Statement of Basis
for
Site 6A – Fuel Calibration Area, Site 10B – Engine Test House, and On-Site Southern Area Plume

Naval Weapons Industrial Reserve Plant
Calverton, New York

Naval Facilities Engineering Command MidAtlantic

Contract Number N62472-03-D-0057

Contract Task Order 004

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STATEMENT OF BASIS
FOR
SITE 6A – FUEL CALIBRATION AREA,
SITE 10B – ENGINE TEST HOUSE, AND
ON-SITE SOUTHERN AREA PLUME

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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ACRONYMS

µg/L	microgram per liter
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
BTEX	benzene, toluene, ethylbenzene, and xylene
CAO	corrective action objective
cfm	cubic foot per minute
CMS	Corrective Measures Study
COC	chemical of concern
CVOC	chlorinated volatile organic compound
cy	cubic yard
DRO	Diesel Range Organics
EE/CA	Engineering Evaluation/Cost Analysis
FS	Feasibility Study
GAC	granular activated carbon
gpm	gallon per minute
GRO	Gasoline Range Organics
HI	hazard index
HNUS	Halliburton NUS
HRC®	Hydrogen Release Compound®
ICR	incremental cancer risk
IR	Installation Restoration
ISCO	In-Situ Chemical Oxidation
LUC	land use control
MCL	maximum contaminant level
mg/kg	milligram per kilogram
NWIRP	Naval Weapons Industrial Reserve Plant
NYCRR	New York Code of Rules and Regulations
O&M	operation and maintenance
ORC®	Oxygen Release Compound®
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PID	photoionization detector
ppm	part per million
PRG	preliminary remediation goal
RCRA	Resource Conservation and Recovery Act

RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
RI	Remedial Investigation
SI	Site Investigation
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TAGM	Technical and Administrative Guidance Memorandum
TCLP	Toxicity Characteristic Leaching Procedure
TPH	total petroleum hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
UST	underground storage tank
VOC	volatile organic compound

1.0 INTRODUCTION

This Statement of Basis has been prepared as a condition of the existing Resource Conservation and Recovery Act (RCRA) Part 373 Permit for the former Naval Weapons Industrial Reserve Plant (NWIRP) located in Calverton, Suffolk County, New York. Specifically, it is the intent of this Statement of Basis to explain the proposed corrective measures for the following Areas of Concern (AOCs): Old Fuel Calibration Area and Engine Test House, both located in Parcel B1. These AOCs are also referred to as Navy Installation Restoration (IR) Sites 6A and 10B, respectively. Although not listed as an AOC on the current Part 373 Permit, the On-Site Southern Area is being included in this Statement of Basis as an area of concern that was investigated because groundwater contamination was detected in a Suffolk County monitoring well downgradient of the NWIRP. As such, the On-Site Southern Area is considered to be part of the requirements of the Part 373 Permit for NWIRP Calverton. The Off-Site Southern Area is being addressed separately. The location of NWIRP Calverton is shown on Figure 1-1, and AOC/IR site locations are shown on Figure 1-2.

This Statement of Basis also includes a compendium of all engineering studies and remedial investigations completed, a description of the corrective measures evaluated, and the rationale for the proposed corrective measures for each site.

Section 2.0 of this document provides an overview of the former NWIRP Calverton facility, including descriptions of Sites 6A and 10B and the On-Site Southern Area. Descriptions of the remedial investigations conducted at these sites are presented in Section 3.0. Section 4.0 describes the corrective measures that were evaluated. Section 5.0 presents the conclusions of the Statement of Basis and the proposed corrective measures to be implemented.

A list of relevant reference documents including environmental investigation reports and corrective measures studies can be found at http://nwirp-calverton.adminrecord.org/.

2.0 FACILITY AND SITE DESCRIPTIONS

This section provides a general overview of the former NWIRP Calverton facility and descriptions of Sites 6A and 10B and the Southern Area. Figure 2-1 shows the locations and physical features of these sites.

2.1 FACILITY LOCATION AND DESCRIPTION

The Navy's Calverton facility is located in Suffolk County on Long Island, approximately 70 miles east of New York City. Formerly engaged in the manufacture of aircraft parts and subassemblies, the Calverton facility has phased out all of its manufacturing process operations, and the former operator of the facility, the Northrop Grumman Corporation, vacated the property in February 1996. Since that time, all the property contained within the perimeter fence, with the exception of four noncontiguous parcels of land totaling approximately 350 acres that are being retained by the Navy to continue IR Program activities, have been conveyed to the Town of Riverhead. There are currently no operational activities being conducted on the Navy's 350 acres. Provided below is a description of the IR sites contained within each parcel:

Parcel	IR Sites	Latitude	Longitude
Parcel A	Fire Training Area (IR Site 2)	N 40° 54' 26"	W 72° 48' 08"
Parcel B1	Fuel Calibration Area (IR Site 6A)	N 40° 54' 38"	W 72° 47' 25"
	Engine Test House (IR Site 10B)		
Parcel B2	On-Site Southern Area	N 40° 54' 28"	W 72° 47' 05"
Parcel C	Fuel Depot Area (IR Site 7)	N 40° 54' 51"	W 72° 47' 54"
	Jet Fuel Systems Lab (IR Site 10A)		
Parcel D	Northeast Pond Disposal Area (IR Site 1)	N 40° 55' 29"	W 72° 46' 52"
	Electronic Countermeasures Area (IR Site 9)		

There are no longer any process-type operations being conducted at the Calverton facility that could generate hazardous waste nor are there any requirements for storage of hazardous materials on the Navy's property. Similarly, there will be no hazardous materials brought onto the Calverton property to be used as part of any process-type operations. Also, the Navy will not be operating a hazardous waste storage area that would require permitting pursuant to 6 New York Code of Rules and Regulations (NYCRR) Part 373. Rather, all wastes generated as a result of continuation of the Navy's IR Program will be managed at each parcel location for which a corrective action is taking place. As such, these parcels should be considered as less than 90-day storage areas that are exempt from 6 NYCRR Part 373 permit requirements.

General descriptions of the Navy IR sites included in this Statement of Basis are provided below.

2.2 SITE 6A – FUEL CALIBRATION AREA

Site 6A is located in Parcel B1 near the south-central portion of the former NWIRP Calverton facility, approximately 2,000 feet north of River Road and 2,000 feet west of the southern gate. Site 6A and related facilities were used in the testing of aircraft fuel and engine systems, which may have resulted in frequent, small fuel spills to the area's pavement. Minor maintenance and repairs to the fuel and engine systems were also conducted at the site, and solvents were used during these activities and were likely spilled during their use.

Site 6A consists of new and old fuel calibration pads. The old fuel calibration pad was located in what is now an open, grass-covered field in an area now partially covered by a wastewater treatment facility. No physical evidence exists of the old calibration area. The new fuel calibration pad is located north and east of the old calibration pad on a concrete apron. The concrete apron between the two fuel calibration pads was also used for the same activities. A shed, piping, and fuel-filtering devices were located in the area in the 1980s. The equipment has since been removed.

A former underground storage tank (UST) was located south of Building 231. It was removed in the early 1990s.

2.3 SITE 10B – ENGINE TEST HOUSE

Site 10B is located approximately 1,000 feet south of Site 6A in Parcel B1. The area consists of a building, surrounding pad, sparse woods, and open grassy areas. A drainage swale and culvert from Site 6A run adjacent to and hydraulically upgradient of Site 10B. Groundwater from Site 6A can enter this swale and flow past Site 10B. Also, from the late 1980s to the early 1990s, groundwater from Site 6A was discharged into this drainage swale and culvert.

Fuel-type contamination was found in the area of a UST that was removed in the mid-1990s. Approximately 80 cubic yards (cy) of fuel-contaminated soil were excavated during removal of the UST. The excavation did not continue under the concrete pad at Site 10B.

2.4 SOUTHERN AREA

The Southern Area is located southeast of Site 10B in Parcel B2 and extends off site to the southeast. This area was investigated because chlorinated solvents were detected in a Suffolk County monitoring well downgradient of the facility. There are no known or suspected contaminant sources within this area.

However, the area is hydraulically downgradient of Site 6A, Site 10B, and the NWIRP general industrial complex. The groundwater flow direction though this area is southeast toward the Peconic River.

The area is mostly wooded and includes two shallow ponds near the northern edge. The ponds receive runoff through a drainage swale and culvert from Site 6A. From the late 1980s to the early 1990s, groundwater from Site 6A was discharged into this drainage swale and culvert and into the western pond. As a result, the presence of chlorinated solvents in groundwater at the Southern Area may be attributable to Site 6A.

3.0 REMEDIAL INVESTIGATIONS

This section describes the environmental investigations conducted at Site 6A – Fuel Calibration Area, Site 10B – Engine Test House, and the Southern Area. An evaluation of the vapor intrusion pathway is also included.

3.1 SITE 6A – FUEL CALIBRATION AREA

3.1.1 Free Product Removal

A free product recovery system including a pumping well, a free product recovery well, and an oil/water separator tank was installed in 1987 and shut down in 1993. Free product recovery using hand bailing continued after the system was shut down. Approximately 1,900 gallons of petroleum product were removed from the site.

3.1.2 Site Investigation

In 1991 and 1992, a Site Investigation (SI) was conducted at several sites including Site 6A (HNUS Environmental, 1992). The investigation at Site 6A consisted of collecting a limited number of soil and groundwater samples to determine whether contamination was present. The investigation found soil and groundwater contamination at Site 6A.

3.1.3 RCRA Facility Investigation

A RCRA Facility Investigation (RFI) was conducted in 1994 and 1995 to delineate the nature and extent of soil and groundwater contamination (HNUS, 1995a). A soil-gas survey at 49 locations and 13 soil borings were used to define the horizontal and vertical extent of soil contamination and to collect soil samples for chemical analysis. Volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and lead were detected in fuel calibration area soil. The VOCs detected were 1,1,1-trichloroethane, 2-butanone, ethylbenzene, xylenes, and Freon-113. The contamination appeared to be localized in an area adjacent to and south of the concrete pad. Polynuclear aromatic hydrocarbons (PAHs) and phthalate esters were detected at several locations; however, only the PAH benzo(a)pyrene was detected at one location at a concentration greater than the state soil action level. Lead concentrations were similar to background levels.

Eighteen temporary monitoring wells, two shallow permanent monitoring wells, and four permanent monitoring well clusters were installed, and two rounds of groundwater sampling were conducted. VOCs and SVOCs were detected at concentrations greater than state and federal drinking water standards

and/or state groundwater quality standards. Floating free product was also detected at the locations of the most contaminated groundwater.

The baseline risk assessment identified potential unacceptable risks under a hypothetical future residential land use scenario. The majority of the potential risk was attributable to exposure to chemicals detected in groundwater. There were no unacceptable risks from exposure to chemicals detected in soil.

3.1.4 Phase 2 RFI and Engineering Evaluation/Cost Analysis

An Engineering Evaluation/Cost Analysis (EE/CA) was prepared to evaluate non-time-critical removal actions at four sites, including Site 6A (TtNUS, 1998). The EE/CA report also included the results of the Phase 2 RFI. In 1997, additional groundwater sampling during Phase 2 of the RFI confirmed the extent of groundwater contamination identified during the initial RFI. Phase 2 of the RFI also included an investigation of the area east of the new fuel calibration pad to determine whether free product was present. Five soil borings were installed, and soil samples were collected at the soil/groundwater interface. A significant free product layer was not detected.

In March 1998, free product recovery tests were performed in two wells. The tests indicated that free product recovery was present; however, the product recovery rates were very low (0.03 gallon per day). Sampling and analysis of free product indicated that it contained polychlorinated biphenyls (PCBs).

3.1.5 Phase 2 Remedial Investigation and Supplemental Groundwater Investigation

The Phase 2 Remedial Investigation (RI), which was previously referred to as the Phase 2 RFI, was conducted in 1997 and included Site 6A, Site 10B, and the Southern Area. At Site 6A, 13 temporary monitoring wells were installed and sampled. In addition, two shallow permanent wells were installed between Sites 6A and 10B and sampled.

A Supplemental Groundwater Investigation was conducted in 2000 and also included Site 6A, Site 10B, and the Southern Area. The Phase 2 RI Report (TtNUS, 2001) included the results the Phase 2 RI and the supplemental investigation. The supplemental investigation activities relevant to Site 6A included sampling two existing permanent monitoring wells, installation and sampling of three temporary monitoring wells at the calibration pad, and installation and sampling of two temporary monitoring wells between Site 6A and Site 10B. Results indicated that groundwater contamination was associated with the old fuel calibration pad and the new fuel calibration pad. The contamination extended east and south from the old pad. The types of contaminants in groundwater were 1,1,1-trichloroethane and breakdown products such as 1,1-dichloroethane. Floating free product and fuel-related contaminants such as benzene, ethyl benzene, toluene, and xylenes were also identified within this area.

