved steel drums and stored at a designated staging area approved by the Navy (see Section 2.3.6.1), pending receipt of laboratory analysis for potential disposal at a later date. Non-contaminated soil will be used to backfill the annular space above the filter pack seal, as described in Section 2.3.4.1.

- Waste fluids (decontamination liquids and well development water) will be collected and containerized in 55-gallon DOT-approved steel drums and transported to a designated staging area (see Section 2.3.6.1). The waste fluids will be temporarily stored at the staging area until the laboratory analytical reports are received and their disposition is determined. Once characterized, waste liquids will be properly disposed off-site.

- The personal protective equipment (PPE) waste generated during work will be decontaminated, double-bagged in plastic bags, and disposed in an industrial dumpster at the completion of work.

The subcontracted driller will transport the IDW on the Site.

2.3.6.1 Storage of IDW

The following NSB New London requirements for the storage of IDW in off-base areas will be implemented during the investigation:

- IDW containers will be stored in an area that is sheltered from the weather, under lock and key, accessible only to the Navy and its contractor. All containers of liquid waste will be stored in an area that provides secondary containment which is capable of holding 10 percent of the total waste capacity or is equal to the largest container capacity, whichever is greater.

- All IDW containers will be inspected prior to use to ensure that they are in good condition.

- All IDW containers greater than 26 gallons will be DOT approved.

- All IDW containers will be closed at all times except when adding or removing waste.

- All IDW containers will be labeled with a fully completed IDW Waste Label (Section 2.3.6.2).

- A field notebook will be kept on-site documenting the volume and disposition of all IDW generated during the investigation.

- IDW will be stored separately from other materials.

2.3.6.2 Drum Labeling

All soil and water generated during drilling activities will be placed in drums as appropriate. After IDW is drummed and the lid clamped tight, the drum will be labeled and marked using a waterproof indelible ink marker with the following information:

- Site name
- Date first accumulated: e.g. 10/22/07
- Drum number (each drum will be given a unique identification number)
- Source(s) of IDW: Soil boring/monitoring well ID# (see Section 2.4)
- Volume(s) of soil or water: e.g. 5 gallons/sample ID#
- Generator contact information

Drum labeling is necessary to identify materials stored in the drums and to evaluate how the drummed material will be sampled for waste characterization.

2.3.6.3 Drilling Equipment and Vehicle Decontamination

Pressure washing will be used to decontaminate drilling equipment, as necessary. Wash water will be contained in a polyethylene-lined decontamination area where it will be collected into drums.

2.3.6.4 Transportation and Disposal Subcontractor

A licensed hazardous waste transportation and disposal subcontractor will be required to transport and dispose of any non-hazardous and hazardous waste streams generated during the investigation. A subcontractor will be procured to transport the IDW waste to approved off-site disposal facilities. The subcontractor will be procured to provide transportation and proper disposal locations (which will require Tetra Tech and Navy approval) for the soil, well development water, and decontamination water.

2.3.6.5 Waste Manifesting Compliance

One hazardous waste manifest will be prepared by the transportation and disposal subcontractor for each shipment of hazardous IDW leaving the Site. Manifests will be completed for all hazardous wastes disposed off site, and must be signed by a Navy representative. Hazardous wastes are not anticipated to be generated during this field effort.

If waste characterization analysis of the IDW indicates that it is non-hazardous, the IDW will be shipped from the Site under a Bill of Lading prepared by the transportation and disposal subcontractor for each shipment of IDW leaving the Site. The Bill of Lading will be signed by a Navy representative. Copies of all documentation of control and disposal of IDW generated by the project will be maintained in the project file located at the Tetra Tech Wilmington office.

2.4 MONITORING WELL IDENTIFICATION SYSTEM

Soil boring and monitoring well locations will be identified in accordance with the following identification system:

- Soil borings (and monitoring wells) located within and adjacent to the 47/49 Arrowwood Drive soil removal area will be numbered SB-101 (MW-101) through SB-104 (MW-104).

- Soil borings (and monitoring wells) located within and adjacent to the 109/113 Arrowwood Drive soil removal area will be numbered SB-201 (MW-201) through SB-203 (MW-203).

- Soil borings (and monitoring wells) located within and adjacent to the 122/124 Arrowwood Drive soil removal area will be numbered SB-301 (MW-301) through SB-305 (MW-305).

- Soil borings (and monitoring wells) located within and adjacent to the 191/195 Arrowwood Drive soil removal area will be numbered SB-401 (MW-401) through SB-404 (MW-404).

Figures 2-1 through 2-4 show the proposed locations of monitoring wells on each of these three properties.

Each sample collected during soil boring advancement will be assigned a unique sample tracking number that will be used to catalog the results and record observations and field-screening measurements. The sample tracking number will consist of alpha-numeric characters identifying the Site, sample medium, location, and depth. Any other pertinent information regarding sample identification will be recorded on the sample logsheets or in the field logbooks.

The alpha-numeric coding to be used in the sample system is detailed below and in the subsequent definitions.

AAA	-	AA	-	(NNN)	-	(NNNN)
(Site ID)	-	(Medium)	-	(Location)	-	(Depth)

Site identifier: "AWD" for Arrowwood Drive

Medium identifier: "SB" for soil samples collected from soil borings,
"GW" will be used in the future to indicate groundwater samples collected from monitoring wells,

Sample location identifier: Sample location designations are described in the bulleted section above and shown on Figure 2-1 through 2-4.

Depth: For soil sample locations, this portion of the sample tracking number will represent the depth in feet below ground surface from which the sample was collected, e.g., for soil samples collected from 0 to 2 feet below ground surface, this portion of the sample tracking number will be "0002", and samples collected from 4 to 6 feet bgs, for example, the portion of the tracking number will be "0406", etc.

For example, a soil sample collected from 0 to 2 feet in borehole SB-101 would be designated as:

AWD-SB-101-0002

2.5 EQUIPMENT DECONTAMINATION

This section provides guidelines for decontamination of equipment used during the field investigation. Personnel decontamination issues will be discussed in the HASP.

2.5.1 Decontamination During Drilling

Equipment used by the drilling subcontractor will be decontaminated prior to use at the site, between work locations, and prior to leaving the site. Decontamination of equipment will be performed using a high-pressure steam wash. The drilling subcontractor will be responsible for designing and locating the decontamination pad that will be used to decontaminate their equipment.

The drilling specification will require the drilling subcontractor to have sufficient downhole equipment available so as not to impede progress of work. All downhole drilling, sampling, and testing equipment for the drilling rig will be steam cleaned prior to beginning drilling, between boring locations, any time the equipment leaves the drill site prior to finishing a boring, and at the conclusion of the drilling program.

2.5.2 Decontamination Procedures During Soil Sampling

All non-disposable sampling and testing equipment that comes in contact with the sample medium (trowels, bowls, shovels, split-spoons, etc.) will be decontaminated to prevent cross-contamination between sampling points, as described below:

1. Brush to remove gross contamination
2. Potable water and detergent (Alconox or Liquinox) wash and scrub with brush
3. Rinse with potable water
4. Rinse with distilled water (analyte free)
5. Rinse with 2-propanol
6. Rinse with de-ionized water
7. Air dry on aluminum foil or in a strainer
8. Wrap in aluminum foil, shiny side out for transport (or if not being used immediately)

2.5.3 Decontamination of Groundwater Pumps

Waterra pumps will be used to develop monitoring wells during this field effort. Waterra pumps do not require decontamination procedures, since the tubing and foot valve which contacts the groundwater is changed for each well to be developed.