3.1.6 Site 6A and Southern Area Supplemental Investigation

Previous investigations determined the nature and horizontal extent of groundwater contamination at Site 6A. The purpose of the supplemental investigation at Site 6A was to refine the vertical extent of groundwater contamination (TtNUS, 2005). Groundwater samples were collected from 10 existing wells and nine new piezometers installed and sampled at various depths. The analytical results from the existing monitoring wells confirmed the results of the previous investigations; however, the supplemental investigation concluded that chemical concentrations had decreased.

The Data Summary Report (TtNUS, 2005) confirmed that contaminated groundwater from Site 6A flows south and east through Site 10B and the Southern Area toward the Peconic River. Groundwater between Site 6A and the Peconic River is also contaminated, but investigations in the area found that the contamination is not continuous.

3.1.7 Site 6A Data Gap Investigation

A data gap investigation (TtNUS, 2006a) was conducted in 2006 to refine the extent of soil contamination initially identified during the RFI. Soil borings were advanced at 25 locations, and surface and subsurface soil samples were collected to refine the horizontal and vertical extent of petroleum-contaminated soil. An area of PCB-contaminated soil was identified within the area of petroleum-contaminated soil. Samples were analyzed using PCB field test kits, and the results were confirmed by samples submitted to a fixed-base laboratory.

3.1.8 Evaluation of Soil Vapor Intrusion

There are no buildings at Site 6A. Therefore, VOCs in soil or groundwater could not vaporize and migrate into a building.

3.2 SITE 10B – ENGINE TEST HOUSE

3.2.1 RCRA Facility Assessment

The Engine Test House was initially evaluated as part of a 1995 RCRA Facility Assessment (RFA) cesspool/leach field investigation (HNUS, 1995b). During the RFA, five soil-gas samples and one groundwater sample were collected at Site 10B. Soil-gas analytical results detected 1,1,1-trichloroethane, toluene, and xylenes. Subsequent testing during the RFA Addendum found that the cesspool at this site was not a source of environmental contamination. Seven soil samples and seven groundwater samples were collected from around the cesspool and a former UST location. No VOCs

were detected in groundwater around the cesspool. However, fuel-type contamination was detected in groundwater near the former UST. Results from soil sampling indicated that free product may be present at the soil/groundwater interface. Approximately 80 cy of soil were removed when the UST was removed in the mid-1990s, before the RFA.

3.2.2 Phase 2 RFI and Engineering Evaluation/Cost Analysis

An EE/CA was prepared to evaluate non-time-critical removal actions at four sites, including Site 10B (TtNUS, 1998). The EE/CA report also included the results of the Phase 2 RFI. In 1997, a Phase 2 RFI was conducted to determine the extent of free product and contaminated groundwater at Site 10B. Ten soil borings were installed, and soil samples were collected at the soil/groundwater interface and analyzed for total petroleum hydrocarbons (TPH) Diesel Range Organics (DRO) and Gasoline Range Organics (GRO). The results indicated that free product may be present. Sixteen temporary monitoring wells were installed to support the investigation of Site 10B and other nearby sites. Fuel-type VOCs were detected just downgradient of the former UST. Chlorinated VOCs were also detected in groundwater; however, the suspected source was migration of contaminated groundwater from Site 6A.

In March 1998, an effort was made to perform free product recovery tests; however, the tests were not performed because of an insufficient amount of free product in the wells.

3.2.3 Phase 2 Remedial Investigation and Supplemental Groundwater Investigation

The Phase 2 RI, which was previously referred to as the Phase 2 RFI, was conducted in 1997 and included Site 6A, Site 10B, and the Southern Area. At Site 10B, 16 temporary monitoring wells were installed and sampled. In addition, two permanent monitoring wells were installed between Sites 6A and 10B and sampled.

A Supplemental Groundwater Investigation conducted in 2000 also included Site 6A, Site 10B, and the Southern Area. The Phase 2 RI Report (TtNUS, 2001) included the results of the Phase 2 RI and the supplemental investigation. The supplemental investigation activities relevant to Site 10B included sampling of the two permanent monitoring wells installed between Sites 6A and 10B. The remainder of the supplemental investigation focused on Site 6A and the Southern Area.

3.2.4 Evaluation of Soil Vapor Intrusion

VOCs in soil and groundwater at Site 10B could vaporize and migrate into the Engine Test House. However, this building is to be removed as part of the proposed corrective action (TtNUS, 2006b). Therefore, vapor intrusion would not be a concern at the completion of the corrective action.

3.3 SOUTHERN AREA

3.3.1 Phase 2 RI and Supplemental Groundwater Investigation

The Phase 2 RI was conducted in 1997 and included Site 6A, Site 10B, and the Southern Area. At the Southern Area, 13 temporary monitoring wells were installed and sampled.

A Supplemental Groundwater Investigation conducted in 2000 also included Site 6A, Site 10B, and the Southern Area. The Phase 2 RI Report (TtNUS, 2001) included the results of the Phase 2 RI and the supplemental investigation. A portion of this investigation focused on groundwater contamination in the Southern Area. Four temporary wells were installed south of the facility and sampled. Twelve temporary piezometers were installed in clusters at four locations near the Peconic River. The piezometers were used for groundwater sampling at various depths and to evaluate the groundwater flow direction near the river. VOCs detected in groundwater were consistent with those observed in the Site 6A groundwater extraction system (free product removal) discharge. The primary discharge point for the extraction system was approximately 600 feet hydraulically upgradient of the most contaminated Southern Area wells. The groundwater contamination at Site 6A and the Southern Area is not continuous, and large areas exist in which no groundwater contamination has been observed.

Two surface water samples were collected from the Peconic River and analyzed. There was no evidence that the river had been impacted.

3.3.2 Site 6A and Southern Area Supplemental Investigation

The supplemental investigation at the Southern Area included the Peconic River Sportsman's Club area, the Peconic River area, and the Swan Pond area southeast of Site 6A (TtNUS, 2005). Private wells at the Sportsman's Club were shut down by the Suffolk County Department of Health because of environmental contamination. The groundwater sampling program for the Southern Area included collecting groundwater samples from nine piezometers. The groundwater sample collected from the Swam Pond area confirmed the southwestern boundary of the Southern Area groundwater contamination. Groundwater samples collected from the Sportsman's Club confirmed the presence of chlorinated VOCs. Groundwater samples collected from the Peconic River area helped to refine the horizontal and vertical extent of groundwater contamination.

Surface water samples were collected from two locations along the Peconic River. VOCs were not detected, which indicates that surface water is not being impacted by groundwater contamination in the area.

The Data Summary Report (TtNUS, 2005) concluded that contaminated groundwater flows south and east from Site 6A through Site 10B and the Southern Area toward the Peconic River. However, investigations at Site 6A, Site 10B, and the Southern Area found that groundwater contamination is not continuous in this area.

3.3.3 Evaluation of Vapor Intrusion

There are no buildings at the On-Site Southern Area. Therefore, VOCs in soil or groundwater could not vaporize and migrate into a building. The Off-Site Southern Area is being addressed separately.

3.4 SUMMARY OF EXTENT OF CONTAMINATION AND SITE RISKS

3.4.1 Site 6A – Fuel Calibration Area

3.4.1.1 Soil

The results of the RFI indicated the presence of VOCs at relatively low to moderate concentrations. The RFI also indicated that petroleum free product remained at the site and had formed a smear zone in vadose zone soil. The petroleum product was most likely derived from jet fuel used in the area. The VOCs and petroleum product were estimated to be present in an area underneath and south of the concrete pad (Figure 3-1). Subsequent testing of free product determined that it contained PCBs. Free product remaining at Site 6A is mostly absorbed on site soil in a smear zone and is not directly recoverable as a liquid.

The 2006 data gap investigation was performed to further define the extent of petroleum- and PCB-contaminated soil. The revised extent of soil contamination including data gap investigation results is presented on Figure 3-2. The extent of PCB contamination is presented on Figure 3-3.

3.4.1.2 Groundwater

Chlorinated solvents and fuel-type VOCs have been consistently detected in Site 6A groundwater; however, concentrations decreased significantly from 1994 to 2005. VOCs detected in groundwater samples collected in 1997, 2000, and 2005 at concentrations greater than state groundwater quality criteria included 1,1,1-trichloroethane, 1,1-dichloroethane, 1,1-dichloroethene, benzene, chloroethane, ethylbenzene, toluene, and xylenes. The greatest concentrations of contamination have typically been detected in the upper 10 feet of the aquifer; however, contamination has been detected as deep as 52 feet (approximately 47 feet below the water table). The horizontal extent of Site 6A groundwater contamination based on the 2005 data set is shown on Figure 3-4.

3.4.1.3 Summary of Site Risks

The risk assessment was conducted to estimate the incremental cancer risk (ICR) and noncancer hazard index (HI) from exposure to soil and groundwater. The qualitative risk assessment compared contaminant concentrations to regulatory standards and criteria for soil and groundwater.

The results of the Site 6A risk assessment showed that adverse risks to human health would only be expected from direct contact with soil and ingestion of groundwater under a hypothetical future residential land use scenario. The HI exceeded 1.0 only for domestic use of groundwater. The ICR calculated for soil was 8.1E-06, and the ICR calculated for groundwater was 3.5E-03. The primary chemicals of concern (COCs) for future residents include chlorinated and non-chlorinated solvents, PAHs, substituted benzene compounds (e.g., 1,2-dichlorobenzene), phenolics, and naphthalene compounds.

3.4.1.4 Exceedances of Regulatory Standards and Criteria

Although no federal standards are generally available for evaluating soil in a qualitative manner, the State of New York has adopted soil criteria designed to be protective of the environment (i.e., groundwater). The criteria are identified in Technical and Administrative Guidance Memorandum (TAGM) Number 4046, Soil Cleanup Objectives and Cleanup Levels. At least one reported analytical result each for xylenes, benzo(a)pyrene, isophorone, 2-methylnaphthalene, naphthalene, nitrobenzene, 2-nitrophenol, and phenol was greater that its TAGM 4046 standard.

Concentrations of chlorinated and fuel-related VOCs were greater that federal or state maximum contaminant levels (MCLs) for public water supplies and/or state groundwater quality standards in at least one sample for all detected chemicals. Detected chemicals include 1,1,1-trichloroethane, 1,2-dichlorobenzene, 1,1-dichloroethane, 1,1-dichloroethene, benzene, chloroethane, ethylbenzene, toluene, total xylenes, 2-methylnaphthalene, 4-methylphenol, and naphthalene.

3.4.2 Site 10B – Engine Test House

3.4.2.1 Soil

In 1997, soil samples were collected from the soil/groundwater interface and analyzed for TPH. Two sample locations, which are shown on Figure 3-1, contained TPH concentrations that indicated that free product may be present. Subsequent testing indicated no measurable free product and that the free product is mostly absorbed on site soils in a smear zone and not directly recoverable as a liquid. The area of fuel-related soil contamination appeared to be localized to an area beneath and west of the concrete pad (see Figure 3-1).

3.4.2.2 Groundwater

Groundwater at Site 10B was last investigated in 1997. Fuel-type VOCs were detected at concentrations greater than state groundwater quality criteria in samples from three wells located just downgradient of the former UST and in a sample from a temporary well located further downgradient. The fuel-type chemicals detected included benzene, ethylbenzene, toluene, and xylenes. Significant fuel-type contamination was not detected at other locations. The estimated horizontal extent of fuel-type VOC contamination is shown on Figure 3-4. The fuel-type contamination was generally detected within the upper 20 feet of the water table aquifer. Fuel-type contamination was sporadically detected at low concentrations at greater depths, but this contamination may be attributable to Site 6A, which is hydraulically upgradient of Site 10B.

3.4.2.3 Summary of Site Risks

A baseline risk assessment was not completed for Site 10B; however, because the contaminants released are similar to those at Site 6A, the risks associated with Site 10B media would probably be similar to those at Site 6A. Some of the contaminated soil associated with the former UST was previously remediated, which may have reduced the risks associated with Site 10B.

3.4.2.4 Exceedances of Regulatory Standards and Criteria

Concentrations of fuel-related VOCs were greater than federal and/or state MCLs and/or state groundwater quality standards in at least one sample for all detected chemicals, which included benzene, ethylbenzene, toluene, and total xylenes.

3.4.3 Southern Area (On Site)

3.4.3.1 Groundwater

The Southern Area is a general area of contamination located downgradient of Sites 6A and 10B (see Figure 3-5). Contamination, which is not contiguous throughout this area, consists of chlorinated solvents and is believed to have resulted from either intermittent releases at Sites 6A and 10B or from potential overland migration through a series of ditches and ponds in the area. This Statement of Basis addresses only the on-site portion, which includes the area north of Grumman Boulevard. The greatest detected concentrations were near and downgradient of Site 10B. The contamination was generally detected within the upper 40 feet of the water table aquifer. The Southern Area extends from Sites 6A and 10B to near the Peconic River.

3.4.3.2 Summary of Site Risks

A baseline risk assessment was not completed for the On-Site Southern Area. The contaminants detected in groundwater in the On-Site Southern Area Plume are similar to those found in groundwater at Sites 6A and 10B. The risks from exposure to groundwater in the On-Site Southern Area Plume would be comparable but lower than the risks from exposure to groundwater at Site 6A.

3.4.3.3 Exceedances of Regulatory Standards and Criteria

Concentrations of chlorinated VOCs were greater than federal and/or state MCLs and/or state groundwater quality standards in at least one sample for all detected chemicals. Detected chemicals associated with the On-Site Southern Area Plume included 1,1,1-trichloroethane, 1,1,2 trichlorofluoroethane (Freon-113), 1,1-dichloroethane, 1,1-dichlorothene, bromomethane, chlorobenzene, chloroethane, chloroform, methylene chloride, and vinyl chloride.

4.0 CORRECTIVE MEASURES ALTERNATIVES

This section describes the corrective measures alternatives developed and evaluated in the Feasibility Study (FS)/Corrective Measures Study (CMS) (TtNUS, 2006b) for Site 6A – Fuel Calibration Area, Site 10B – Engine Test House, and the On-Site Southern Area Plume. Separate alternatives were developed for contaminated soil at Sites 6A and 10B, contaminated groundwater at Sites 6A and 10B, and contaminated groundwater at the On-Site Southern Area.

Corrective action objectives (CAOs) were developed in the FS/CMS for each site as medium-specific and contaminant-specific objectives that will result in the protection of human health and the environment. The CAOs are based on the contaminants, results of the risk assessment, and compliance with applicable federal and state regulations and guidance.

The CAOs for contaminated soil are as follows:

- Prevent human exposure (ingestion, dermal contact, and dust inhalation) to contaminated soil with concentrations greater than preliminary remediation goals (PRGs).

- Prevent leaching of contaminants at resultant groundwater concentrations greater than groundwater PRGs.

- Comply with chemical-, location-, and action-specific applicable or relevant and appropriate requirements (ARARs) and guidance.

The PRGs for soil at Site 6A are provided in Table 4-1.

No chemical-specific analyses were performed on soil samples from Site 10B; however, TPH DRO and GRO analyses performed on 10 samples indicated that fuel-related contamination, primarily SVOCs with some VOCs, was present. The following recommended soil cleanup objectives from TAGM 4046 were selected as PRGs for soil:

- Individual VOCs and SVOCs less than TAGM 4046 values
- Total VOCs less than 10 milligrams per kilogram (mg/kg).
- Total SVOCs less than 100 mg/kg.
- Individual SVOCs less than 50 mg/kg.
- Soil shall not exhibit a discernable odor nuisance.

When chemical-specific soil data are available prior to completion of the remedial design, the PRG list will be amended, and the soil cleanup objectives from TAGM 4046 will be used to develop chemical-specific PRGs for soil.

The CAOs for contaminated groundwater are as follows:

- Prevent human exposure (through ingestion, dermal contact, and inhalation) to groundwater having contaminant concentrations greater than PRGs.

- Restore contaminated groundwater quality to PRGs to the maximum extent that is technically feasible.

- Comply with chemical-, location-, and action-specific ARARs and guidance.

The PRGs for groundwater for Site 6A is provided in Table 4-2, and the PRGs for Site 10B and the On-Site Southern Area Plume are provided in Table 4-3.

4.1 SITES 6A AND 10B SOIL

The alternatives analyzed for Sites 6A and 10B soil are presented below and are numbered to correspond with the numbers in the FS/CMS Report. The alternatives are as follows:

- Alternative S1: No Action

- Alternative S2: Land Use Controls (LUCs)/Deed Notifications and Monitoring

- Alternative S3: Excavation and Off-Site Treatment and Disposal

- Alternative S4: Excavation, On-Site Treatment (Thermal), and On-Site Re-Use

- Alternative S5: LUCs/Deed Notifications, In-Situ Treatment (Soil Vapor Extraction, and Monitoring)

- Alternative S6: LUCs/Deed Notifications, Monitoring, and Excavation of PCB-Contaminated Hot Spots and Off-Site Treatment/Disposal

- Alternative S7: Excavation of PCB-Contaminated Hot Spots and Off-Site Treatment/Disposal and In-Situ Treatment of Petroleum- and Solvent-Contaminated Soil by In-Situ Chemical Oxidation (ISCO)

4.1.1 Alternative S1: No Action

The no-action alternative is evaluated to establish a baseline for comparison. Under this alternative, no further action would be taken to prevent exposure to soil contamination at Sites 6A and 10B. There are no costs associated with the no-action alternative.

4.1.2 Alternative S2: LUCs/Deed Notifications and Monitoring

LUCs would be implemented by the Navy while it retains ownership of the property, and deed notifications would be incorporated into the facility transfer documents when the property is transferred by the Navy. These controls would restrict access to and use of contaminated soil across approximately 41,640 square feet (0.96 acre) at Site 6A and approximately 10,300 square feet (0.2 acre) at Site 10B. An investigation would be conducted at each site to confirm the extent of contamination and the COCs. Approximately 30 soil samples would be collected and analyzed for VOCs, SVOCs, PAHs, TPH-DRO, pesticides/PCBs, and Toxicity Characteristic Leaching Procedure (TCLP) metals.

This alternative also includes monitoring of soil contaminant concentrations as they degrade by natural processes to determine when the controls on the soil can be removed. Approximately four soil samples would be collected from each site during each soil monitoring event and analyzed for VOCs, SVOCs, PAHs, PCBs, and TPH-DRO. A total of seven soil sampling events would be conducted including a baseline event and six rounds of sampling at 5-year intervals for the next 30 years. A re-evaluation of the sites would be performed every 5 years to determine whether any changes to the controls or remedy would be required.

The estimated costs for Alternative S2 are as follows:

- Capital cost: $227,000
- Operation and maintenance (O&M) cost: $0 per year
- Monitoring cost: $1,000 per year
  $36,000 every 5 years
- Present worth: $317,000

4.1.3 Alternative S3: Excavation and Off-Site Treatment and Disposal

Prior to implementing this alternative, a pre-design investigation would be conducted at both sites to confirm the extent of contamination and the COCs. Approximately 30 samples would be collected at each site and analyzed for VOCs, SVOCs, PAHs, TPH-DRO, pesticides/PCBs, and TCLP metals.

Excavation at Site 6A would require the removal of approximately 320 cubic yards (cy) of reinforced concrete pad. The concrete would be stockpiled and analyzed for disposal purposes. Depending on the results, the concrete would be disposed or reused off site as appropriate. Approximately 7,420 cy of uncontaminated soil overlies the area of contaminated soil. The uncontaminated soil would be excavated, stockpiled, analyzed to verify that COC concentrations are less than PRGs, and used as backfill. Approximately 3,380 cy of contaminated soil would be removed, tested for disposal purposes, and disposed off site as a nonhazardous or hazardous waste, depending on the testing results. Verification samples would be collected to confirm the removal of contaminants in excess of PRGs, and additional contaminated soil would be removed, if required. The excavated area would be backfilled with a combination of on-site uncontaminated soil and additional clean fill from off-site sources. Disturbed areas would be vegetated with grass.

A similar sequence of activities would be conducted for Site 10B. Excavation at Site 10B would require the removal of a steel building and approximately 240 cy of reinforced concrete, 1,860 cy of uncontaminated soil, and 770 cy of contaminated soil. Verification samples would be collected to confirm the removal of contaminants in excess of PRGs. After excavation is complete, the uncontaminated soil and additional clean fill from an off-site source would be used to fill the excavation and restore the site. Disturbed areas would be vegetated with grass.

There would be no restrictions related to soil at Sites 6A and 10B after Alternative S3 is complete, and 5-year reviews would not be required. Alternative S3 is expected to take less than 6 months to complete. The estimated costs for Alternative S3 are as follows:

- Capital cost: $3,710,000
- O&M cost: $0 per year
- Monitoring cost: $0 per year
- Present worth: $3,710,000

4.1.4 Alternative S4: Excavation, On-Site Treatment (Thermal), and On-Site Re-Use

This alternative would include the same delineation and excavation components (including verification sampling) as Alternative S3. The excavated contaminated soil from Sites 6A and 10B would be treated in

an on-site mobile high-temperature thermal treatment unit. The efficiencies of the treatment system should allow the contaminated soil to be treated to the PRGs and re-used on site. Additional soil characterization and treatability studies would be required to determine appropriate treatment system design elements (e.g., temperature, residence time, need for off-gas treatment).

Approximately 7,340 cy of soil would be treated, including 4,150 cy of contaminated soil and 3,190 cy of adjacent soils excavated with the contaminated soil. Treated soil would be used to backfill the excavated areas. Approximately 600 cy of clean fill would still be required for site restoration to replace the concrete that was removed. Residual waste (if any) generated from off-gas treatment (if required) would be disposed off site. After all soil had been treated, the mobile thermal treatment unit would be demobilized from the site.

There would be no restrictions related to soil at Sites 6A and 10B after treatment, and 5-year reviews would not be required. Alternative S4 is expected to take less than 6 months to complete. The estimated costs for Alternative S4 are as follows:

- Capital cost: $5,114,000
- O&M cost: $0 per year
- Monitoring cost: $0 per year
- Present worth: $5,114,000

4.1.5 Alternative S5: LUCs/Deed Notifications, In-Situ Treatment (Soil Vapor Extraction), and Monitoring

This alternative would include the same delineation component as Alternative S2. Separate soil vapor extraction (SVE) systems would be installed at each site. The systems would include extraction trenches, an extraction pump with moisture separator, and a granular activated carbon (GAC) off-gas treatment system. The extraction trenches for Sites 6A and 10B would be sized to address both soil and groundwater contamination at the sites because it was assumed that air sparging systems would also be installed to treat groundwater contamination. Approximately 10 extraction trenches, each 500 feet long, would be installed for the Site 6A system, and approximately 5 extraction trenches, each 200 feet long, would be installed for the Site 10B system. Soil vapor would be removed using vacuum pumps, and the extracted soil vapor would be treated using GAC (although other off-gas treatment options are available). The spent GAC would be regenerated/treated off site.

The SVE systems should be very effective for VOCs and moderately effective for PAHs, SVOCs, and petroleum hydrocarbons. SVE would not be effective for the PCBs at Site 6A. SVE treatment is expected to take up to 4 years. The PCBs at Site 6A are expected to remain for more than 30 years.

The LUCs/deed notifications discussed in Alternative S2 would need to be implemented until treatment by SVE is complete and contaminant concentrations, including PCBs, have decreased to less than PRGs.

This alternative includes monitoring of the off-gas treatment system for VOCs. Soil monitoring would be necessary to determine when the SVE systems can be shut down and LUCs/deed notifications for soil can be removed. Approximately four samples would be collected annually from each site for 4 years while the SVE system is operating. Samples would be analyzed for VOCs, SVOCs, PAHs, PCBs, and TPH-GRO. Soil monitoring at Site 6A for PCBs would continue after the SVE system is shut down. Approximately four samples would be collected every 5 years and analyzed for PCBs.

It is anticipated that 5-year reviews would only be needed for Site 6A. The estimated costs for Alternative S5 are as follows:

- Capital cost: $2,370,000
- O&M cost: $210,000 per year (Year 1) to $169,000 per year (Year 4)
- Monitoring cost: $1,000 per year (Annually)
  $30,000 per year (Years 1 through 4)
  $30,000 (every 5 years)
- Present worth: $3,155,000

4.1.6 Alternative S6: LUCs/Deed Notifications, Monitoring, and Excavation of PCB Hot Spots and Off-Site Treatment/Disposal

This alternative is similar to Alternative S2 because it would include LUCs/deed notifications at Sites 6A and 10B and performing soil monitoring at both sites. However, this alternative would also include excavation of the PCB-contaminated hot spots with off-site treatment/disposal.

The excavation and material handling and analysis sequence would be similar to that for Alternative S3. Approximately 420 cy of PCB-contaminated soil would be removed. Removal of approximately 100 cy of uncontaminated soil and 8 cy of reinforced concrete pad would need to be removed to access the PCB-contaminated soil. The concrete would be stockpiled and analyzed for disposal purposes. Depending on the results, the concrete would be disposed or re-used off site, as appropriate. Visual observations and field instruments would be used to identify contaminated versus uncontaminated soil. Verification samples would be collected to confirm the removal of PCBs (and other COCs) in excess of PRGs. After excavation is complete, the uncontaminated soil and clean fill from an off-site source would be used to fill the excavation and restore the site. Disturbed areas would be vegetated with grass. Excavation and off-site disposal of PCB-contaminated soil is expected to take less than 2 months.