2.5.4 Instrument and Meter Decontamination

Water level meters and oil-water interface probes (and any other instrument that comes in contact with potentially contaminated groundwater) will be decontaminated using the following steps:

1. Rinse with potable water
2. Rinse with 2-propanol
3. Rinse with deionized water

TABLES

TABLE 1-1

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED FROM 122/124 ARROWWOOD DRIVE PRIOR TO SOIL EXCAVATION
ARROWWOOD HOUSING SITES - NSB NEW LONDON
GROTON, CONNECTICUT

PARAMETER	SAMPLE ID					MW-2			MW-4			MW-7			MW-8		
	GW ELEVATION					DRY	96.24	96.11	DRY	95.86	95.46	92.00	94.03	94.06	91.73	93.96	94.02
	SAMPLE DATE					09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06
	Unit	RVC	ICVC	GWPC	SWPC												
CT Extractable Petroleum Hydrocarbons	mg/L	NE	NE	0.1	NE	---	**0.124**	<0.075	---	**1.33**	**0.882**	**0.3**	**1.19**	**1.37**	**9.2**	**0.719**	**1.71**
Volatile Organic Compounds																	
Benzene	µg/L	215	530	1	710	---	<1	<1	---	<1	<1	<1	<1	<1	<1	<1	<1
Toluene	µg/L	23500	50000	1000	4000000	---	<1	<1	---	<1	<1	<1	<1	<1	<1	<1	<1
Ethylbenzene	µg/L	50000	50000	700	580000	---	<1	<1	---	1.4	1.3	3.0	12.3	11.2	4.0	<1	<1
o-Xylene	µg/L	21300	50000	530	NE	---	<1	<1	---	4.6	6.1	2.0	18.4	14.6	10.0	3.8	1.8
p-Xylene	µg/L	21300	50000	530	NE	---	---	---	---	---	---	4	---	---	18	---	---
m+p-Xylene	µg/L	21300	50000	530	NE	---	<2	<2	---	2.4	<2	---	17.7	16.3	---	2.3	<2
Total Xylenes	µg/L	21300	50000	530	NE	---	<3	<3	---	7.0	6.1	2.0	36.1	30.9	10.0	6.1	1.8
1,2,4-Trimethylbenzene	µg/L	360	NE	350	NE	---	<1	<1	---	6.00	9.40	18.00	67.30	80.80	28.00	3.90	2.10
1,2-Dibromoethane	µg/L	4	16	0.05	NE	---	<1	<0.5	---	<1	<0.5	<1	<1	<0.5	<1	<1	<0.5
1,3,5-Trimethylbenzene	µg/L	280	NE	350	NE	---	<1	<1	---	<1	<1	6.00	10.90	9.20	13.00	2.20	1.20
4-Isopropyltoluene	µg/L	1600	NE	30	NE	---	<1	<1	---	<1	<1	8.00	2.50	2.30	5.00	1.20	<1
Bromodichloromethane	µg/L	NE	NE	0.6	NE	---	<1	<1	---	<1	<1	<0.5	<1	<1	<0.5	<1	<1
Chloroform	µg/L	287	710	6	14100	---	<2	3.10	---	<2	<2	<1	<2	<2	<1	<2	<2
Dibromochloromethane	µg/L	NE	NE	0.5	1020	---	<5	**0.90**	---	<5	<0.5	<0.5	<5	<0.5	<0.5	<5	<0.5
Hexachlorobutadiene	µg/L	NE	NE	0.45	NE	---	<1	<1	---	<1	<1	<10	<1	<1	<10	<1	<1
Isopropylbenzene	µg/L	2800	NE	30	NE	---	<1	<1	---	1.90	2.50	11.00	8.60	10.90	8.00	1.20	<1
Naphthalene	µg/L	NE	NE	280	NE	---	<5	<2	---	26.00	31.10	20.00	87.00	96.40	40.00	6.20	3.00
n-Butylbenzene	µg/L	NE	NE	61	NE	---	<1	<1	---	1.30	<1	1.00	<1	3.80	1.00	1.70	<1
n-Propylbenzene	µg/L	NE	NE	61	NE	---	<1	<1	---	1.80	2.70	5.00	9.20	11.70	4.00	<1	<1
sec-Butylbenzene	µg/L	NE	NE	61	NE	---	<1	<1	---	1.40	<1	6.00	4.20	5.90	13.00	1.50	<1
Styrene	µg/L	580	2065	100	NE	---	<1	<1	---	<1	<1	<1	1.2	<1	<1	<1	<1
tert-Butylbenzene	µg/L	NE	NE	61	NE	---	<1	<1	---	1.00	<1	<1	1.2	<1	<1	1.10	<1
Acrylonitrile	µg/L	NE	NE	0.5	20	---	<5	<5	---	<5	<5	NA	<5	<5	NA	<5	<5

NOTES:

1. Shading indicates one or more exceedances of Connecticut RSRs.
2. RVC = CT DEP Residential Volatilization Criteria
3. ICVC = CTDEP Industrial/Commercial Volatilization Criteria
4. GWPC = CTDEP Groundwater Protection Criteria
5. SWPC = CTDEP Surface Water Protection Criteria
6. NA = Not applicable
7. NE = No standard established by CTDEP

TABLE 1-1

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED FROM 122/124 ARROWWOOD DRIVE PRIOR TO SOIL EXCAVATION
ARROWWOOD HOUSING SITES - NSB NEW LONDON
GROTON, CONNECTICUT

PARAMETER	SAMPLE ID					MW-9			MW-10			MW-12			MW-13		
	GW ELEVATION					92.24	93.95	94.10	92.16	94.01	94.03	92.31	94.21	94.22	92.45	94.10	94.10
	SAMPLE DATE					09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06
	Unit	RVC	ICVC	GWPC	SWPC												
CT Extractable Petroleum Hydrocarbons	mg/L	NE	NE	0.1	NE	<0.10	**0.182**	<0.075	<0.10	<0.075	<0.075	**0.3**	**0.9**	**0.436**	<0.10	**0.108**	<0.075
Volatile Organic Compounds																	
Benzene	µg/L	215	530	1	710	<1	<1	<1	<1	<1	<1						
Toluene	µg/L	23500	50000	1000	4000000	<1	<1	<1	<1	<1	<1						
Ethylbenzene	µg/L	50000	50000	700	580000	<1	<1	<1	<1	<1	<1	<1	2.2	<1	<1	<1	<1
o-Xylene	µg/L	21300	50000	530	NE	<1	<1	<1	<1	<1	<1	<1	16.6	<1	<1	<1	<1
p-Xylene	µg/L	21300	50000	530	NE	1	---	---	<1	---	---	<1	---	---	<1	---	---
m+p-Xylene	µg/L	21300	50000	530	NE	---	<2		---	<2	<2	---	4.5	<2	---	<2	<2
Total Xylenes	µg/L	21300	50000	530	NE	<1	<3	<3	<1	<3	<3	<1	21.1	<3	<1	<3	<3
1,2,4-Trimethylbenzene	µg/L	360	NE	350	NE	<1	1.10	<1	<1	<1	<1	<1	15.9	<1	<1	<1	<1
1,2-Dibromoethane	µg/L	4	16	0.05	NE	<1	<1	<0.5	<1	<1	<0.5	<1	<1	<0.5	<1	<1	<0.5
1,3,5-Trimethylbenzene	µg/L	280	NE	350	NE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
4-Isopropyltoluene	µg/L	1600	NE	30	NE	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Bromodichloromethane	µg/L	NE	NE	0.6	NE	<0.5	<1	<1	<0.5	<1	<1	<0.5	<1	<1	<0.5	<1	<1
Chloroform	µg/L	287	710	6	14100	<1	<2	<2	<1	<2	<2	<1	<2	<2	<1	2.5	2.2
Dibromochloromethane	µg/L	NE	NE	0.5	1020	<0.5	<5	<0.5	<0.5	<5	<0.5	<0.5	<5	<0.5	<0.5	<5	**0.9**
Hexachlorobutadiene	µg/L	NE	NE	0.45	NE	<10	<1	<1	<10	<1	<1	<10	<1	<1	<10	<1	<1
Isopropylbenzene	µg/L	2800	NE	30	NE	5.00	1.80	<1	<1	<1	<1	7.00	5.90	3.20	<1	<1	<1
Naphthalene	µg/L	NE	NE	280	NE	<10	<5	<2	<10	<5	<2	35.00	39.10	2.00	<10	<5	<2
n-Butylbenzene	µg/L	NE	NE	61	NE	<1	1.20	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
n-Propylbenzene	µg/L	NE	NE	61	NE	<1	<1	<1	<1	<1	<1	4.00	5.60	3.20	<1	<1	<1
sec-Butylbenzene	µg/L	NE	NE	61	NE	<1	1.70	<1	<1	<1	<1	<1	2.70	2.30	<1	<1	<1
Styrene	µg/L	580	2065	100	NE	<1	<1	<1	<1	<1	<1	<1	1.10	<1	<1	<1	<1
tert-Butylbenzene	µg/L	NE	NE	61	NE	<1	1.10	<1	<1	<1	<1	<1	1.20	<1	<1	<1	<1
Acrylonitrile	µg/L	NE	NE	0.5	20	NA	<5	<5	NA	<5	<5	NA	<5	<5	NA	<5	<5

NOTES:

1. Shading indicates one or more exceedances of Connecticut RSRs.
2. RVC = CT DEP Residential Volatilization Criteria
3. ICVC = CTDEP Industrial/Commercial Volatilization Criteria
4. GWPC = CTDEP Groundwater Protection Criteria
5. SWPC = CTDEP Surface Water Protection Criteria
6. NA = Not applicable
7. NE = No standard established by CTDEP

TABLE 1-1

ANALYTICAL RESULTS FOR GROUNDWATER SAMPLES COLLECTED FROM 122/124 ARROWWOOD DRIVE PRIOR TO SOIL EXCAVATION
ARROWWOOD HOUSING SITES - NSB NEW LONDON
GROTON, CONNECTICUT

PARAMETER	SAMPLE ID					MW-14			TB-1		
	GW ELEVATION					92.36	93.76	93.81	NA	NA	NA
	SAMPLE DATE					09/07/05	12/21/05	03/10/06	09/07/05	12/21/05	03/10/06
	Unit	RVC	ICVC	GWPC	SWPC						
CT Extractable Petroleum Hydrocarbons	mg/L	NE	NE	0.1	NE	**0.7**	**0.872**	**0.794**	<0.01	NA	NA
Volatile Organic Compounds											
Benzene	µg/L	215	530	1	710						
Toluene	µg/L	23500	50000	1000	4000000						
Ethylbenzene	µg/L	50000	50000	700	580000	<1	<1	<1	<1	<1	<1
o-Xylene	µg/L	21300	50000	530	NE	11.0	6.3	3.3	<1	<1	<1
p-Xylene	µg/L	21300	50000	530	NE	<1	---	---	<1	---	---
m+p-Xylene	µg/L	21300	50000	530	NE	---	<2	<2	---	<2	<2
Total Xylenes	µg/L	21300	50000	530	NE	11.0	6.3	3.3	<1	<3	<3
1,2,4-Trimethylbenzene	µg/L	360	NE	350	NE	<1	<1	<1	<1	<1	<1
1,2-Dibromoethane	µg/L	4	16	0.05	NE	<1	<1	<0.5	<1	<1	<0.5
1,3,5-Trimethylbenzene	µg/L	280	NE	350	NE	<1	<1	<1	<1	<1	<1
4-Isopropyltoluene	µg/L	1600	NE	30	NE	4.0	<1	<1	<1	<1	<1
Bromodichloromethane	µg/L	NE	NE	0.6	NE	<0.5	<1	<1	<0.5	<1	<1
Chloroform	µg/L	287	710	6	14100	<1	<2	<2	<1	<2	<2
Dibromochloromethane	µg/L	NE	NE	0.5	1020	<0.5	<5	<0.5	<0.5	<5	<0.5
Hexachlorobutadiene	µg/L	NE	NE	0.45	NE	<10	<1	<1	<10	<1	<1
Isopropylbenzene	µg/L	2800	NE	30	NE	12.0	9.1	10.7	<1	<1	<1
Naphthalene	µg/L	NE	NE	280	NE	36	21.7	8.3	<10	<5	<2
n-Butylbenzene	µg/L	NE	NE	61	NE	<1	1.7	1.9	<1	<1	<1
n-Propylbenzene	µg/L	NE	NE	61	NE	<1	1.0	<1	<1	<1	<1
sec-Butylbenzene	µg/L	NE	NE	61	NE	<1	6.2	7.8	<1	<1	<1
Styrene	µg/L	580	2065	100	NE	<1	<1	<1	<1	<1	<1
tert-Butylbenzene	µg/L	NE	NE	61	NE	<1	1.3	<1	<1	<1	<1
Acrylonitrile	µg/L	NE	NE	0.5	20	NA	<5	<5	NA	<5	<5

NOTES:

1. Shading indicates one or more exceedances of Connecticut RSRs.
2. RVC = CT DEP Residential Volatilization Criteria
3. ICVC = CTDEP Industrial/Commercial Volatilization Criteria
4. GWPC = CTDEP Groundwater Protection Criteria
5. SWPC = CTDEP Surface Water Protection Criteria
6. NA = Not applicable
7. NE = No standard established by CTDEP

TABLE 1-2

ANALYTICAL RESULTS FOR SURFACE WATER SAMPLES COLLECTED FROM 122/124 ARROWWOOD DRIVE PRIOR TO SOIL EXCAVATION
ARROWWOOD HOUSING SITES - NSB NEW LONDON
GROTON, CONNECTICUT