There would still be restrictions related to soil at Sites 6A and 10B after Alternative S6 is complete, and 5-year reviews would be required. The estimated costs for Alternative S6 are as follows:

- Capital cost: $540,000
- O&M cost: $0 per year
- Monitoring cost: $1,000 per year (Annually)
  $35,000 (Every 5 years)
- Present worth: $627,000

4.1.7 Alternative S7: Excavation of PCB-Contaminated Hot Spots and Off-Site Treatment/Disposal and In-Situ Treatment of Petroleum- and Solvent-Contaminated Soil by ISCO

This alternative would include the same pre-design delineation component as Alternative S3. Excavation of PCB-contaminated soil at Site 6A would be conducted first. The excavation and disposal process would be the same as for Alternative S6.

The petroleum- and solvent-contaminated soil remaining at Sites 6A and 10B would be treated in situ using ISCO. A bench-scale treatability study and a pilot study would be completed prior to full-scale implementation. The full-scale treatment process would involve injecting an oxidant/activator slurry capable of treating both petroleum and solvents. It is expected that three treatments with the oxidant/activator would be required to reduce contaminant concentrations to PRGs. The oxidant would be applied through approximately 1,000 injection points during each treatment. Two rounds of soil samples would be collected at each site 3 and 6 months after the final treatment to confirm that PRGs have been attained.

There would be no restrictions related to soil at Sites 6A and 10B after Alternative S7 has been completed, and no 5-year reviews would be required. Implementation of this alternative would take approximately 2 years. The estimated costs for Alternative S7 are as follows:

- Capital cost: $32,217,000
- O&M cost: $0 per year
- Monitoring cost: $0 per year
- Present worth: $32,217,000

4.2 SITES 6A AND 10B GROUNDWATER

The alternatives analyzed for Sites 6A and 10B groundwater are presented below and are numbered to correspond with the numbers in the FS/CMS Report. The alternatives are as follows:

- Alternative SAGW1: No Action
- Alternative SAGW2: LUCs/Deed Notifications, Natural Attenuation, and Monitoring
- Alternative SAGW3: LUCs/Deed Notifications, Groundwater Extraction (Wells), Treatment (Air Stripping/Activated Carbon), Reinjection (Infiltration Galleries), and Monitoring
- Alternative SAGW4: LUCs/Deed Notifications, In-Situ Treatment (Air Sparging), and Monitoring
- Alternative SAGW5: LUCs/Deed Notifications, In-Situ Biological Treatment [Biostimulation with Hydrogen Release Compound® (HRC®) and Oxygen Release Compound® (ORC®)], Natural Attenuation, and Monitoring

4.2.1 Alternative SAGW1: No Action

The no-action alternative is evaluated to establish a baseline for comparison. Under this alternative, no further action would be taken to prevent exposure to groundwater contamination at Sites 6A and 10B. There are no costs associated with the no-action alternative.

4.2.2 Alternative SAGW2: LUCs/Deed Notifications, Natural Attenuation, and Monitoring

LUCs would be implemented by the Navy while it maintains ownership of the property, and deed notifications would be incorporated into facility transfer documents when the property is transferred by the Navy. These controls would restrict access to and use of contaminated groundwater in an area of approximately 100,000 square feet (2.3 acres) at Site 6A and 25,200 square feet (0.6 acre) at Site 10B.

This alternative would also monitor decreases in groundwater contaminant concentrations through natural processes. Groundwater modeling predicted that it would require up to 100 years for natural attenuation to address groundwater contamination if the source of contamination at Site 6A is not addressed. If the contaminant source area was removed, the modeling predicted that contaminant concentrations in groundwater may attenuate to PRGs in less than 10 years. For evaluation purposes, it was assumed that a majority of the source of contamination at both sites would be addressed and that groundwater

remediation would occur within 30 years at Site 6A and 10 years at Site 10B. Actual remediation times may vary from these assumed times.

For Site 6A, six existing monitoring wells and two new monitoring wells would be included in the monitoring program. Groundwater monitoring would be conducted quarterly for the first year and annually for the next 29 years. For Site 10B, four new monitoring wells would be installed for the monitoring program, and groundwater monitoring would be conducted quarterly for the first year and annually for the next 9 years. Groundwater samples from both sites would be analyzed for VOCs, SVOCs, PAHs, and natural attenuation indicator parameters. Groundwater analytical data would be reviewed periodically to evaluate the effectiveness of natural attenuation. Additional groundwater contaminant fate and transport modeling would be conducted as necessary to predict contaminant migration and natural attenuation.

A re-evaluation of the sites would be performed every 5 years as long as contaminant concentrations are greater than PRGs to determine whether any changes to the controls or remedy would be required. The analytical program would be optimized during the monitoring program, as necessary. The estimated costs for Alternative SAGW2 are as follows:

- Capital cost: $181,000
- O&M cost: $0 per year
- Monitoring cost: $69,700 per year (Year 1)
  $20,900 to $25,700 per year (Years 2 through 30)
  $23,000 (every 5 years)
- Present worth: $564,000

4.2.3 Alternative SAGW3: LUCs/Deed Notifications, Groundwater Extraction (Wells), Treatment (Air Stripping/Activated Carbon), Reinjection (Infiltration Galleries), and Monitoring

LUCs/deed notifications would be implemented as discussed in Alternative SAGW2 until PRGs are attained.

Separate groundwater extraction and treatment systems would be installed for Sites 6A and 10B. Similar to Alternative SAGW2, it was assumed that the source of groundwater contamination would be remediated. Six extraction wells would be installed at Site 6A to extract a total of approximately 80 gallons per minute (gpm) of contaminated groundwater and would operate for an estimated 30 years. Two extraction wells would be installed at Site 10B to extract a total of approximately 40 gpm of contaminated groundwater and would operate for an estimated 9 years.

Extracted groundwater would be treated to meet PRGs prior to reinjection. Groundwater treatment for each site would consist of equalization/chemical precipitation, clarification, filtration, and air stripping or GAC. Off-gas treatment from the air stripper would not be required. An oil-water separator may be needed for Site 6A. A treatability test would be conducted on each system to confirm that they treat groundwater to the required PRGs.

After treatment, the effluent would be reinjected into the overburden aquifer via infiltration galleries placed upgradient of each source area plume. The infiltration galleries for each site would be sized to accommodate the system flow rates. Effluent monitoring of each system would be conducted weekly for the first month of operation and then monthly for the duration of each systems operation. The effluent samples would be analyzed for VOCs, SVOCs, and PAHs.

Groundwater monitoring at both sites would be conducted quarterly for the first year and then annually thereafter to monitor the progress and effectiveness of groundwater remediation. Eight wells at Site 6A and four wells at Site 10B would be sampled as part of the monitoring program. The groundwater samples would be analyzed for VOCs, SVOCs, and PAHs.

A re-evaluation of the sites would be performed every 5 years as long as contaminant concentrations are greater than PRGs to determine whether any changes to the extraction system, treatment system, or overall remedy would be required. The estimated costs for Alternative SAGW3 are as follows:

- Capital cost: $1,653,000
- O&M cost: $98,000 to $177,000 per year (Years 1 through 30)
- Monitoring cost: $20,900 to $60,700 per year (Years 1 through 30)
  $23,000 (every 5 years)
- Present worth: $3,692,000

4.2.4 Alternative SAGW4: LUCs/Deed Notifications, In-Situ Treatment (Air Sparging), and Monitoring

LUCs/deed notifications would be implemented at the sites as discussed in Alternative SAGW2 until PRGs are attained.

Separate air sparging systems would be developed for each site. At Site 6A, approximately 600 cubic feet per minute (cfm) of air would be injected into the saturated zone through 51 injection wells. At Site 10B, approximately 160 cfm of air would be injected through 13 injection wells. Air sparging is usually used in combination with SVE to remove contaminant vapors released from groundwater and vadose

zone soil. Alternative S5 provides the details for the SVE systems. The combination of Alternative SAGW4 and S5 may be able to address both groundwater and soil contamination at the sites.

Approximately six existing monitoring wells at Site 6A and four new wells at Site 10B would be included in the groundwater monitoring program. Groundwater monitoring would be conducted quarterly for the first year and then annually until PRGs are attained. Samples would be analyzed for VOCs, SVOCs, PAHs, and water quality parameters.

Similar to Alternative S5, it was assumed that the air sparging systems would address groundwater contamination within 4 years; therefore, 5-year reviews should not be required. The estimated costs for Alternative SAGW4 are as follows:

- Capital cost: $967,000
- O&M cost: $118,600 per year (Years 1 through 4)
- Monitoring cost: $69,700 per year (Year 1)
  $25,700 per year (Years 2 through 4)
- Present worth: $1,497,000

4.2.5 Alternative SAGW5: LUCs/Deed Notifications, In-Situ Biological Treatment (Biostimulation with HRC® and ORC®), Natural Attenuation, and Monitoring

LUCs/deed notifications would be implemented as discussed in Alternative SAGW2 until PRGs are attained.

Separate groundwater treatments using HRC® and ORC® would be completed for Sites 6A and 10B. Similar to Alternative SAGW2, it was assumed that the source of groundwater contamination would be remediated. HRC® injections would be conducted first to enhance existing anaerobic degradation of chlorinated solvents. HRC® would be injected at 126 locations at Site 6A and 30 locations at Site 10B. It was estimated that HRC® treatment would be fully effective at treating the chlorinated solvents within 1 year.

After HRC® treatment, groundwater at both sites would be allowed to return to aerobic conditions by natural processes for 1 year. The groundwater would then be treated using ORC® to enhance biodegradation of fuel-related contaminants. ORC® would be injected at 234 locations at Site 6A and 120 locations at Site 10B. It was estimated that one application of ORC® would be needed.

As a contingency, it was assumed that after application of the HRC® and ORC®, the groundwater would not be completely cleaned up and that a remedy similar to Alternative SAGW2 (natural attenuation) would

be implemented. It was assumed that PRGs would be attained within 3 years after treatment or within a total of 6 years from initiation of the alternative.

Groundwater monitoring would be conducted to determine the effectiveness of the HRC® and ORC® injections. For Site 6A, six existing monitoring wells and two new monitoring wells would be included in the monitoring program. For Site 10B, four new monitoring wells would be installed for the monitoring program. Groundwater sampling would be conducted quarterly for the first 3 years when treatment is occurring and then annually for the next 3 years when natural attenuation is occurring. Groundwater samples from both sites would be analyzed for VOCs, SVOCs, PAHs, and natural attenuation indicator parameters.

A re-evaluation of the sites would be performed after 5 years to determine whether any changes to the remedy or controls would be required. The estimated costs for Alternative SAGW5 are as follows:

- Capital cost: $1,899,000
- O&M cost: $0 per year
- Monitoring cost: $59,700 per year (Years 1 through 3)
  $15,700 per year (Years 4 through 6)
  $23,000 (every 5 years)
- Present worth: $2,105,000

4.3 ON-SITE SOUTHERN AREA PLUME

The alternatives analyzed for the On-Site Southern Area Plume are presented below and are numbered to correspond with the numbers in the FS/CMS Report. The alternatives are as follows:

- Alternative OSAGP1: No Action

- Alternative OSAGP2: LUCs/Deed Notifications, Natural Attenuation, and Monitoring

- Alternative OSAGP3: LUCs/Deed Notifications, Groundwater Extraction (Wells), Treatment (Air Stripping/Activated Carbon), Reinjection (Infiltration Galleries), and Monitoring

- Alternative OSAGP4: LUCs/Deed Notifications, In-Situ Biological Treatment (Biobarrier with HRC®), Natural Attenuation, and Monitoring

4.3.1 Alternative OSAGP1: No Action

The no-action alternative is evaluated to establish a baseline for comparison. Under this alternative, no further action would be taken to prevent exposure to groundwater contamination at the On-Site Southern Area Plume. There are no costs associated with the no-action alternative.

4.3.2 Alternative OSAGP2: LUCs/Deed Notifications, Natural Attenuation, and Monitoring

LUCs would be implemented by the Navy while it maintains ownership of the property, and deed notifications would be incorporated into facility transfer documents when the property is transferred by the Navy. These controls would restrict access to and use of contaminated groundwater in the On-Site Southern Area Plume, which covers an area of approximately 86 acres.

This alternative would also monitor decreases in groundwater contaminant concentrations through natural processes. Groundwater modeling predicted that it would require up to 100 years for natural attenuation to address groundwater contamination if the source of contamination at Site 6A is not addressed. If the contaminant source area was removed, modeling predicted that contaminant concentrations in groundwater may attenuate to PRGs in less than 10 years. For evaluation purposes, it was assumed that a majority of the source of contamination would be addressed and that groundwater remediation would occur within 30 years.