PARAMETER	Unit	SAMPLE ID				SW-01		
		SAMPLE DATE				09/07/05	12/21/05	03/10/06
		CT Water Quality Standards						
		Aquatic Life Criteria, Freshwater		Human Health Criteria, Consumption of:				
		Acute	Chronic	Organisms Only	Water & Organisms			
CT Extractable Petroleum Hydrocarbons	mg/L	NE	NE	NE	NE	0.1	0.442	0.311
Volatile Organic Compounds								
Benzene	µg/L	NE	NE	71	1.2	<1	<1	<1
Toluene	µg/L	NE	NE	200000	1000	<1	<1	<1
Ethylbenzene	µg/L	NE	NE	29000	700	<1	<1	<1
o-Xylene	µg/L	NE	NE	NE	NE	<1	2.3	1.3
p-Xylene	µg/L	NE	NE	NE	NE	<1	---	---
m+p-Xylene	µg/L	NE	NE	NE	NE	---	2.3	<2
Total Xylenes	µg/L	NE	NE	NE	NE	<1	4.6	1.3
1,2,4-Trimethylbenzene	µg/L	NE	NE	NE	NE	<1	3.4	<1
1,2-Dibromoethane	µg/L	NE	NE	NE	NE	<1	<1	<0.5
1,3,5-Trimethylbenzene	µg/L	NE	NE	NE	NE	<1	1.0	<1
4-Isopropyltoluene	µg/L	NE	NE	NE	NE	<1	1.1	<1
Bromodichloromethane	µg/L	NE	NE	46	0.56	<0.5	<1	<1
Chloroform	µg/L	NE	NE	470	5.7	<1	<2	<2
Dibromochloromethane	µg/L	NE	NE	34	0.41	<0.5	<5	<0.5
Hexachlorobutadiene	µg/L	NE	NE	50	0.44	<10	<1	<1
Isopropylbenzene	µg/L	NE	NE	NE	NE	<1	5.4	3.6
Naphthalene	µg/L	NE	NE	20513	677	<10	5.4	4.3
n-Butylbenzene	µg/L	NE	NE	NE	NE	<1	1.3	<1
n-Propylbenzene	µg/L	NE	NE	NE	NE	<1	<1	<1
sec-Butylbenzene	µg/L	NE	NE	NE	NE	<1	3.8	2.4
Styrene	µg/L	NE	NE	NE	NE	<1	<1	<1
tert-Butylbenzene	µg/L	NE	NE	NE	NE	<1	1.2	<1
Acrylonitrile	µg/L	NE	NE	0.66	0.059	NA	<5	<5

NOTES:

1. Shading indicates one or more exceedances of Connecticut RSRs.
2. NE = No standard established by CTDEP

FIGURES

ACAD: \00869\0211\LOCUS.DWG 07/16/07 DWM

BASEMAP: PORTIONS OF THE FOLLOWING U.S.G.S. QUADRANGLE MAPS: NEW LONDON, CONN.–N.Y., 1984 AND UNCASVILLE, CONN., 1984

GRAPHIC SCALE
0 0.5 MILE 1 MILE

QUADRANGLE LOCATION

TETRA TECH, INC.

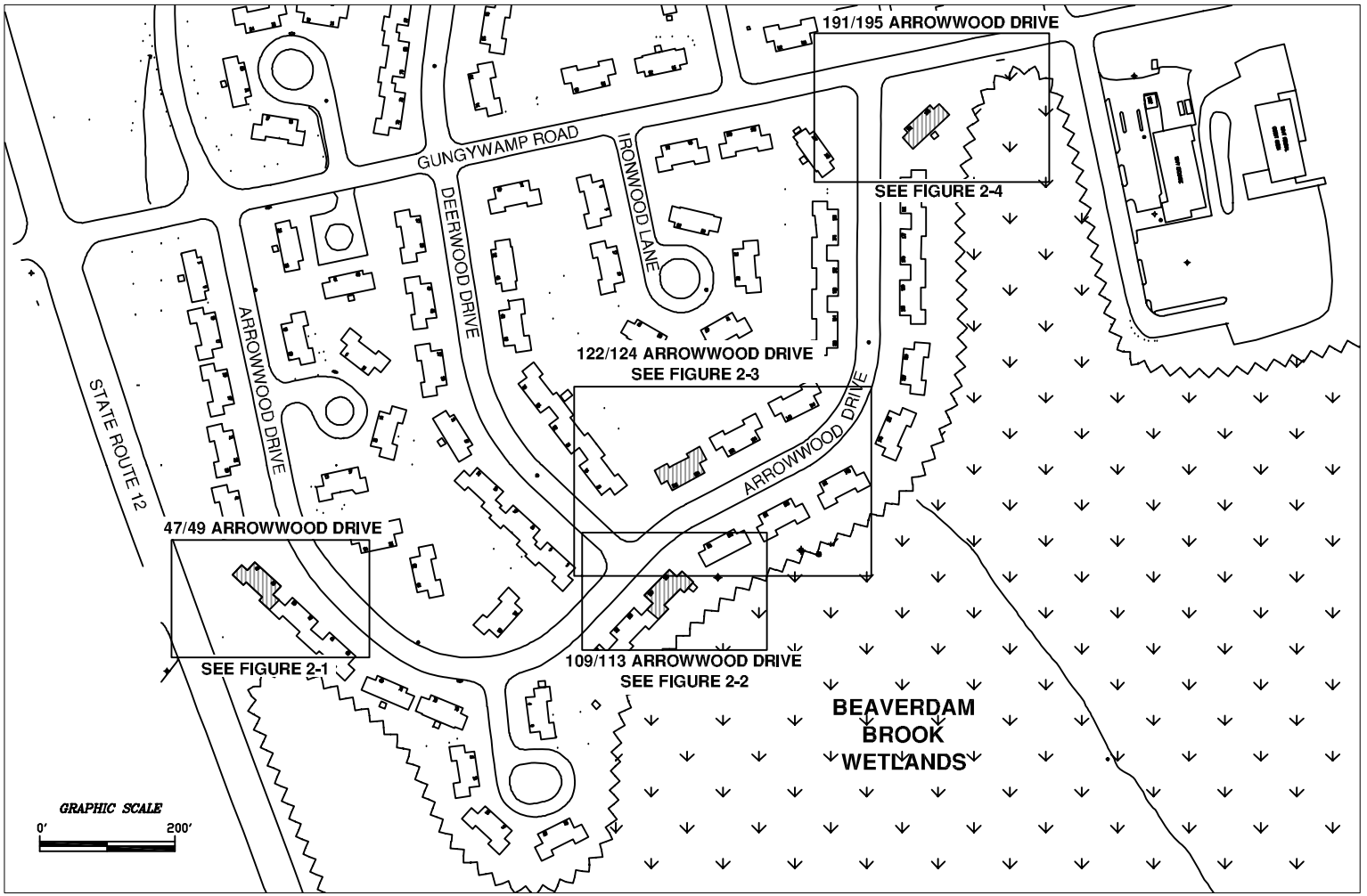
SITE LOCUS

NAVAL SUBMARINE BASE NEW LONDON

GROTON, CONNECTICUT

SCALE	AS NOTED
FILE	\00869\0211\LOCUS.DWG
REV	0
DATE	07/16/07
FIGURE NUMBER	1–1

ACAD: 00869\0211\NP.DWG 07/16/07 DWM



LEGEND

TREE LINE (APPROXIMATE)

WETLAND (APPROXIMATE)

TETRA TECH, INC.

FORMER ARROWWOOD DRIVE HOUSING PLAN

NAVAL SUBMARINE BASE NEW LONDON

GROTON, CONNECTICUT

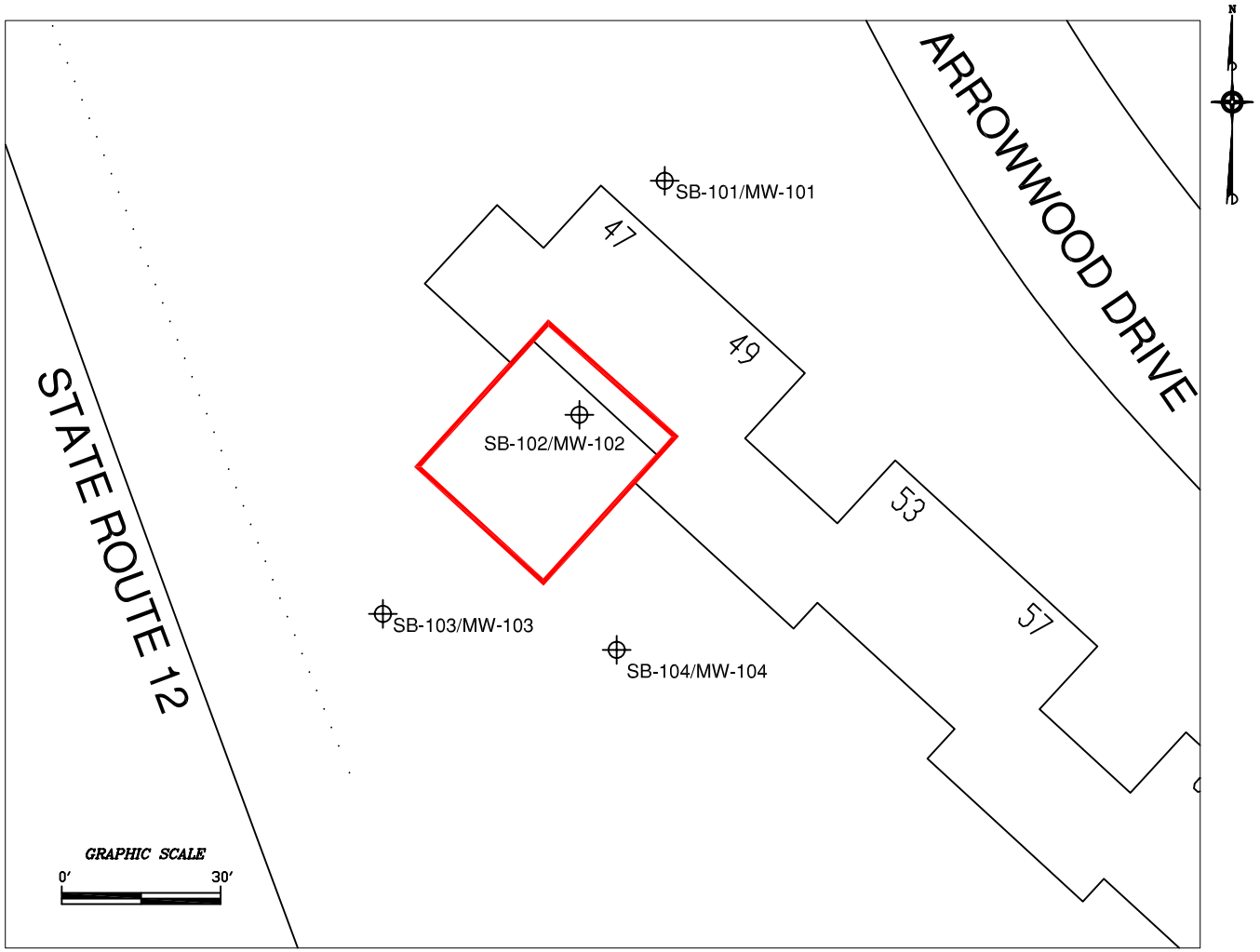
SCALE	AS NOTED
FILE	00869\0211\NP.DWG
REV	0
DATE	07/16/07
FIGURE NUMBER	1-2

ACAD: 00869\0211\NP.DWG 10/30/07 DWM

LEGEND

LIMITS OF JUNE 2006 SOIL EXCAVATION

PROPOSED MONITORING WELL LOCATION



NOTES:

1. BASE MAP PROVIDED BY NSB NEW LONDON
2. EXCAVATION LIMITS FROM DRAFT PROJECT CLOSEOUT REPORT FOR HOUSING UST REMEDIATION (TtEC, 2006)

TETRA TECH, INC.

FORMER 47/49 ARROWWOOD DRIVE

NAVAL SUBMARINE BASE NEW LONDON

GROTON, CONNECTICUT

SCALE	AS NOTED
FILE	00869\0211\NP.DWG
REV	0
DATE	10/30/07
FIGURE NUMBER	2-1

ACAD: 00869\0211\NP.DWG 09/04/07 DWM

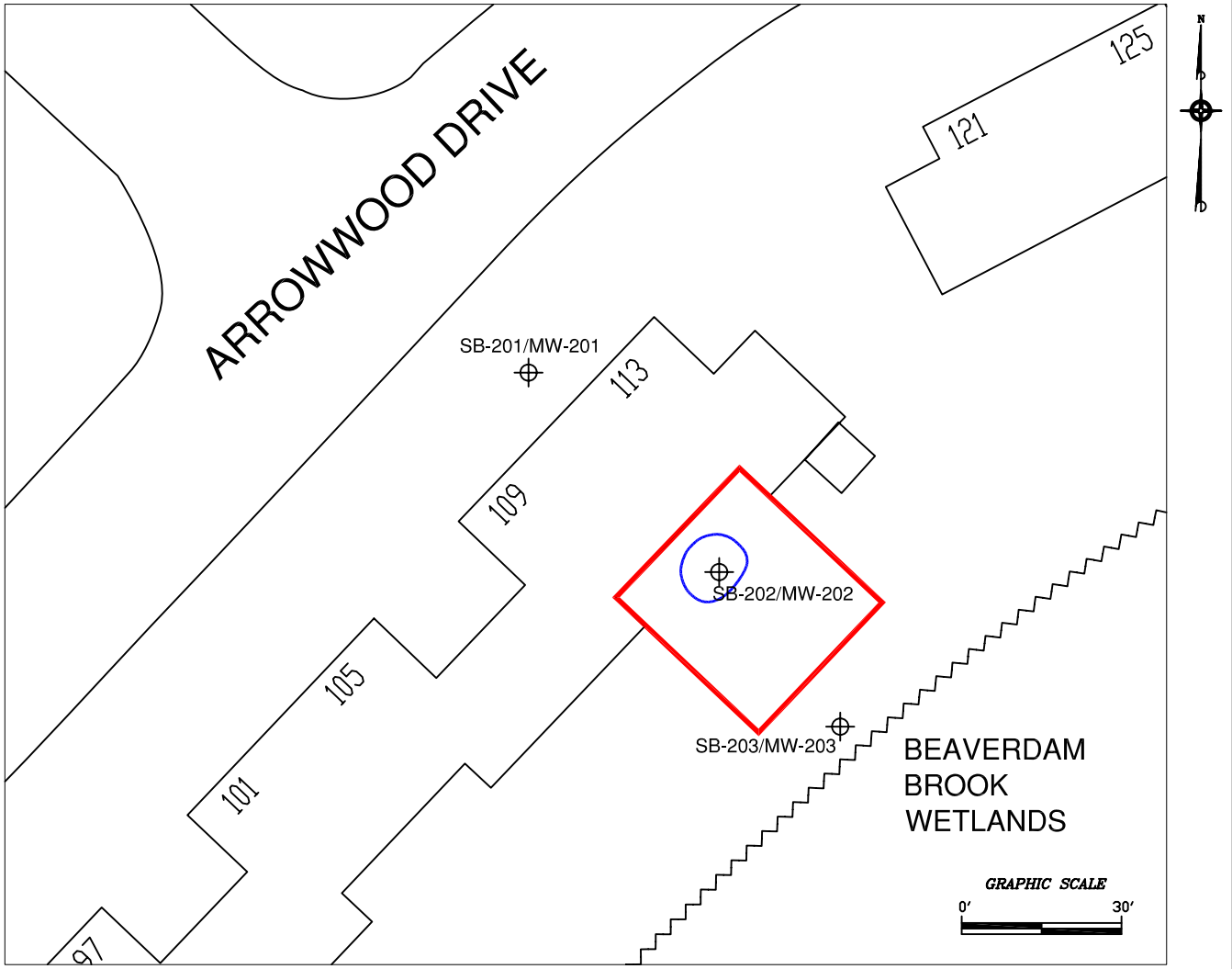
LEGEND

LIMITS OF MAY 2006 SOIL EXCAVATION

FORMER UST LOCATION

TREE LINE (APPROXIMATE)