Approximately 10 new monitoring wells would be included in the monitoring program. Groundwater monitoring would be conducted quarterly for the first year and annually for the next 29 years. Groundwater samples would be analyzed for VOCs, SVOCs, PAHs, and natural attenuation indicator parameters. Groundwater analytical data would be reviewed periodically to evaluate the effectiveness of natural attenuation. Additional groundwater contaminant fate and transport modeling would be conducted as necessary to predict contaminant migration and natural attenuation.

A re-evaluation of the site would be performed every 5 years as long as contaminant concentrations are greater than PRGs to determine whether any changes to the controls or remedy would be required. The analytical program would be optimized during the monitoring program, as necessary. The estimated costs for Alternative OSAGP2 are as follows:

- Capital cost: $108,000
- O&M cost: $0 per year

- Monitoring cost: $60,900 per year (Year 1)
  $23,500 per year (Years 2 through 30)
  $23,000 (every 5 years)
- Present worth: $484,000

4.3.3 Alternative OSAGP3: LUCs/Deed Notifications, Groundwater Extraction (Wells), Treatment (Air Stripping/Activated Carbon), Reinjection (Infiltration Galleries), and Monitoring

LUCs/deed restrictions would be implemented as discussed in Alternative OSAGP2 until PRGs are attained.

A groundwater extraction and treatment system would be installed to address the On-Site Southern Area Plume. Similar to Alternative OSAGP2, it was assumed that the source of groundwater contamination would be remediated. Because of the size of the On-Site Southern Area Plume, this alternative was mainly developed to contain and prevent off-site migration of contaminated groundwater. However, if the system is operated long enough, it should also remediate the plume. Five extraction wells would be installed along the downgradient edge of the base boundary over the width of the plume. The wells would extract a total of approximately 200 gpm and would operate for an estimated 11 years.

Extracted groundwater would be treated to meet PRGs prior to reinjection. Groundwater treatment would consist of equalization/chemical precipitation, clarification, filtration, and air stripping or GAC. Off-gas treatment from the air stripper would not be required. A treatability study would be conducted on the system to confirm that it treats groundwater to the required PRGs.

After treatment, the effluent would be reinjected into the overburden aquifer via infiltration galleries placed upgradient of the source area plumes. The infiltration galleries would be sized to accommodate the system flow rate. Effluent monitoring would be conducted weekly for the first month of operation and then monthly for the duration of the system operation. The effluent samples would be analyzed for VOCs, SVOCs, and PAHs.

Groundwater monitoring would be conducted quarterly for the first year and annually thereafter to monitor the progress of groundwater remediation. Ten wells would be sampled as part of the monitoring program. The groundwater samples would be analyzed for VOCs, SVOCs, and PAHs.

A re-evaluation of the site would be performed every 5 years as long as contaminant concentrations are greater than PRGs to determine whether any changes to the extraction system, treatment system, or overall remedy would be required. The estimated costs for Alternative OSAGP3 are as follows:

- Capital cost: $1,786,000
- O&M cost: $154,600 per year (Year 1)
  $143,500 per year (Years 2 through 11)
- Monitoring cost: $60,900 per year (Year 1)
  $23,500 per year (Years 2 through 11)
  $23,000 per year (every 5 years)
- Present worth: $3,111,000

4.3.4 Alternative OSAGP4: LUCs/Deed Notifications, In-Situ Biological Treatment (Biobarrier with HRC®), Natural Attenuation, and Monitoring

LUCs/deed notifications would be implemented as discussed in Alternative OSAGP2 until PRGs are attained.

A single treatment barrier consisting of two rows of HRC® injection points would be completed. Similar to Alternative OSAGP2, it was assumed that the source of groundwater contamination would be remediated. HRC® would be injected at 445 locations along the property boundary. It was estimated that HRC® treatment would be effective at treating the chlorinated solvents for 1 year. Assuming that COC concentrations in the plume decrease to less than PRGs within 11 years, the barrier would need to be maintained for this duration. Therefore, HRC® would need to be injected 11 times.

Groundwater monitoring would be conducted to determine the effectiveness of the HRC® barrier. Ten new monitoring wells (five upgradient and five downgradient) would be installed for the monitoring program. Groundwater sampling would be conducted quarterly for the first year to provide baseline information and annually for the next 10 years while the barrier is in place. Groundwater samples would be analyzed for VOCs, SVOCs, PAHs, and natural attenuation indicator parameters.

A re-evaluation of the site would be performed after 5 years to determine whether any changes to the remedy or controls would be required. The estimated costs for Alternative OSAGP4 are as follows:

- Capital cost: $2,563,000 (Year 0)
  $2,064,000 per year (Years 1 through 10)
- O&M cost: $0 per year
- Monitoring cost: $60,900 per year (Year 1)
  $23,500 per year (Years 2 through 10)
  $23,000 per year (every 5 years)
- Present worth: $17,290,000

5.0 CONCLUSIONS AND EVALUATION OF ALTERNATIVES

This section identifies the proposed remedies for soil at Sites 6A and 10B, groundwater at Sites 6A and 10B, and groundwater at the On-Site Southern Area Plume. This section also summarizes the performance of the proposed remedies against the four general standards and five remedy decision factors, noting how they compare to the other options under consideration. The general standards are protection of human health and the environment, attainment of media clean-up standards, controlling the source of releases, and compliance with waste management standards. The remedy decision factors are long-term reliability and effectiveness, reduction of toxicity, mobility, or volume of waste, short-term effectiveness, implementability, and cost. Additional details on the evaluation of corrective measures alternatives are included in the FS/CMS (TtNUS, 2006b).

5.1 SITES 6A AND 10B SOIL

The recommended remedial action for soil at Sites 6A and 10B is Alternative S3 – Excavation and Off-Site Treatment and Disposal. This alternative includes excavation of 14,000 cy of material. Of this volume, approximately 3,900 cy of petroleum-, solvent-, and/or PCB-contaminated materials would be sent off site for treatment and/or disposal. The remaining soil would be evaluated on site for the presence of residual contamination and, if determined acceptable, used as on-site backfill material. This alternative would remove more than 90 percent of the petroleum-contaminated soil and all of the PCB-contaminated soil. The residual petroleum contamination is below the water table and cannot be efficiently excavated. After the alternative is implemented, the remaining contamination in the source area soil should naturally attenuate and/or be addressed by one of the groundwater alternatives.

5.1.1 Protection of Human Health and the Environment

Alternatives S3, S4, S5, and S7 would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional controls. The proposed remedy would remove all contaminated soil.

Alternative S1 includes no actions to address risks to human health. Under Alternatives S1, S2, and S6, the sources of groundwater contamination would not be controlled. Therefore, Alternatives S1, S2, and S6 are not considered further in this analysis as options for Sites 6A and 10B soil.

5.1.2 Attainment of Media Clean-Up Standards

Alternatives S3, S4, and S7 would meet their respective media clean-up standards under federal and state environmental laws. Although Alternative S5 would not comply with PRGs for PCBs, LUCs/deed

notifications would address potential risks from human exposure to PCB-contaminated soil. PCBs are not expected to leach from soil and migrate to groundwater. The proposed remedy (Alternative S3) would remove soil with COC concentrations greater than PRGs based on protection of human health and contaminant migration to groundwater.

5.1.3 Controlling the Sources of Releases

Alternatives S3, S4, S5, and S7 would be effective in reducing, to the maximum extent practicable, further releases of contaminants to groundwater. The proposed remedy (Alternative S3) would remove soil with COC concentrations greater than PRGs based on protection of groundwater. Contaminant migration to surface water, air, and other soil is not a concern at Sites 6A and 10B.

5.1.4 Compliance with Waste Management Standards

Excavated soil generated during implementation of the proposed remedy (Alternative S3) and Alternative S7 would be tested for disposal purposes (e.g., hazardous versus nonhazardous waste) and would be handled accordingly. Alternatives S4 and S5 would generate minimal quantities of waste for off-site treatment/disposal. Under Alternative S4, treated soil would be tested to determine that COC concentrations are less than PRGs prior to use as backfill. Testing of soil and treatment residuals under all of these alternatives would assure that management of wastes is conducted in a protective manner.

5.1.5 Long-Term Reliability and Effectiveness

The proposed remedy (Alternative S3) would be reliable and effective because contaminated soil with COC concentrations greater than PRGs would be permanently removed from the sites and treated and/or disposed at a permitted off-site facility. Monitoring would not be required to evaluate the long-term effectiveness of the remedy. LUCs/deed notifications and 5-year reviews for soil would not be required because the land would be available for unlimited use and unrestricted exposure.

Alternative S4 is similar to Alternative S3, except that contaminated soil with COC concentrations greater than PRGs would be treated on site and used as backfill instead of being transported off site. Monitoring of the treated soil would be necessary to ensure attainment of PRGs. LUCs/deed notifications and 5-year reviews would not be required.

Alternative S5 would use SVE to permanently reduce the concentrations of petroleum- and solvent-related COCs in soil. However, SVE would not be effective for PCBs, and LUCs/deed notifications would be needed to control exposure to PCB-contaminated soil. Soil monitoring would be required to ensure that SVE reduces petroleum- and solvent-related COC concentrations to acceptable levels and to

determine whether PCB concentrations are being reduced through natural processes. Five-year reviews would be required as long as PCB concentrations are greater than PRGs.

Alternative S7 would use ISCO to permanently reduce the concentrations of petroleum- and solvent-related COCs. PCB-contaminated soil would be permanently removed from Site 6A and treated and/or disposed at a permitted off-site facility. Soil monitoring would be required to ensure that ISCO reduces petroleum- and solvent-related COC concentrations to acceptable levels. LUCs/deed notifications and 5-year reviews would not be required.

5.1.6 Reduction of Toxicity, Mobility, or Volume of Wastes

Alternative S4 would use high-temperature thermal treatment to reduce the toxicity of petroleum-, solvent-, and PCB-contaminated soil.

Alternative S5 would use SVE and Alternative S7 would use ISCO to reduce the toxicity of petroleum- and solvent-contaminated soil.

The proposed remedy (Alternative S3) does not include on-site treatment of contaminated soil to reduce toxicity, mobility, or volume. Treatment may be needed at the off-site facility that would be used for contaminated soil disposal. However, this would depend on COC concentrations in the excavated soil, waste classification (hazardous versus nonhazardous), and disposal facility waste acceptance criteria.

5.1.7 Short-Term Effectiveness

The proposed remedy (Alternative S3) and Alternative S4 could be implemented more quickly (less than 6 months) that Alternatives S5 and S7. The treatment components of Alternatives S5 and S7 would take approximately 4 years and 1 year, respectively, to attain PRGs.

Alternatives S3 and S7 have some minor, short-term risks of exposure to the community during transportation of contaminated soil to an off-site treatment/disposal facility. Potential short-term risks to the environment during excavation activities (Alternatives S3, S4, and S7) would be adequately controlled using proper erosion and fugitive dust controls. Risks to on-site remediation workers during excavation and material handling activities would be minimized through the use of personal protective equipment and adherence to a site-specific health and safety plan.

5.1.8 Implementability

The proposed remedy (Alternative S3) and Alternative S5 are readily implementable. Contractors and equipment are readily available for excavation and off-site treatment disposal and SVE, respectively.

There are limited vendors of the mobile high-temperature thermal treatment equipment required to implement on-site treatment under Alternative S4. There may be administrative issues related to air emissions from on-site thermal treatment.

There are limited vendors of the quantity of remediation-grade oxidation chemicals needed for ISCO under Alternative S7. There may be administrative issues related to injection of chemicals into the subsurface.

5.1.9 Costs

The estimated present-worth cost of the proposed remedy (Alternative S3) is $3,710,000. The lowest cost alternative is Alternative S5 with an estimated present-worth cost of $3,155,000. The highest cost alternative is Alternative S7 with an estimated present-worth cost of $32,217,000. Alternative S4 has an estimated present-worth cost of $5,114,000.

5.1.10 Summary

The proposed remedy (Alternative S3) would remove all potential risks associated with contaminated soil without the need for long-term actions such as LUCs/deed notifications, O&M, and monitoring. It is the lowest cost alternative that addresses all risks and that does not require any long-term actions.

5.2 SITES 6A AND 10B GROUNDWATER

The recommended remedial action for groundwater at Sites 6A and 10B is Alternative SAGW2 – LUCs/Deed Notifications, Natural Attenuation, and Monitoring. This alternative includes implementation of LUCs/deed notifications and a long-term groundwater monitoring program.