PROPOSED MONITORING WELL LOCATION



NOTES:

1. BASE MAP PROVIDED BY NSB NEW LONDON
2. EXCAVATION LIMITS FROM DRAFT PROJECT CLOSEOUT REPORT FOR HOUSING UST REMEDIATION (TtEC, 2006)

TETRA TECH, INC.

FORMER 109/113 ARROWWOOD DRIVE

NAVAL SUBMARINE BASE NEW LONDON

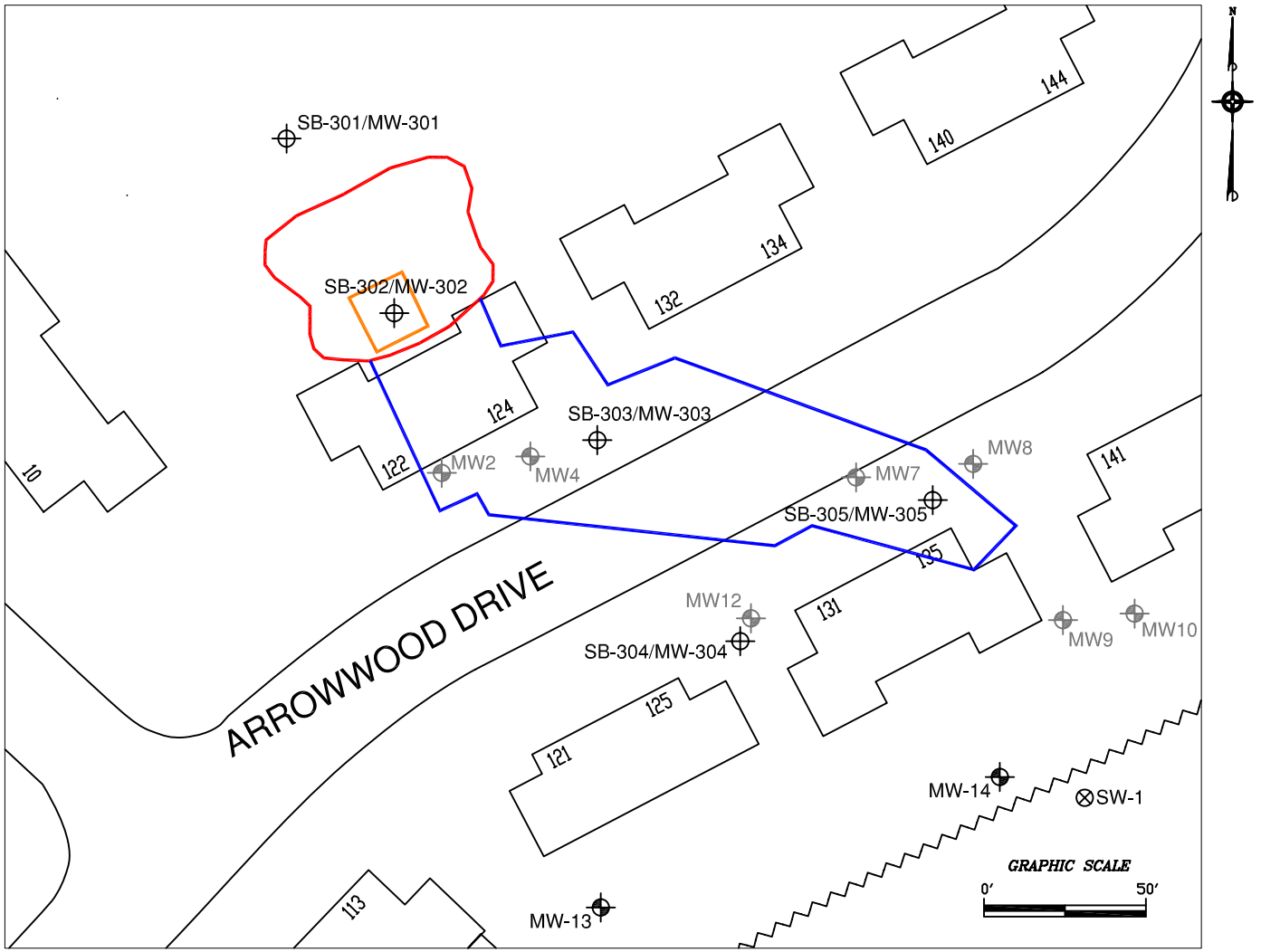
GROTON, CONNECTICUT

SCALE	AS NOTED
FILE	00869\0211\NP.DWG
REV	0
DATE	09/04/07
FIGURE NUMBER	2-2

ACAD: 00869\0211\NP.DWG 09/04/07 DWM

LEGEND

- LIMITS OF 2002 SOIL EXCAVATION
- LIMITS OF MAY 2006 SOIL EXCAVATION
- FORMER UST LOCATION
- TREE LINE (APPROXIMATE)
- PROPOSED MONITORING WELL LOCATION
- EXISTING MONITORING WELL LOCATION
- EXISTING SURFACE WATER SAMPLING LOCATION
- FORMER MONITORING WELL LOCATION



NOTES:

1. BASE MAP PROVIDED BY NSB NEW LONDON
2. EXCAVATION LIMITS FROM DRAFT PROJECT CLOSEOUT REPORT FOR HOUSING UST REMEDIATION (TtEC, 2006)

TETRA TECH, INC.