5.2.1 Protection of Human Health and the Environment

All of the alternatives, with the exception of the no-action alternative (SAGW1) would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional controls. The proposed remedy (Alternative SAGW2) would impose LUCs/deed notifications to prevent use of groundwater until PRGs have been attained through natural attenuation processes.

The no-action alternative is not protective of human health and the environment. Although COC concentrations would naturally attenuate, there would be no controls to prevent exposure and no monitoring to evaluate the potential for off-site contaminant migration. Therefore, it is not considered further in this analysis as an option for Sites 6A and 10B groundwater.

5.2.2 Attainment of Media Clean-Up Standards

Alternatives SAGW2, SAGW3, SAGW4, and SAGW5 would eventually meet their respective media clean-up standards under federal and state environmental laws. The estimated time frames to meet the clean-up standards are as follows: 4 years for Alternative SAGW4, 6 years for Alternative SAGW5, and 30 years for Alternatives SAGW2 and SAGW3.

5.2.3 Controlling the Sources of Releases

This criterion is not applicable to groundwater, which is not considered the source of the release. Alternatives SAGW2 through SAGW5 assume that the sources of contamination (contaminated soil at Sites 6A and 10B) would be controlled.

5.2.4 Compliance with Waste Management Standards

No waste would be generated during implementation of the proposed remedy (Alternative SAGW2). Minimal waste would be generated for the in-situ treatment alternatives (Alternatives SAGW4 and SAGW5). Treatment residuals would be generated by Alternative SAGW3. Testing of waste and treatment residuals under all of these alternatives would assure that management of wastes is conducted in a protective manner.

5.2.5 Long-Term Reliability and Effectiveness

Because Alternatives SAGW2 through SAGW5 involve some form of active or passive groundwater remediation, they are expected to be effective at decreasing groundwater contaminant concentrations over the long term. The LUCs/deed notifications under these alternatives would minimize future threats to human health until PRGs are attained. All of these alternatives include monitoring to evaluate the effectiveness of the remedy and the potential for contaminant migration. The treatment system included under Alternative SAGW3 would need to be properly operated and maintained to assure reliability and effectiveness. Five-year reviews would be required under all alternatives until PRGs are attained.

5.2.6 Reduction in Toxicity, Mobility, or Volume of Wastes

The proposed remedy (Alternative SAGW2) does not include treatment of contaminated groundwater. The groundwater treatment system under Alternative SAGW3 would reduce the toxicity of groundwater before reinjection into the aquifer. Alternative SAGW4 uses air sparging to reduce the toxicity of contaminated groundwater. Alternative SAGW5 uses injection of biostimulation chemicals to reduce the toxicity through in-situ biological treatment.

5.2.7 Short-Term Effectiveness

No short-term risks to the community, on-site workers, or the environment are anticipated during implementation of the proposed remedy (Alternative SAGW2). For the other alternatives, potential risks to on-site workers could be adequately controlled. Potential risks to the community or environment would not be anticipated.

5.2.8 Implementability

Alternatives SAGW2 through SAGW5 are readily implementable. Contractors and equipment are available for implementation of all remedy components. Alternative SAGW3 is the only alternative that would involve significant construction (extraction wells and treatment system). The proposed remedy (Alternative SAGW2) has the fewest remedy components to be implemented.

5.2.9 Cost

The estimated present-worth cost of the proposed remedy (Alternative SAGW2), which has the lowest cost, is $564,000. The highest cost alternative is Alternative SAGW3 with an estimated present-worth cost of $3,692,000. The estimated present-worth costs for the other alternatives are $1,497,000 (Alternative SAGW4) and $2,105,000 (Alternative SAGW5).

5.2.10 Summary

The proposed remedy (Alternative SAGW2) provides adequate protection of human health and the environment in the most cost-effective manner. This alternative is expected to attain PRGs within a reasonable time frame (30 years), considering that there are no current or projected future users of shallow groundwater at the sites. For Alternative SAGW3, which has the highest cost, up to 30 years may still be needed for attainment of some PRGs. Although Alternatives SAGW4 and SAGW5 would result in attainment of PRGs in shorter time frames (4 and 6 years, respectively), these alternatives would cost approximately three to four times as much as the proposed remedy.

5.3 ON-SITE SOUTHERN AREA PLUME

The recommended remedial action for groundwater in the On-Site Southern Area Plume is Alternative OSAGP2 – LUCs/Deed Notifications, Natural Attenuation, and Monitoring. This alternative includes implementation of LUCs/deed notifications and a long-term groundwater monitoring program.

5.3.1 Protection of Human Health and the Environment

All of the alternatives, with the exception of the no-action alternative (OSAGP1) would provide adequate protection of human health and the environment by eliminating, reducing, or controlling risk through treatment, engineering controls, or institutional controls. The proposed remedy (Alternative OSAGP2) would impose LUCs/deed notifications to prevent use of groundwater until PRGs have been attained through natural attenuation processes.

The no-action alternative is not protective of human health and the environment. Although COC concentrations would naturally attenuate, there would be no controls to prevent exposure and no monitoring to evaluate the potential for off-site migration. Therefore, it is not considered further in this analysis as an option for the On-Site Southern Area Plume.

5.3.2 Attainment of Media Clean-Up Standards

Alternatives OSAGP2, OSAGP3, and OSAGP4 would eventually meet their respective media clean-up standards under federal and state environmental laws. The estimated time frames to meet the clean-up standards are as follows: 10 years for Alternative OSAGP4, 11 years for OSAGP3, and 30 years for the proposed remedy (Alternative OSAGP2).

5.3.3 Controlling the Sources of Releases

This criterion is not applicable to groundwater, which is not considered the source of the release. Alternatives OSAGP2 through OSAGP4 assume that the sources of contamination (contaminated soil at Sites 6A and 10B) would be controlled.

5.3.4 Compliance with Waste Management Standards

No waste would be generated during implementation of the proposed remedy (Alternative OSAGP2). Minimal waste would be generated for the in-situ treatment alternative (Alternative OSAGP4). Treatment residuals would be generated by Alternative OSAGP3. Testing of wastes and treatment residuals under all these alternatives would assure that management of wastes is conducted in a protective manner.

5.3.5 Long-Term Reliability and Effectiveness

Because Alternatives OSAGP2 through OSAGP4 involve some form of active or passive groundwater remediation, they are expected to be effective at decreasing groundwater contaminant concentrations over the long term. The LUCs/deed notifications under these alternatives would minimize future threats to human health until PRGs are attained. All of these alternatives include monitoring to evaluate the effectiveness of the remedy and the potential for contaminant migration. The treatment system included under Alternative OSAGP3 would need to be properly operated and maintained to assure reliability and effectiveness. Five-year reviews would be required under all alternatives until PRGs are attained.

5.3.6 Reduction in Toxicity, Mobility, or Volume of Wastes

The proposed remedy (Alternative OSAGP2) does not include treatment of contaminated groundwater. The groundwater treatment system under Alternative OSAGP3 would reduce the toxicity of groundwater before reinjection into the aquifer. Alternative OSAGP4 uses injection of biostimulation chemicals to reduce toxicity through in-situ biological treatment.

5.3.7 Short-Term Effectiveness

No short-term risks to the community, on-site workers, or the environment are anticipated during implementation of the proposed remedy (Alternative OSAGP2). For the other alternatives, potential risks to on-site workers could be adequately controlled. Potential risks to the community or environment would not be anticipated.

5.3.8 Implementability

Alternatives OSAGP2 through OSAGP4 are readily implementable. Contractors and equipment are available for implementation of all remedy components. Alternative OSAGP3 is the only alternative that would involve significant construction (extraction wells and treatment system). The proposed remedy (Alternative OSAGP2) has the fewest remedy components to be implemented.

5.3.9 Cost

The estimated present-worth cost of the proposed remedy (Alternative OSAGP2), which has the lowest cost, is $484,000. The highest cost alternative is Alternative OSAGP4 with an estimate present-worth cost of $17,290,000. The present-worth cost of Alternative OSAGP3 is $3,111,000.

5.3.10 Summary

The proposed remedy (Alternative OSAGP2) provides adequate protection of human health and the environment in the most cost-effective manner. This alternative is expected to attain PRGs within a reasonable time frame (30 years), considering that there are no current or projected future users of shallow groundwater in the area. Although Alternatives OSAGP3 and OSAGP4 would result in attainment of PRGs in shorter time frames (10 to 11 years), these alternatives would cost approximately 6 and 36 times, respectively, as much as the proposed remedy.

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TABLES

TABLE 4-1

PRELIMINARY REMEDIATION GOALS FOR SOIL
SITE 6A – FUEL CALIBRATION AREA
NWIRP CALVERTON, NEW YORK

Chemical of Concern	Maximum Detected Concentration (mg/kg)	Preliminary Remediation Goal (mg/kg)
Volatile Organic Compounds		
Total xylenes	17	0.12
Semivolatile Organic Compounds		
Benzo(a)pyrene	0.11	0.33 (0.061)[(1)]
Isophorone	5	0.44
2-Methylnaphthalene	37	3.64
Naphthalene	15	1.3
Nitrobenzene	2.4	0.33 (0.02)[(1)]
2-Nitrophenol	5.8	0.33
Phenol	0.047	0.33 (0.003)[(1)]
Polychlorinated biphenyls		
PCBs	330	1 surface; 10 subsurface

Source: TtNUS, 2006b.

1 The preliminary remediation goal is the practical quantitation limit. The goal for the laboratory analyzing soil samples is to reach the values presented in parentheses.

TABLE 4-2

PRELIMINARY REMEDIATION GOALS FOR GROUNDWATER
SITE 6A – FUEL CALIBRATION AREA
NWIRP CALVERTON, NEW YORK

Chemical of Concern	Maximum Detected Concentration (µg/L)	Preliminary Remediation Goal (µg/L)
Volatile Organic Compounds		
1,1,1-Trichloroethane	2,000	5
1,2-Dichlorobenzene	9	3
1,1-Dichloroethane	3,400	5
1,1-Dichloroethene	30	5
Benzene	43.9	1
Chloroethane	20	5
Ethylbenzene	46	5
Toluene	140	5
Total xylenes	540	5
Semivolatile Organic Compounds		
2-Methylnaphthalene	74	50
4-Methylphenol	84	5 (1)[(1)]
Naphthalene	120	10

Source: TtNUS, 2006b.

1 The preliminary remediation goal is the practical quantitation limit. It is anticipated that a laboratory can reach a lower detection limit. The goal for the laboratory analyzing groundwater samples is to reach the value presented in parentheses.

TABLE 4-3

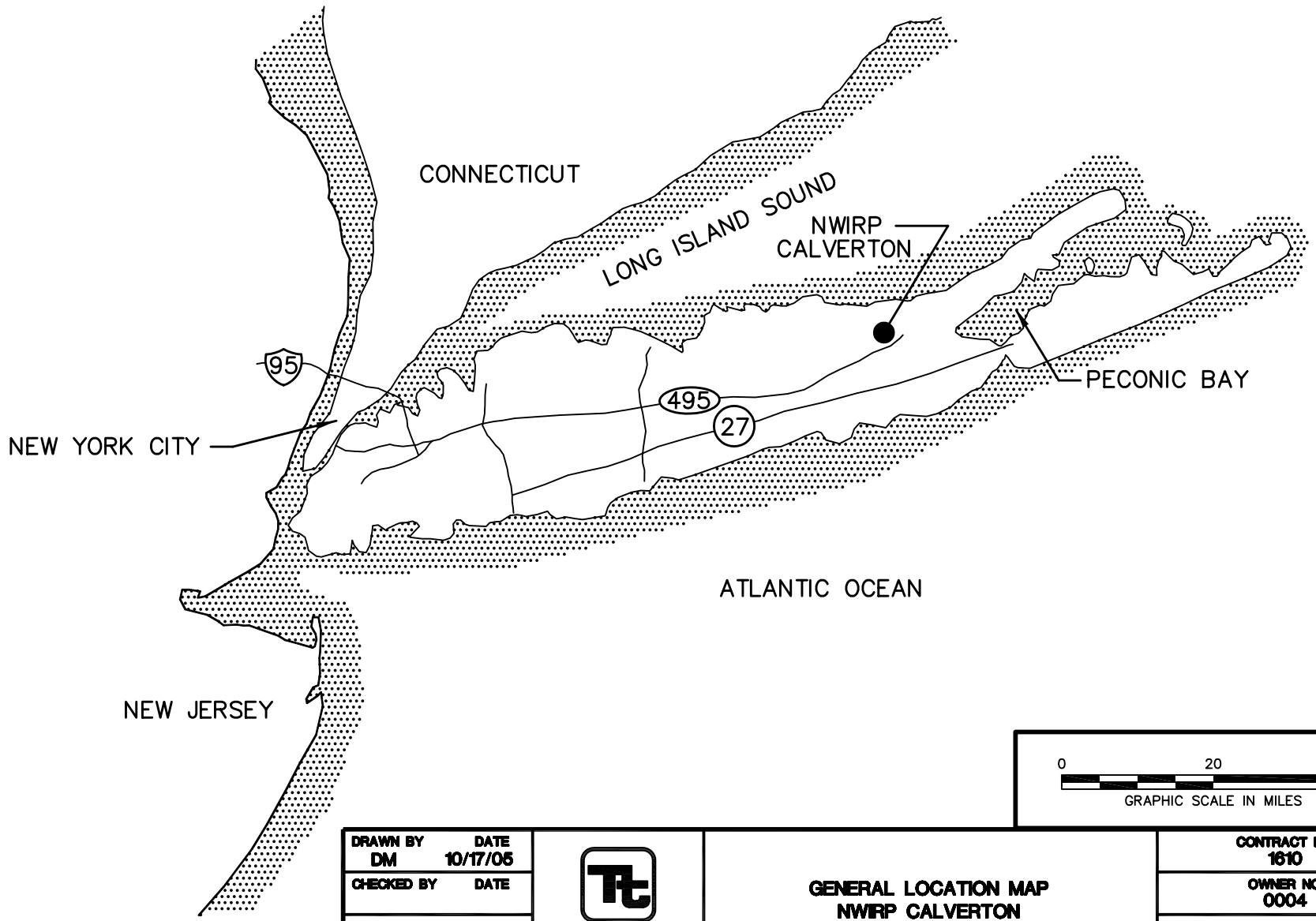
PRELIMINARY REMEDIATION GOALS FOR GROUNDWATER
SITE 10B – ENGINE TEST HOUSE AND ON-SITE SOUTHERN AREA
NWIRP CALVERTON, NEW YORK

Chemical of Concern	Maximum Detected Concentration (µg/L)	Preliminary Remediation Goal (µg/L)
Volatile Organic Compounds		
1,1,1-Trichloroethane	166	5
1,1,2-Trichlorofluoroethane	152	5
1,1-Dichloroethane	49.2	5
1,1-Dichloroethene	188	5
Benzene	1.95	1
Bromomethane	353	5
Chlorobenzene	381	5
Chloroethane	138	5
Chloroform	15.3	7
Ethylbenzene	1,084	5
Methylene chloride	7	5
Toluene	337	5
Total xylenes	196	5
Vinyl chloride	59.8	2

Source: TtNUS, 2006b.

FIGURES

ACAD: 1610CM17.dwg 02/21/07 DT



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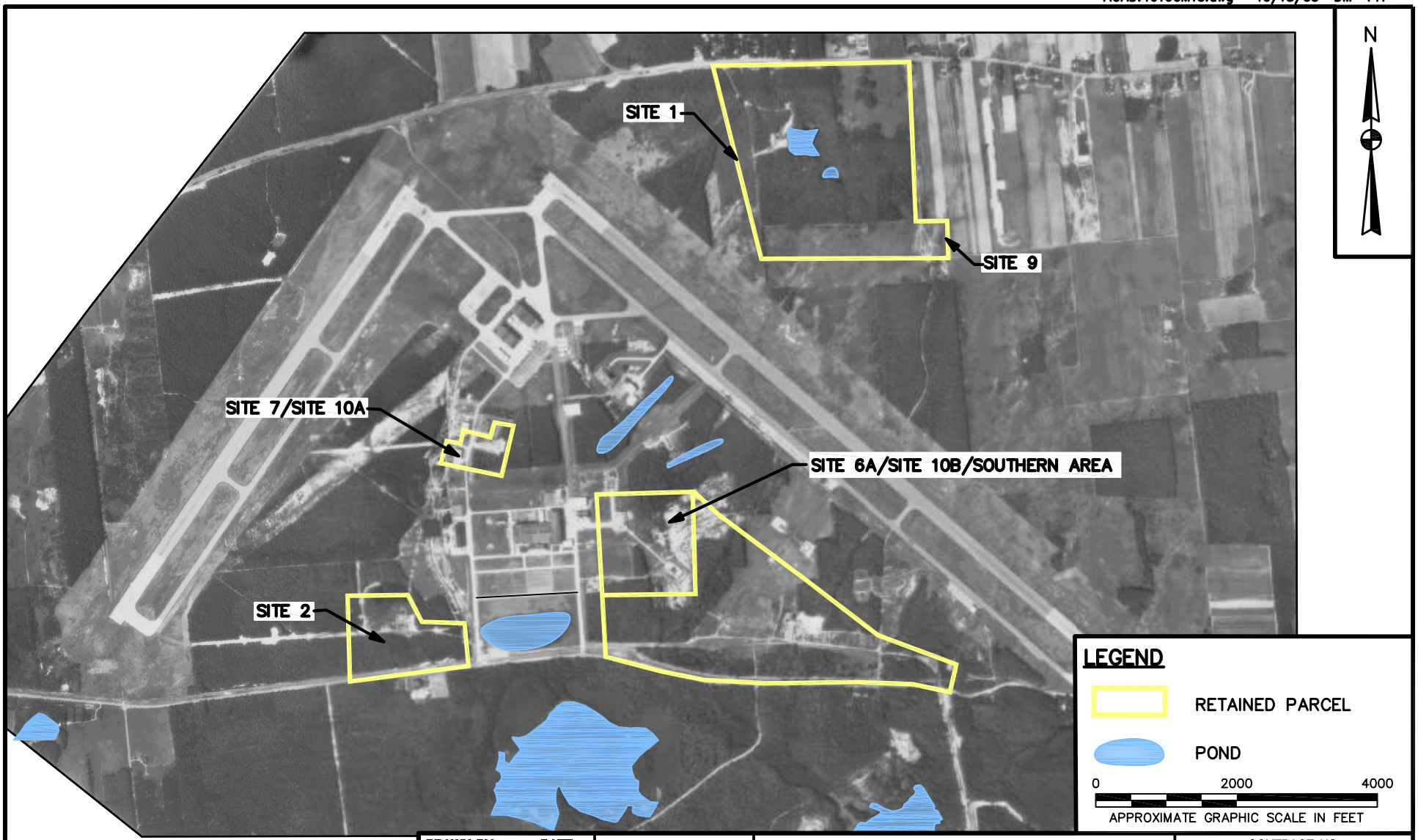
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE: AS NOTED			

CONTRACT NO. 1610	
OWNER NO. 0004	
APPROVED BY	DATE
DRAWING NO. FIGURE 1-1	REV. 0

FORM CADD NO. TTNUS-AH.DWG - REV 1 -9/10/98

ACAD:1610CM13.dwg 10/18/05 DM PIT



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CHECKED BY DATE			OWNER NO. 0004
REVISED BY DATE			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 REV. 0

FORM CADD NO. TTNUS-AH.DWG - REV 1 -9/10/98

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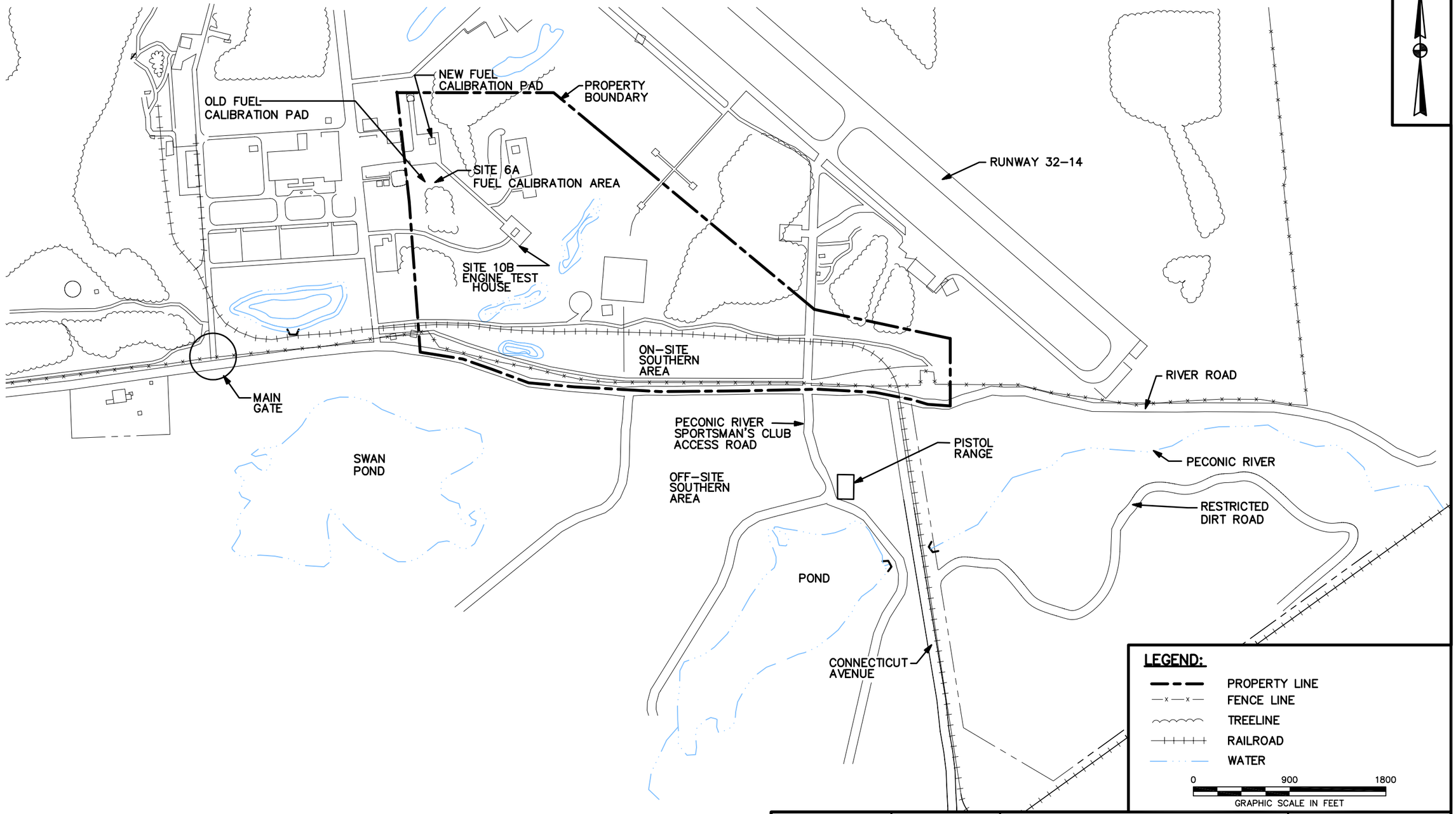

DRAWN BY: DT	DATE: 2/21/07	Tetra Tech NUS, Inc.	SITE LAYOUT SITE 6A, SITE 10B, AND SOUTHERN AREA NWIRP CALVERTON CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE: AS NOTED			

CONTRACT NO.	1610
OWNER NO.	0004
APPROVED BY	DATE
DRAWING NO.	FIGURE 2-1
REV.	0

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N

FC-VPB-112
FC-PZ-106D2
FC-MW-01-I
FC-MW-01-S
FC-TW-20A
FC-PZ-102D
FC-PZ-02D
FC-PZ-02D2
FC-SB-05
FC-MW-03-S
FC-MW-08-S
FC-MW-04-I
FC-MW-04-S
FC-MW-02
FC-PZ-103D
FC-MW-02-S
FC-SB-04
FC-MW-07-S
FC-PZ-104D2
FC-PZ-104D1
FC-PZ-02D1
FC-PZ-101D
FC-PZ-104D (FC-VPB-111)
FC-SB-03
FC-TW-09A
ET-TW-09A
FUEL CALIBRATION AREA
FC-TW-21A
FC-MW-06-S
FC-PZ-105D1
FC-PZ-105D2
FC-MW-05-S
FC-MW-05-I
ET-TW-11A
ET-TW-8A
ET-TW-05A
ET-TW-7A
ET-TW-15A
FORMER UNDERGROUND STORAGE TANK
ET-TW-02A
ENGINE TEST HOUSE

CHEMICAL	FC-SB-05 0204	FC-SB-05 0406
ETHYLBENZENE	1,300 J	1,500 J
TOTAL XYLENES	11,000 J	13,000 J
NITROBENZENE	2,400 J	
ISOPHORONE	5,000 J	
DIBENZOFURAN	880 J	22 J
TOTAL PAHS	21,870 J	143 J
TOTAL PHTHALATES	2,000 J	37 J
LEAD	59.7 R	3.0 R

CHEMICAL	FC-SB-04 0204	FC-SB-04 0406	FC-SB-04 0406 DU
ETHYLBENZENE		1,800 J	1,400 J
TOTAL XYLENES		17,000 J	13,000 J
ISOPHORONE		4,600 J	
2-NITROPHENOL		5,800 J	3,700 J
DIBENZOFURAN		1,100 J	820
TOTAL PAHS		53,860 J	39,390 J
TOTAL PHTHALATES	60 J		
LEAD	2.0 R	0.68 R	0.44 R

CHEMICAL	ET-TW/SB-03A 0406
TPH-DRO	8,500,000

CHEMICAL	ET-TW/SB-01A 0406
TPH-DRO	7,700,000

LEGEND:

- SOIL BORING LOCATION
- PIEZOMETER LOCATION
- EXISTING PERMANENT MONITORING WELL
- PID READING, SHEEN ON WATER TABLE, OR FUEL ODOR IN PURGE WATER DURING 2005 SAMPLING
- FORMER TEMPORARY WELLS
- 10 µg/L (MICROGRAMS PER LITER) CHLORINATED VOC SOIL GAS CONTOUR FROM RFI (HNUS, 1995)
- 10 µg/L (MICROGRAMS PER LITER) BTEX SOIL GAS CONTOUR FROM (HNUS, 1995)
- LIMIT OF SOIL CONTAMINATION (SOURCE AREA)
- PROPERTY LINE
- TREELINE
- WATER

NOTE: SITE 6A AND SITE 10B SOIL DATA PRESENTED IN TAGS WERE TAKEN FROM RFI (HNUS, 1995) AND PHASE 2 RFI (CF BRAUN, 1998), RESPECTIVELY, AND UNITS ARE µg/kg (MICROGRAMS PER KILOGRAM).