FORMER 122/124 ARROWWOOD DRIVE

NAVAL SUBMARINE BASE NEW LONDON

GROTON, CONNECTICUT

SCALE	AS NOTED
FILE	00869\0211\NP.DWG
REV	0
DATE	09/04/07
FIGURE NUMBER	2-3

ACAD: 00869\0211\NP.DWG 09/04/07 DWM

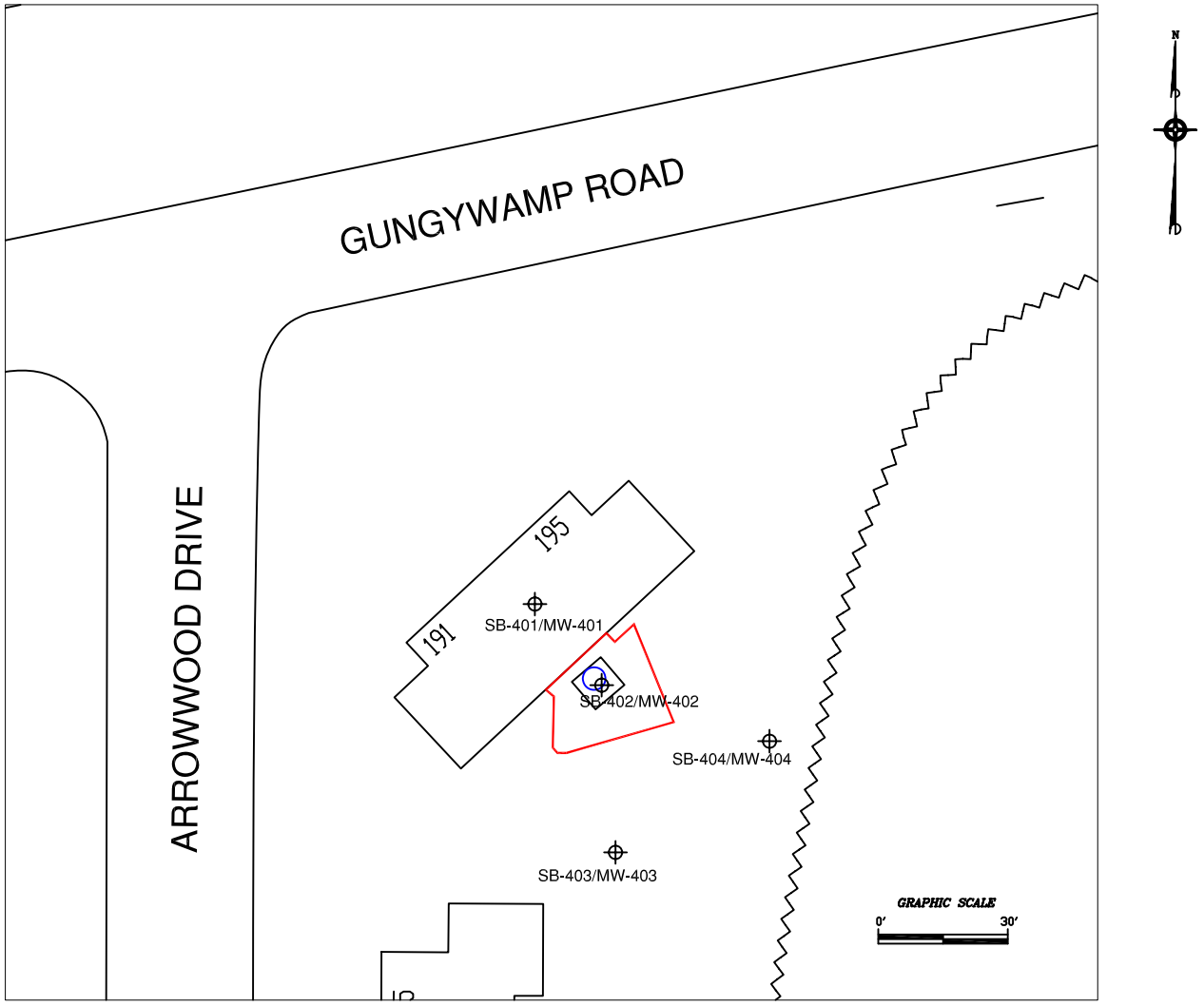
LEGEND

LIMITS OF MAY 2006 SOIL EXCAVATION

FORMER UST LOCATION

TREE LINE (APPROXIMATE)

PROPOSED MONITORING WELL LOCATION



NOTES:

1. BASE MAP PROVIDED BY NSB NEW LONDON
2. EXCAVATION LIMITS FROM DRAFT PROJECT CLOSEOUT REPORT FOR HOUSING UST REMEDIATION (TtEC, 2006)

TETRA TECH, INC.

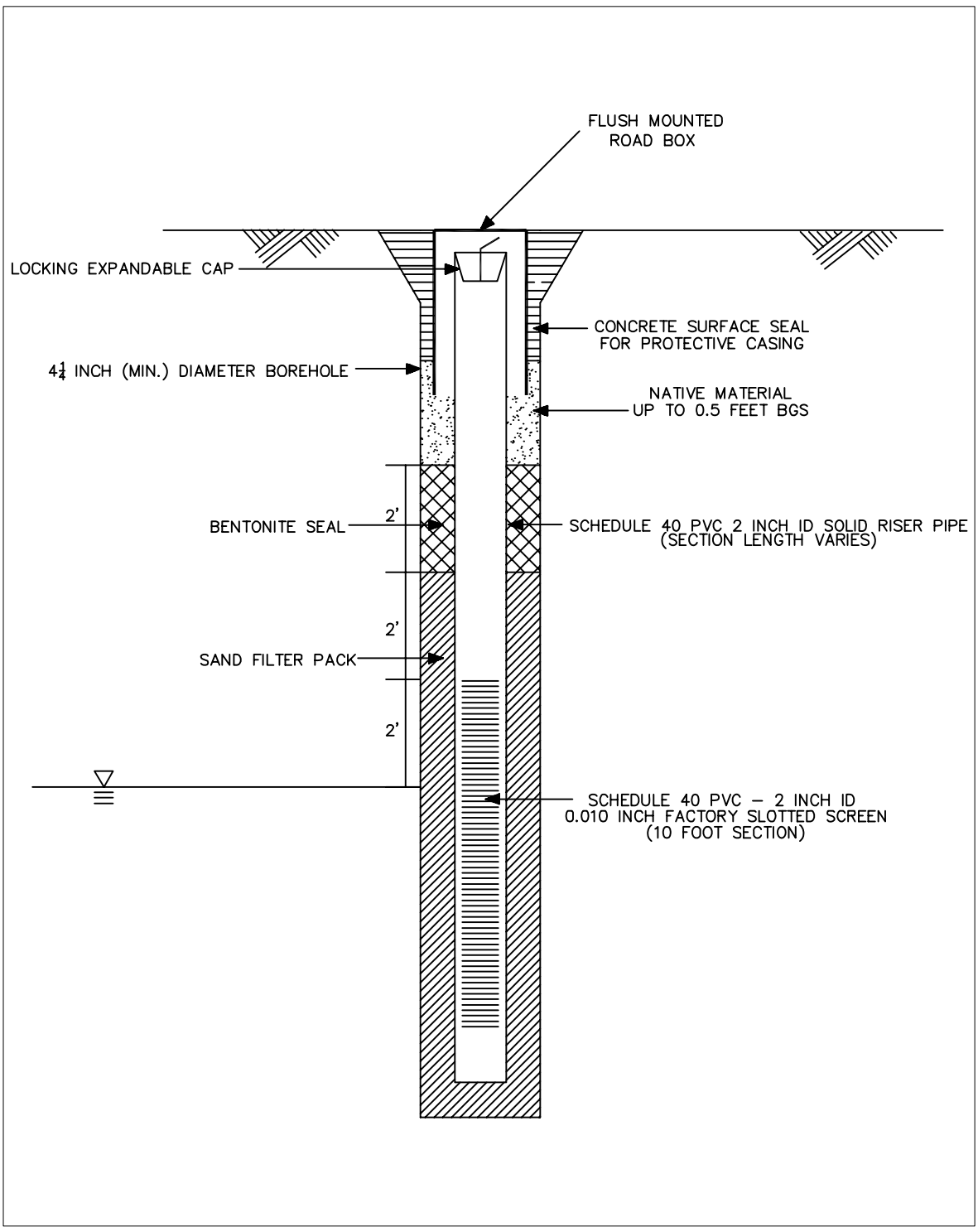
FORMER 191/195 ARROWWOOD DRIVE

NAVAL SUBMARINE BASE NEW LONDON

GROTON, CONNECTICUT

SCALE	AS NOTED
FILE	00869\0211\NP.DWG
REV	0
DATE	09/04/07
FIGURE NUMBER	2-4

ACAD: \00869\0211\WELL.DWG 07/16/07 DWM



TETRA TECH NUS, INC.