0 200 400
GRAPHIC SCALE IN FEET

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CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

SOIL SOURCE AREA
BASED ON HISTORIC DATA
SITE 6A - FUEL CALIBRATION AREA
AND SITE 10B - ENGINE TEST HOUSE
NWIRP CALVERTON
CALVERTON, NEW YORK

CONTRACT NO. 1610	
OWNER NO. 0004	
APPROVED BY	DATE
DRAWING NO. FIGURE 3-1	REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD:1610CM28.dwg 08/30/07 MF PIT

N

FC-MW-08-S

FC-SB-112

FC-SB-124

FC-SB-123

FC-SB-122

FC-SB-111

FC-SB-110

FC-SB-125

FC-SB-126

BLDG 231

FC-MW-04-I

FC-MW-02-I

FC-MW-02-S

FC-SS-128

FC-MW-03-S

11/CG

FC-SB/SS-103

FC-SB/SS-102

FC-MW-04-S

FC-SB-117

HEADWALL

DITCH

FC-SS-129

M.H.

FC-SB/SS-106

WOOD FENCE

FC-SB/SS-116

FC-SB-118

FC-SB-113

FC-SB-127

CONCRETE PAD

FC-SB-119

FC-SB/SS-101

FC-SB/SS-109

FC-SB/SS-105

4/CG

FC-SB-120

FC-SB/SS-104

FC-SB/SS-108

FC-SB-114

FC-SB/SS-107

FC-SB-115

M.H. 1

FC-MW-07-S

FC-SS-121

CONC PAD

M.H. E-13

M.H. E-14

FC-MW-06-S

LEGEND:

- 2006 LOCATION, NO PID SCREENING
- 2006 LOCATION WITH NO EVIDENCE OF PETROLEUM CONTAMINATION
- 2006 LOCATION WHERE PETROLEUM CONTAMINATION IS EVIDENT
- EXISTING PERMANENT MONITORING WELL
- MANHOLE
- EXTENT OF PETROLEUM CONTAMINATED SOIL
- UGE UGE UNDERGROUND ELECTRIC LINE
- PROPERTY LINE
- TREELINE
- FENCE

NOTE:

1.) LOCATIONS OF SITE FEATURES, MONITORING WELLS, SOIL BORINGS, AND SURFACE SOIL LOCATIONS ARE APPROXIMATE.

2.) THE PRESENCE OF PETROLEUM CONTAMINATION IN SOIL WAS BASED ON PID READING EXCEEDING 50 ppm.

0 50 100

GRAPHIC SCALE IN FEET

DRAWN BY DT	DATE 2/21/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

REVISED EXTENT OF PETROLEUM CONTAMINATION IN SOIL
SITE 6A - FUEL CALIBRATION AREA
NWIRP CALVERTON
CALVERTON, NEW YORK

CONTRACT NO. 1610	
OWNER NO. 004	
APPROVED BY	DATE
DRAWING NO. FIGURE 3-2	REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

ACAD:1610CM29.dwg 03/02/07 MF PIT

N

FC-MW-08-S

FC-SB-112

FC-SB-124

FC-SB-123

FC-SB-122

FC-SB-111

FC-MW-04-I

BLDG 231

FC-SB-110

FC-SB-125

FC-SB-126

11/CG

FC-SS-128

FC-SB/SS-103

FC-MW-04-S

FC-MW-02-I

FC-MW-02-S

FC-MW-03-S

FC-SB/SS-102

FC-SB-117

HEADWALL

M.H.

DITCH

FC-SS-129

FC-SB/SS-116

FC-SB/SS-106

FC-SB-118

WOOD FENCE

FC-SB-127

FC-SB-113

FC-SB-119

CONCRETE PAD

FC-SB/SS-101

FC-SB/SS-109

FC-SB/SS-105

4/CG

FC-SB-120

FC-SB/SS-104

FC-SB/SS-108

M.H. 1

FC-SB/SS-107

FC-SB-115

FC-SB-114

FC-MW-07-S

FC-SS-121

CONC PAD

M.H. E-13

M.H. E-14

FC-MW-06-S

UGE

LEGEND:

- EXTENT OF PCB CONTAMINATION IN SUB-SURFACE SOIL (GROUNDWATER INTERFACE)
- EXTENT OF PCB CONTAMINATION IN SURFACE SOIL
- 2006 LOCATION, NO PCB SAMPLING
- 2006 LOCATION WHERE PCB CONCENTRATIONS EXCEED SCREENING CRITERIA (SURFACE SOIL ONLY)
- 2006 LOCATION WHERE PCB CONCENTRATIONS EXCEED SCREENING CRITERIA (SURFACE AND SUBSURFACE SOIL)
- 2006 LOCATION WHERE PCB CONCENTRATIONS ARE BELOW SCREENING CRITERIA (SURFACE AND SUBSURFACE SOIL)
- EXISTING PERMANENT MONITORING WELL
- MANHOLE
- UGE UNDERGROUND ELECTRIC LINE
- PROPERTY LINE
- TREELINE
- FENCE

NOTE:

1.) LOCATIONS OF SITE FEATURES, MONITORING WELLS, SOIL BORINGS, AND SURFACE SOIL LOCATIONS ARE APPROXIMATE.

2.) THE PRESENCE OF PCB CONTAMINATION IN SOIL WAS BASED ON SAMPLE RESULTS EXCEEDING 1 ppm IN SURFACE SOIL AND 10 ppm IN SUBSURFACE SOIL.

0 50 100

GRAPHIC SCALE IN FEET

DRAWN BY DT	DATE 2/21/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

EXTENT OF PCB CONTAMINATION IN SOIL
SITE 6A - FUEL CALIBRATION AREA
NWIRP CALVERTON
CALVERTON, NEW YORK

CONTRACT NO. 1610	
OWNER NO. 004	
APPROVED BY	DATE
DRAWING NO. FIGURE 3-3	REV. 0

ACAD:1610CP76.dwg 03/01/07 MF PIT

N

FC-VPB-112
FC-PZ-106D2
FC-MW-01-I
FC-MW-01-S
FC-MW-08-S
FC-TW-20A
FC-PZ-102D
FC-PZ-02D2
FC-MW-04-I
FC-PZ-02D
FC-MW-02-I
FC-MW-04-S
FC-PZ-02D1
FC-PZ-103D
FC-MW-02-S
FC-MW-03-S
FC-MW-07-S
FUEL CALIBRATION AREA
FC-PZ-104D2
FC-PZ-101D
FC-PZ-104D1
FC-TW-09A
FC-PZ-104D (FC-VPB-111)
ET-TW-09A
FC-TW-21A
FC-MW-06-S
FC-PZ-105D1
FC-PZ-105D2
FC-MW-05-S
FC-MW-05-I
ET-TW-11A
ET-TW-8A
ET-TW-05A
ET-TW-15A
ET-TW-7A
FORMER UNDERGROUND STORAGE TANK
ET-TW-03A
ET-TW-01A
ET-TW-02A
ENGINE TEST HOUSE

LEGEND:

- PIEZOMETER LOCATION
- EXISTING PERMANENT MONITORING WELL
- PID READING, SHEEN ON WATER TABLE, OR FUEL ODOR IN PURGE WATER DURING 2005 SAMPLING
- FORMER TEMPORARY WELLS
- SITE 6A CVOC AND BTEX SOURCE AREA (2005 DATA)
- SITE 10B BTEX SOURCE AREA (1997 DATA)
- PROPERTY LINE
- TREELINE
- WATER

0 200 400
GRAPHIC SCALE IN FEET

DRAWN BY DT	DATE 2/21/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

GROUNDWATER SOURCE AREAS SITE 6A - FUEL CALIBRATION AREA AND SITE 10B - ENGINE TEST HOUSE NWIRP CALVERTON CALVERTON, NEW YORK

CONTRACT NO. 1610	
OWNER NO. 0004	
APPROVED BY	DATE
DRAWING NO. FIGURE 3-4	REV. 0

FORM CADD NO. TTNUS-BH.DWG - REV 1 - 9/10/98

DRAWING NO. FIGURE 3-5
REV. 0

N

PROPERTY BOUNDARY
RUNWAY 32-14
FUEL CALIBRATION AREA
ENGINE TEST HOUSE
RIVER ROAD
MAIN GATE
SWAN POND
PECONIC RIVER SPORTSMEN CLUB ACCESS ROAD
POND
CONNECTICUT AVENUE
RESTRICTED DIRT ROAD
PECONIC RIVER

FC-MW-01-I
FC-MW-01-S
FC-MW-08-S
FC-MW-04-I
FC-MW-04-S
FC-MW-02
FC-MW-03-S
FC-MW-02-S
FC-MW-07-S
FC-MW-06-S
FC-MW-05-I
FC-MW-05-S
ET-TW-8A
SA-TW-11A
SA-TW-7A
ET-TW-05A
ET-TW-03A
ET-TW-15A
ET-TW-02A
ET-TW-01A
SA-TW-102
SA-TW-103
SA-TW-105
SA-TW-107
SA-TW-101
SA-TW-104
SA-TW-106
SA-PZ-101S,I,D
SA-TW-108
SA-PZ-120S
SA-VPB-120
SA-PZ-104S,I,D
SA-SW-103
SA-VPB-122
SA-PZ-122D
SA-TW-111
SA-PZ-123
SA-VPB-123
SA-TW-112
SA-VPB-114
SA-PZ-114D
SA-PZ-115D
SA-VPB-115
SA-PZ-116D
SA-VPB-116
SA-PZ-102S,I,D
SA-PZ-102
SA-VPB-117
SA-PZ-118S
SA-PZ-118I
SA-SW-101
SA-PZ-118D/SA-VPB-118
SA-TW-109
SA-PZ-121S
SA-PZ-121I
SA-PZ-121D
SA-PZ-103S,I,D
SA-TW-110

LEGEND:
- FORMER TEMPORARY WELL/ PIEZOMETER SAMPLE POINTS (ABANDONED)
- PIEZOMETER LOCATION/ VERTICAL PROFILE BORING LOCATION 2004/2005
- SURFACE WATER SAMPLE (2005)
- WELL/PIEZOMETER WITHIN PLUME WITH (MAXIMUM VOC CONCENTRATION > 5.0 ug/L)
- ON-SITE SOUTHERN AREA PLUME (MAXIMUM VOC CONCENTRATION > 5.0 ug/L)
- OFF-SITE SOUTHERN AREA PLUME (MAXIMUM VOC CONCENTRATION > 5.0 ug/L)
- PROPERTY LINE
- FENCE LINE
- TREELINE
- RAILROAD
- WATER
- CROSS SECTION LOCATION

0 400 800
GRAPHIC SCALE IN FEET

DRAWN BY DT	DATE 2/21/07
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

Tetra Tech NUS, Inc.

ON-SITE AND OFF-SITE SOUTHERN AREA GROUNDWATER CONTAMINANT PLUMES NWIRP, CALVERTON CALVERTON, NEW YORK

CONTRACT NO. 1610	
OWNER NO. 0004	
APPROVED BY	DATE
DRAWING NO. FIGURE 3-5	REV. 0

FORM CADD NO. TTNUS-D-STD.DWG - REV 1 - 9/11/98

ACAD:1610GP77.dwg 02/21/07 DT