TYPICAL WELL CONSTRUCTION DETAIL
WELL INSTALLATION WORK PLAN
NAVAL SUBMARINE BASE NEW LONDON
GROTON, CONNECTICUT

SCALE	AS NOTED
FILE	\00869\0211\WELL.DWG
REV	0
DATE	07/16/07
FIGURE NUMBER	2–5

REFERENCES

REFERENCES

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EA, 2004. Post Treatment Sampling and Assessment Report; 122-124 Arrowwood Drive; November.

Goldsmith, 1960. Surficial Geology of the Uncasville Quadrangle, Connecticut. U.S. Geological Survey.

HRP Associates, 2006. Draft Groundwater Monitoring Report; 122-124 Arrowwood Drive, Nautilus Park in Groton, Connecticut; Naval Submarine Base New London, Connecticut.

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APPENDIX A

FIELD FORMS

BORING LOG FOR: _____ BORING NO.: _____

PROJECT NO.: _____ START DATE: _____

LOGGED BY: _____ TRANSCRIBED BY: _____ COMPLETION: DATE: _____

DRILLED BY (Company/Driller): _____ MON. WELL NO.: _____

GRD. SURFACE ELEVATION: _____ ELEVATION FROM: _____ CHECKED BY: _____

DEPTH (FEET)	BLOWS PER 6"	SAMP REC. / SAMP LENG.	SAMPLING TIME & SAMPLE NO. (QA/QC STATUS)	DEPTH MAT'L CHG./ WELL PROF'L	SOIL DENSITY/ CONSIS. or ROCK HARD.	CLR	MATERIAL CLASSIFICATION	USCS or ROCK BRKN	REMARKS (moisture condition; odors; geological classification; rock weathering; etc.)	FIELD SCREENING DATA *METHOD* = [FID, (PPM)]

TYPE OF DRILLING RIG: _____

METHOD OF ADVANCING BORING: _____

METHOD OF SOIL SAMPLING: _____

METHOD OF ROCK CORING: _____

GROUNDWATER LEVELS: _____

OTHER OBSERVATIONS: _____

Tetra Tech NUS, Inc.

BORING NO.:

PAGE: OF

TtNUS Form 0018

FLUSH MOUNT MONITORING WELL CONSTRUCTION LOG

TETRA TECH NUS INC.

PROJECT NAME: _____ PROJECT NO: _____

PROJECT LOCATION: _____ WELL NO: _____

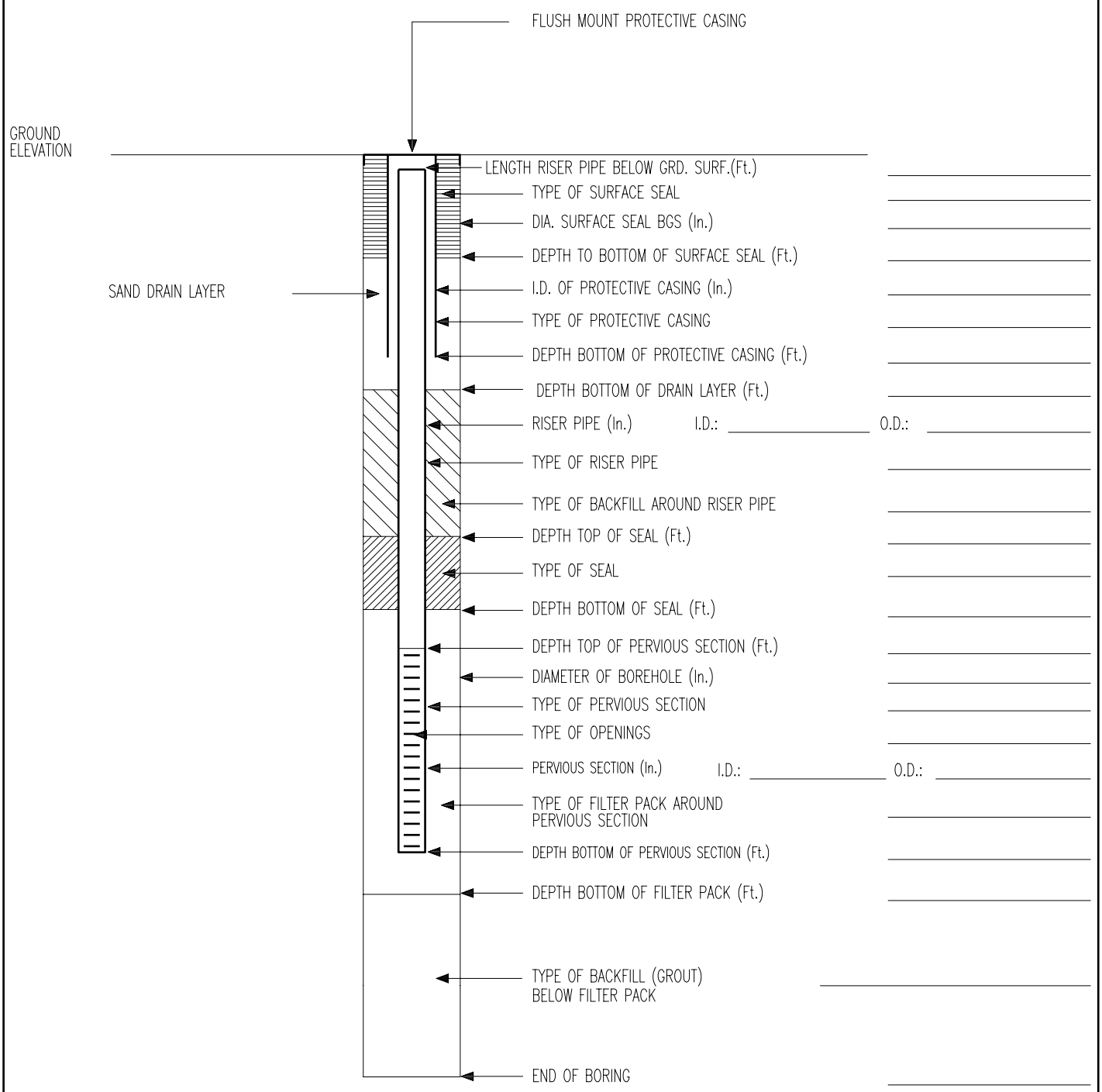
CLIENT: _____ BORING NO: _____

CONTRACTOR: _____ DRILLER: _____ BORING LOCATION:

LOGGED BY: _____ DATE: _____ _____

CHECKED BY: _____ DATE: _____ _____

PAGE: 1 OF 1



GENERAL NOTE:

1. Entry of 0.00 for Ground Elevation Indicates that Surveyed Ground Elevation is NOT Available.

TtNUS Form 0058